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Codes of Practice for Kinnow Farming & Processing

Trade Related Technical Assistance (TRTA II) Programme
Funded by the European Union

Mobile Harvesters Field School
Development of Code of Practices



**A guide book to help address the critical control points along the supply chain
for enhancing competitiveness and exports**

Disclaimer

This guide book to address the critical control points along the entire Kinnow supply chain has been developed based on the research carried out by Citrus Research Institute (CRI) and University of Agriculture Faisalabad (UAF) and practical implementation of their research outputs at the pilot farm clusters and pack houses under the overall guidance and monitoring by the EU funded TRTA II National and International Experts.

The main objectives of these guidelines is to enhance the competitiveness and exports of Kinnow and are in line with those developed by FAO for similar produce. These guidelines also support the overall strategy to strengthen the horticulture sector in Pakistan

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Codes of Practice

for Kinnow Farming & Processing

The guide book has been developed by the European Union (EU) funded Trade Related Technical Assistance (TRTA II) Programme, implemented by UNIDO, in association with ITC and WIPO.



European Union



United Nations Industrial
Development Organization



International
Trade
Centre



Preface

Food security and nutrition are the foundations for human and economic well-being. Without this people would experience poor health that would lead to low productivity and stymied economic growth. However, the effects of food insecurity go beyond human and economic well-being. It is imperative that the poor and vulnerable are not trapped in the vicious poverty cycle, food insecurity, and malnutrition; instead, they should benefit from and contribute to a country's rising prosperity. Innovative solutions are necessary to break this poverty cycle, as the growing threat of climate change is expected to hinder production of staple foods in regions of high vulnerability.

Pakistan is blessed with a climate that supports the growth of premier quality Mangoes and Kinnow mandarins. The country produces almost 2 million tons each of Kinnow and mango every year and can earn a lot of foreign exchange by developing the value and supply chains of these fresh fruits.

Improving the quality and consistency of the fresh fruits that are available to consumers is an important goal of The Punjab Agriculture Department. Providing outstanding-quality fruit in the market that consumers will want to purchase again and again requires a commitment to quality by each and every stakeholder involved in the mango and Kinnow production and handling.

Every step in the handling of fresh fruits contributes to the delivery of good quality and enhances shelf-life. Therefore, attention to detail is required at each step of the preparation and distribution. This manual outlines all the steps involved in the Kinnow and mango handling and distribution and addresses the common problems and recommended best practices that will ensure delivery of the best quality mangoes to both domestic and international markets. The manual also includes the quality-control procedures used when monitoring the maturity and quality of mangoes in commercial handling operations.

Market oriented production trends across Asia and the Pacific region, spurred by growth in the food service, supermarket and export sectors, rising living standards and growing consumer awareness, necessitate a shift toward improved handling practices in fresh produce supply chains. Within the post-harvest system, the packing-house serves as a control point where quality management can assure a reliable supply of quality produce. Packing houses also serve as sites for the effective implementation of strategies designed to eliminate or minimize microbial, chemical, physical and pest contamination. Well-designed packing house facilities that conform to the principles of HACCP/Good Hygiene Practice (GHP) and which are equipped with an appropriate level of post-harvest technology are, therefore, a critical and important component of the infrastructural base to support value addition, quality and safety management along the fresh produce supply chains.

The development of Codes of Practices (CoPs) and formulation of the guidelines to address the Critical Control Points along the entire Kinnow and mango supply chains was a very good initiative of the European Union funded Trade Related Technical Assistance (TRTA II) Programme implemented by United Nations Industrial Development Organization (UNIDO) in association with International Trade Centre (ITC) and World Intellectual Property Organization (WIPO). Further more, the Punjab Agriculture Department also acknowledges the work done by FAO in this sector which has been referenced in the guide. The department also appreciates the collective efforts of MRS, CRI, UAF, PHDEC and TDAP in development of the CoP manual and CCP guide. Such programmes are greatly appreciated by the Government of The Punjab and acknowledged as being essential for the Pakistan's integration into the global economy.

This publication documents good practice in the design, management and operation of fresh produce packing-houses. The guide is intended to serve as a technical resource for extension specialists, planners, farmer organizations, clusters and cooperatives on upgrading their post-harvest operations. It is hoped that the guide will serve as a useful resource/tool to these key stakeholders.

Rashid Mehmood
Secretary
Agriculture Department
Government of the Punjab

Message by the EU Ambassador

Safe food is a basic right for every consumer and should be affordable and accessible to all. The European Union is supporting this goal through numerous initiatives like the Trade Related Technical Assistance Programmes, in Pakistan, implemented by the United Nations Industrial Development Organization, UNIDO in association with International Trade Centre, ITC and World Intellectual Property Organization, WIPO.

The main objective of the TRTA Programmes is to promote trade through the integration of Pakistan's economy with the global market. This entails strengthening of Pakistan's conformity assessment infrastructure, revamping the regulatory framework to address both Technical Barriers to Trade, TBT and Sanitary & Phytosanitary, SPS compliance measures and focusing on critical gaps along the supply chain of certain products that have a high-end value and marketability. This is to ensure that quality produce is made available to enhance market access.

One such intervention includes strengthening the capacity of the Pakistani Kinnow farmers, processors and exporters through a collaborative effort of developing comprehensive codes of practice along the critical control points of the Kinnow supply chain. Once the quality of the produce (Kinnow) is assured, the TRTA II programme then establishes market linkages in order to sustain the exports and enhance profitability. This, in turn, will also allow the farm labourers to earn a more respectable income.

The production of this illustrated version of the Codes of Practice for the Kinnow cultivation and post-harvest processing, in characterizing the critical control points, is a novel approach, engaging both the small and big farmers as well as the exporters. This will effectively allow the poorest farmers to have a greater voice in decision-making and increase their market share.

The European Union welcomes the successful production of this manual and acknowledges the involvement of Provincial and Federal Departments of the Government of Pakistan (PHDEC, TDAP), Research Institutions (CRI, MRS), Academia (UAF) and private sector associations, as well as the contribution from the other International Donor Agencies (FAO), in sharing their expertise and information and adding value to this publication.

Lars Gunnar Wigemark
Ambassador
European Union Delegation to Pakistan

Foreword

Pakistan stands among the top ten citrus growing countries in the world. Kinnow mandarin is a cross between the 'King' & 'Willow-leaf' species of citrus fruits, created after successful experimentation at the Citrus Research Centre, University of California, USA in 1951. The soil and climatic conditions in Pakistan have given to Kinnow a unique flavour which distinguishes it from other comparable mandarins grown in the world. Winter in the plains of Punjab province provides an excellent atmosphere for this fruit and the resulting taste is sweet and very distinct.

Kinnow is grown primarily on more than 194,500 hectares in the plains of Punjab province of Pakistan and the total production is more than 2 million tons. According to an estimate approximately 95 percent of the total Kinnow mandarins produced all over the world is grown in Pakistan. During the season 2013-14 the Country exported more than 387,000 Metric Tons of the citrus fruit worth USD \$156 million. Every year Pakistan exports only around 8% of its production and unfortunately almost 40% of the produce is wasted due to improper farming, harvesting, processing, transportation, etc.

Although the country is blessed with natural high quality Kinnow mandarins, having inherent superior taste which is unique and liked all over the world, the export performances have not been up to the mark. Kinnow mandarins, if treated with proper fungicide, waxed carefully and stored at 4°C, can retain their freshness up to 2 months. Pakistan could earn substantial amounts of foreign exchange by increasing Kinnow exports.

Sanitary and Phytosanitary (SPS) standards continue to hinder market access. Pakistan has limited SPS management capacity to address food safety, animal and plant health. Therefore it is imperative that Pakistan develops an integrated, coordinated SPS management and control system. Food safety has become a very significant issue, due to the increasing food concerns in Europe. The consumers now want to be aware about the food they are consuming through appropriate labelling and traceability schemes.

Farmers must adapt Good Agriculture Practice to make certain the safety and the quality of the produce. Farmers and processors need guidance to improve the quality of the production and reduce losses during production process, post-harvest processing, storage and transportation.

Maintenance of Kinnow orchards is necessary to get good quality fruit. For example, pruning has become an essential feature of Kinnow farming. Currently minimum pruning is practiced. However, it is necessary that annually after harvest, the diseased, dried, broken branches and those touching the ground be pruned off. Judicious use of correct (scientifically proven) fertilizers must be ensured. In addition, appropriate harvesting and processing of Kinnow for the local and export markets is also essential to improve its shelf life.

As a member of the WTO Pakistan is committed to comply with the Sanitary and Phytosanitary Agreement and in order to protect its exports Pakistan should address the phytosanitary issues such as fruit fly infestation.

TRTA II conducted detailed studies of the sector to identify the critical areas where improvements were required. In this connection detailed value chain analysis was conducted and critical control points along the supply chain identified.

The Programme, as a remedy, has developed some comprehensive guidelines to address the critical points along the entire supply chain. The Programme also integrated the information already available in the form of manuals/guidelines/hand books, developed by other donors and stakeholders. Once developed and implemented, these CoPs would enable both the farmers and processors, to get optimal income.

The idea of developing the Codes of Practice (CoPs) and Critical Control Points (CCPs) was conceptualized by TRTA II International Expert, Dr Mike Dillon and National Experts Mr Badar-ul-Islam and Dr Ali Abbas Qazilbash. Subsequently these CoPs were tested through implementation at pilot farm clusters for a period of 3 years.

I would also like to acknowledge the commendable efforts of the technical staff of Citrus Research Institute (CRI) led by Mr Abdul Aziz, Mr Altaf-ur-Rehman Khan (Director CRI), Prof. Dr. Amanullah Malik (University of Agriculture Faisalabad - UAF), Mr. Kit Chan (TRTA II International Expert) and Mr Muhammad Aurangzaib Khan (TRTA II National Expert) in authoring, designing and streamlining the illustrated version for the remedies to the critical control points along the supply chain in a reader friendly manner.

This has all been possible due to the continued support of the European Union that has funded the TRTA II programme.

Bruno Valanzuolo
Chief Technical Advisor
Trade Related Technical Assistance (TRTA II) Programme

Message by the FAO Representative

Agriculture is the foundation of Pakistan's economy. The sector employs 45% of the country's labour force, generates approximately 21% of the country's Gross Domestic Product and is responsible for as much as 70% of all exports.

Pakistan became a member of FAO only three weeks after gaining independence in 1947. Subsequently, there has been a long and rewarding relationship; with FAO providing technical assistance to Pakistan over the years in the agriculture, livestock, fisheries and forestry sectors while experts from Pakistan have worked with FAO supporting development in many countries around the world.

Horticulture is of special interest to myself as I come to FAO with an agro-forestry background and have worked with fruit trees in many countries. Here in Pakistan, FAO has provided support to horticulture development over the past decades notably in Swat, Gilgit Baltistan and currently in Balochistan. Horticulture is very important for food security and income generation in many parts of Pakistan. Proper management and value chain development is critical to ensure maximum benefit to the producers. Public and private partnership is needed to open and develop overseas markets as well as branding for Pakistan products to ensure steady profits which will further stimulate development and expansion of the sector.

The quality of both Kinnow and mango produced in Pakistan is exceptional and should demand top prices internationally. The "Codes of Practice" prepared by TRTA II and their development partners, for both Kinnow and mango, address all aspects cultivation, management and post-harvest handling. These are valuable contributions to the sector and I hope they are fully utilized to improve and strengthen quality production and expand exports.

I congratulate TRTA II for the fine job on preparing these "Codes of Practice" and I express my gratitude to the European Union for their financial support to UNIDO/TRTA II for support to the horticulture sector.

As horticulture develops, it is the larger farmers who benefit first but let's keep the small farmers in mind and work to bring them along in the development process.

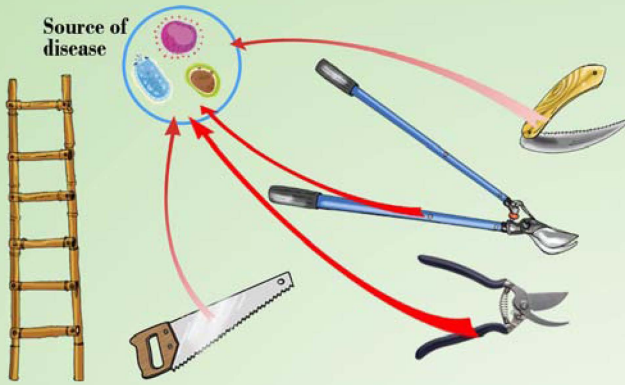
Patrick T. Evans
FAO Representative

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Pruning (after Harvest)

Existing Practices

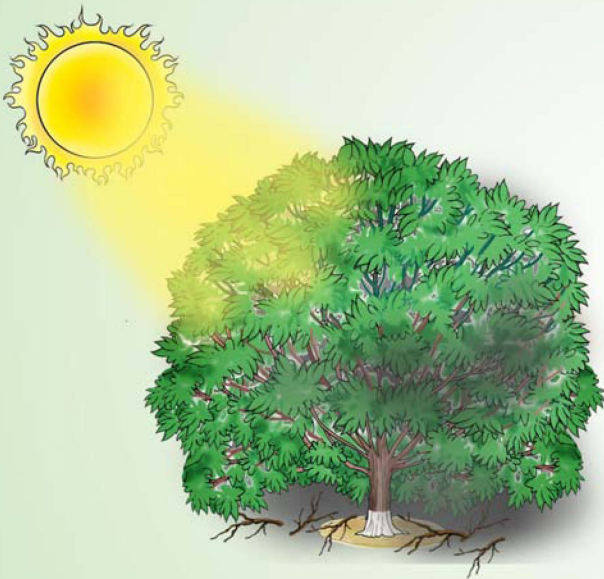


Unsanitized tools cause disease

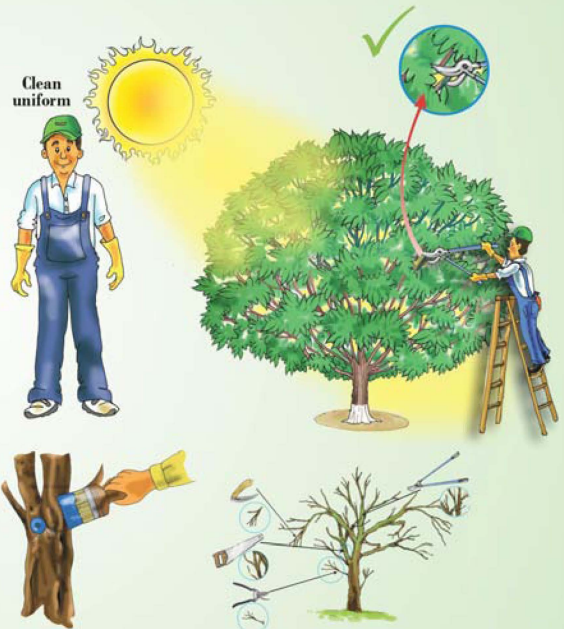
Recommended Practices



Clean tools with detergent



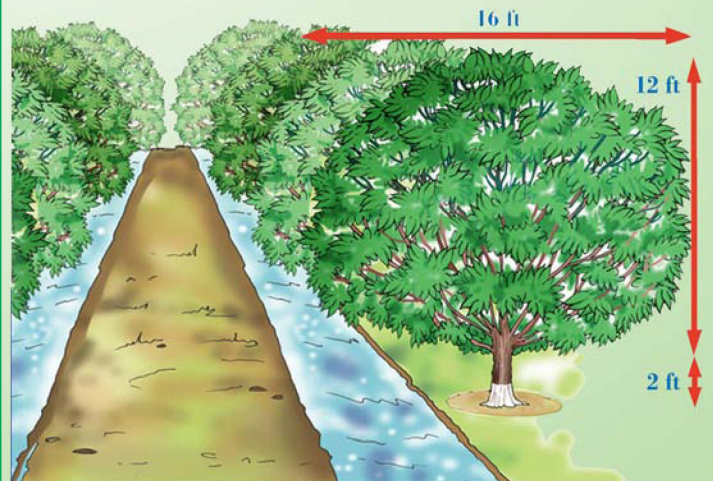
Unpruned tree with dense canopy bears low quality fruit



Re-size the plant by removing water shoots, dried and diseased branches



Unpruned trees produce low quality fruit
Diseases spread in orchard with unpruned trees



Pruned trees produce high quality fruit.
Fruit is disease free and high quality

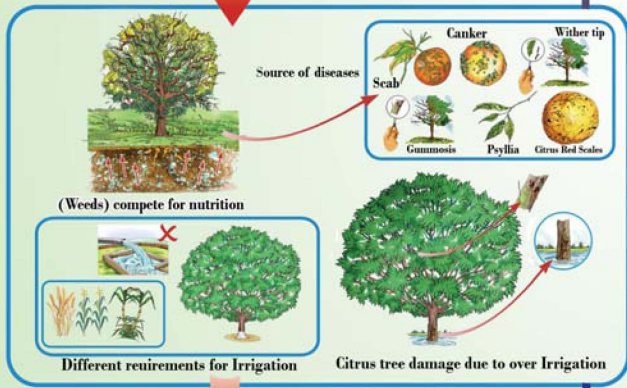
Inter-cropping

Existing Practices



Cause nutrients wastage

- 4 Mustard Mar - Apr
- 5 Barseen (fodder) Oct - Apr
- 6 Sorghum Mar - May, Jul - Sept

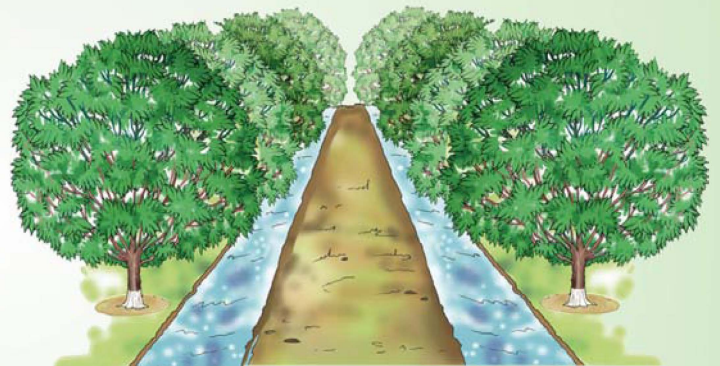


inter-cropping weakens the Kinnow trees and fruit quality is poor.
Low yield

Recommended Practices



Summer and Winter Vegetables should be sown



Neat and clean orchard

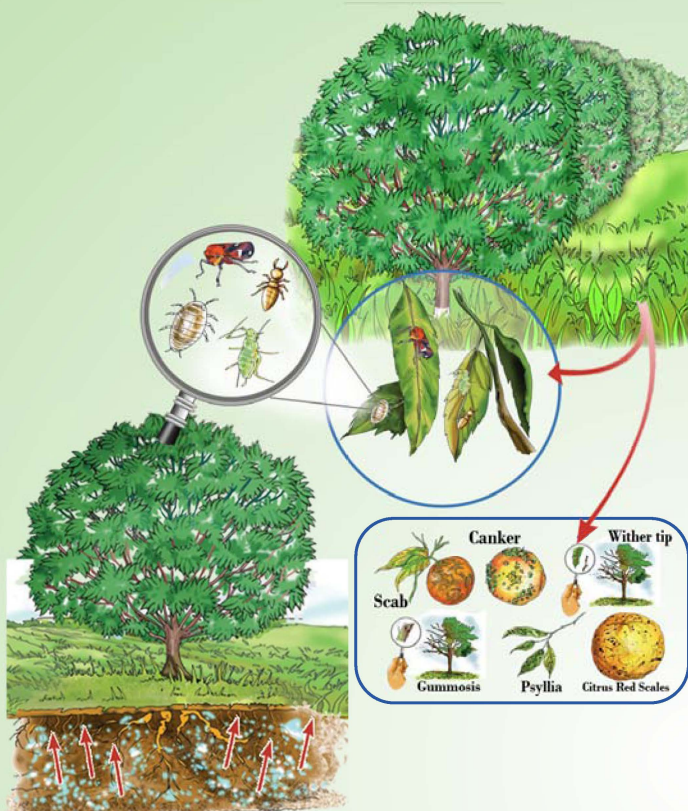


Healthy trees produce disease free and high quality fruit.
Yield is high

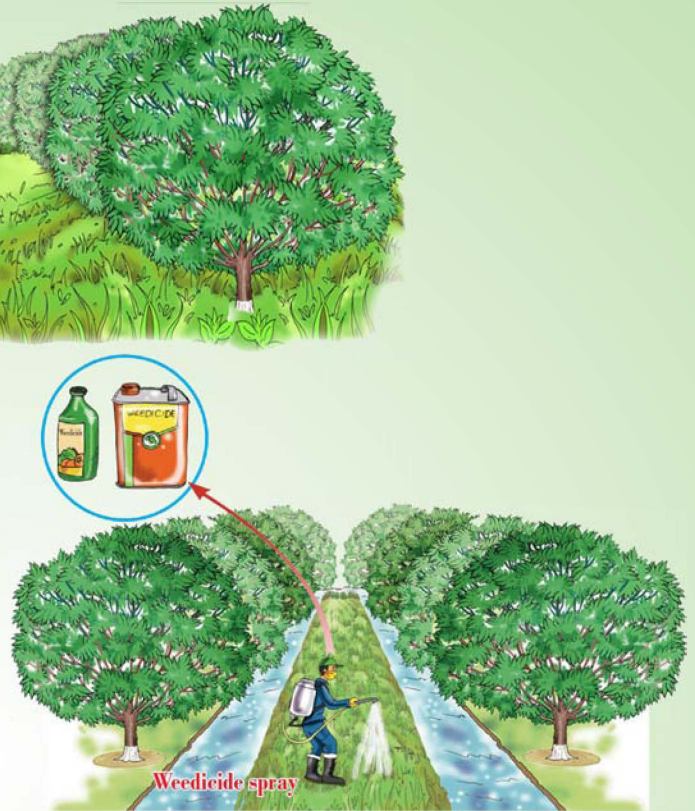
Weed Control

Existing Practices

Recommended Practices



Weeds compete for nutrition and host disease causing agents



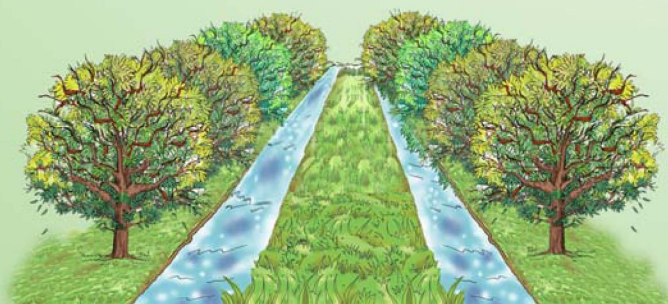
Weedicide spray to control weeds



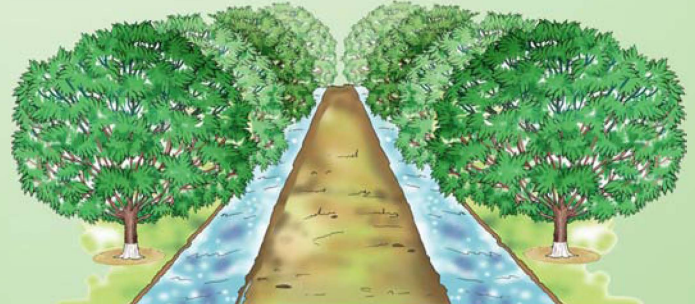
Uncontrolled weeds weaken the tree



Hoeing, slashing and ploughing to control weeds



Irregular orchard - weak trees

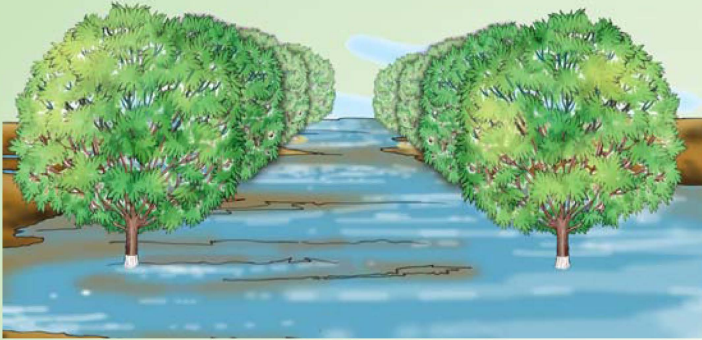


Neat and clean orchard - healthy trees

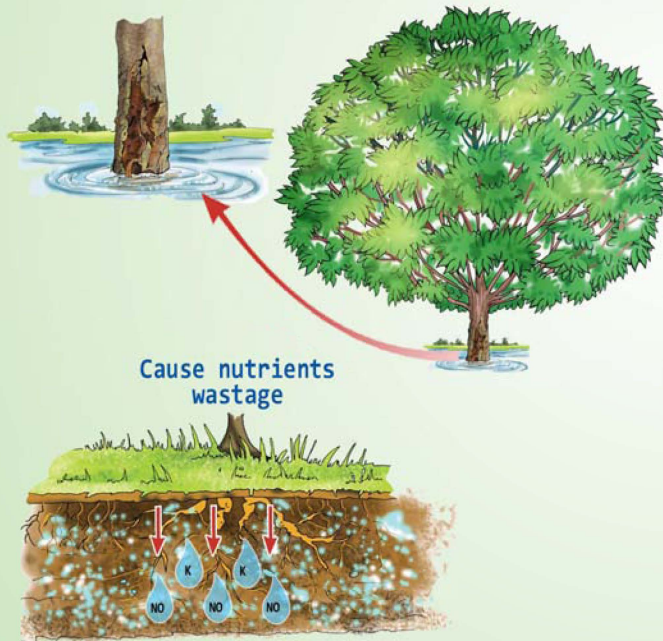
Irrigation

Existing Practices

Flood Irrigation



Flood irrigation results in excessive water loss



Cause nutrients wastage

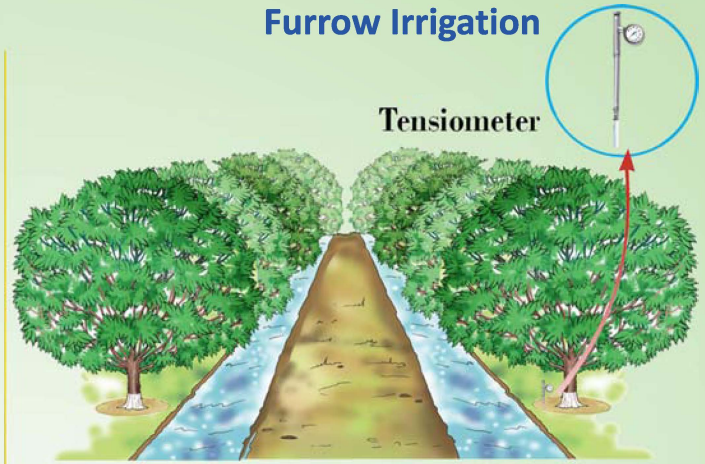
Flood irrigation causes nutrient wastage and damage the plant stem



Excessive weeds grow and trees become weak and give low yield

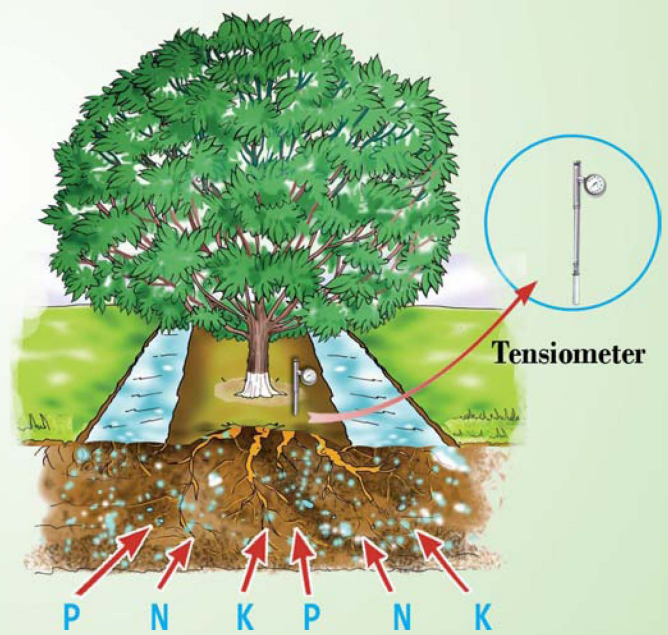
Recommended Practices

Furrow Irrigation



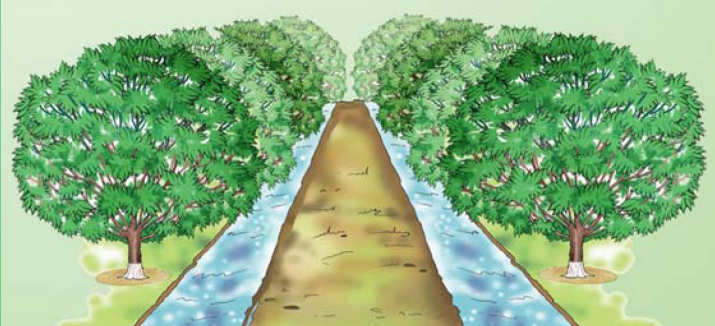
Tensiometer

Furrow irrigation saves 40% water



Tensiometer

Furrow irrigation promotes the uptake of nutrients



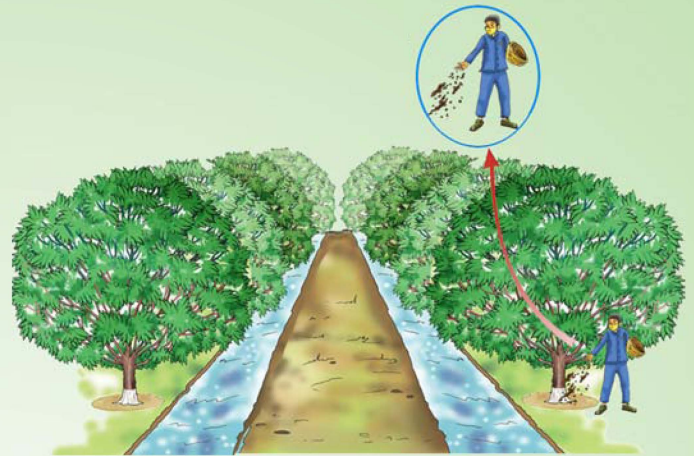
Weeds effectively controlled. Healthy tree gives high yield

Existing Practices



Application of fresh FYM increases termite attack and the incidence of other fungal and bacterial diseases

Recommended Practices



Application of well rotted Farmyard Manure (FYM) (Dec / Jan) improves tree health



Unbalanced fertilizer weakens the tree



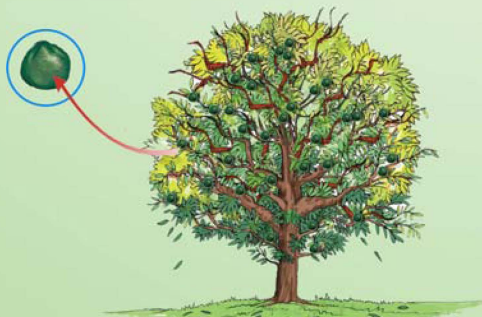
Application of Phosphorus and Potassium (Dec / Jan) keeps plant healthy



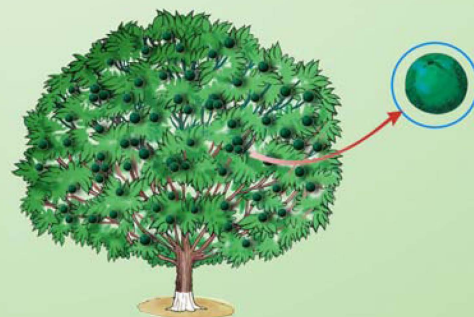
Plant weakens



Application of first dose of Nitrogen (Feb) keeps plant healthy



Plant bears irregular shape and small sized fruit

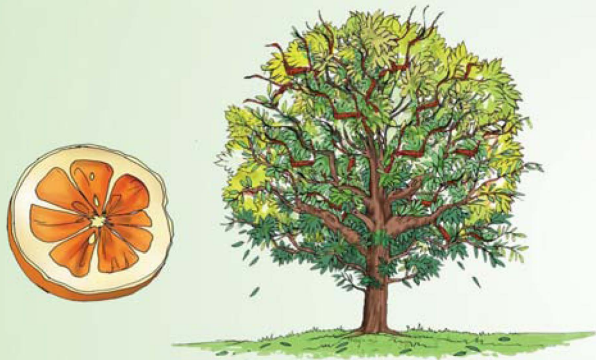


Plant bears healthy fruit if second dose of Nitrogen (Apr) is applied

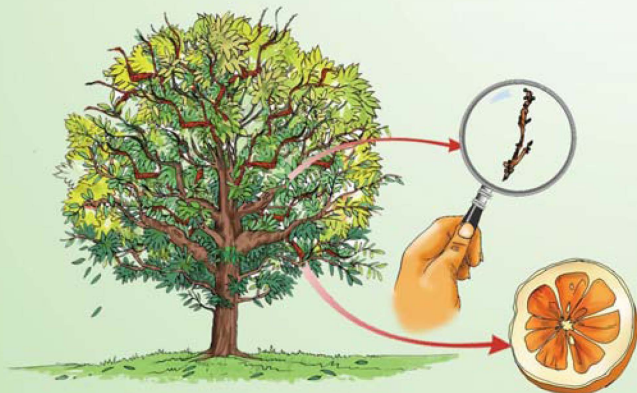
Existing Practices



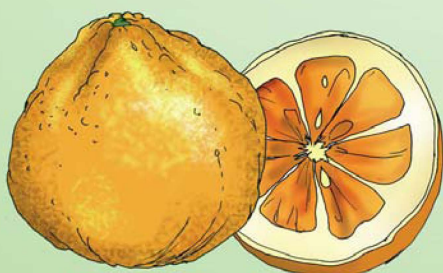
Fruit shrinks and drops, if third dose of nitrogen is not applied



Fruit becomes thick skin if phosphorus is not applied



Fruit de-shapes if Potassium is not applied

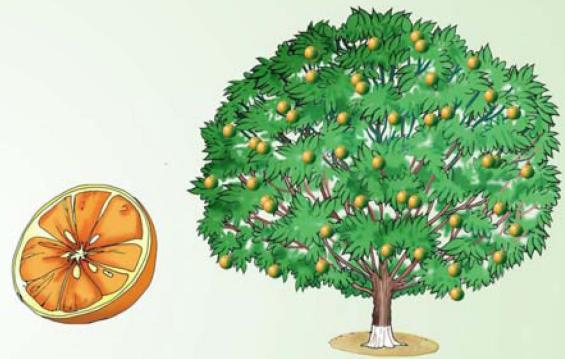


Low yield, irregular shaped fruit

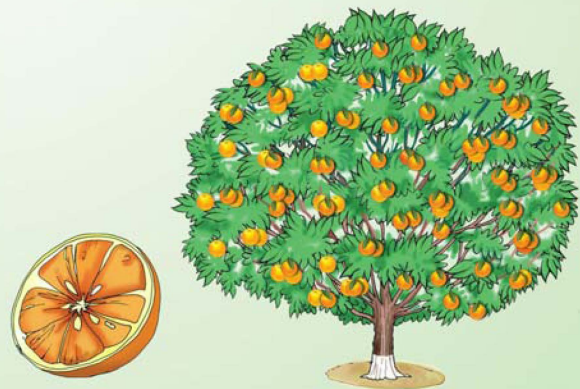
Recommended Practices



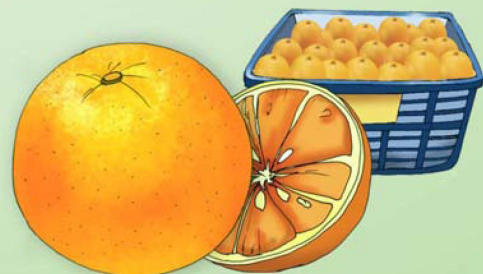
Fruit grows well if third dose of Nitrogen (Aug / Sep) is applied



Fruit skin remains healthy if Phosphorus (Dec/Jan) is applied



Application of Potassium (Dec/Jan) gives healthy fruit



High yield and high quality fruit

Application of pesticide and fungicide-1

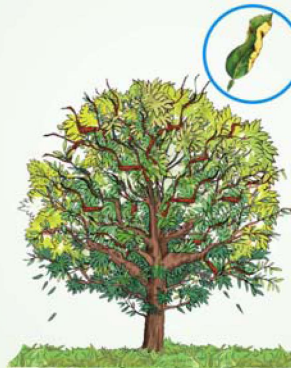
Pre flowering

Existing Practice

Improper Pesticide and Fungicide application before flowering results in pest attack and disease



Mealy Bug effected plant



effected plant



Scab effected fruit



Melanose effected fruit



Canker effected fruit

Recommended Practice

Apply Bifenthrine (1 ml/L water) and Copperoxy chloride (3 g/L water) protects from pest and disease



Hoeing to kill mealy bug eggs



healthy plant



Healthy fruit

Pests



Mealy Bug



Aphid

Diseases



Scab



Melanose



Canker

Application of pesticide and fungicide-2

After fruit setting

Existing Practice

Improper Pesticide and Fungicide application at fruit setting results in pest attack and disease

Pests



Mealy Bug



Psyllia



Thirps



White Fly



Lemon Butterfly



Leaf Miner

Diseases



Melanose



Canker



Stem End Rot results in fruit drop



Effected plant



Effect of Psyllia



Effected Fruit



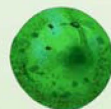
Effected Fruit



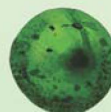
Effected Plant



Signs of Leaf Miner



Melanose effected fruit



Canker effected fruit



dropped fruit

Recommended Practice

Apply spantoram (0.2ml/L water) and Metiran (2g/L water)



Healthy fruit and tree

Application of pesticide and fungicide-3

Fruit Development and maturity stage

Pests



Psyllia



White Fly



Scale Insect



Fruit Fly



Lemon Butterfly



Leaf Miner

Diseases



Scab



Melanose



Gummosis



Fruit Drop

Existing Practice

Improper Pesticide and Fungicide application at fruit development and maturity results in pest attack and disease



Effectuated plant



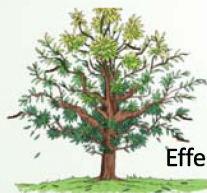
Effectuated fruit



Effectuated fruit



Effectuated plant



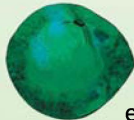
Effectuated plant



Signs of Leaf Miner



Scab effectuated fruit



Melanose effectuated fruit



Effectuated plant



Dropped fruit

Recommended Practice

Apply Bifenthrin (1 ml/L water) and Copperoxy chloride (3 g/L water) protects from pest and disease



Healthy fruit and tree

General sanitation and maintenance prior to harvest



Wash harvesting crates regularly by brushing and using detergent solution with a pressurized nozzle, followed by rinsing in chlorinated water



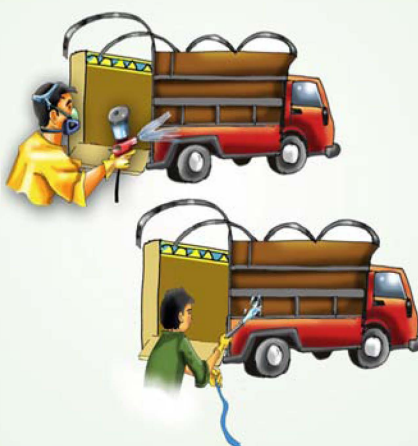
- Harvesting tools must be cleaned daily after harvest in the evening by dipping in kerosene oil. Wipe with a clean cloth to dry, then dip in chlorinated solution for disinfection.
- Lubricate and air dry before use



Keep the orchard floor clean by picking up all fallen fruits and plant debris from the ground and properly dispose / dump it



Paint rusty ladders when required and clean them regularly



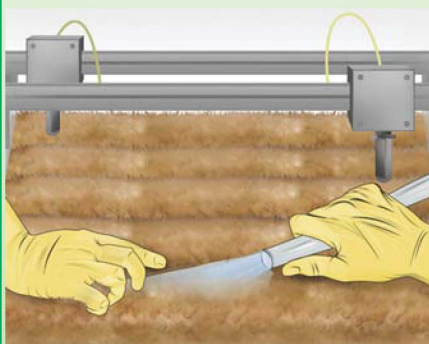
Clean up the transportation vehicle and paint it when required



Keep the packhouse floor clean



Clean all machine parts in the pack-house regularly



Clean waxing brushes regularly



- Clean cold store and disinfect it.
- Check for any gas leakage, refrigeration units, etc.

Preparation for harvest



Take a shower



Keep a tools cleaning kit (kerosene oil, Bleach, Lubrication oil, clothe and brush)



Take all necessary implements and equipments for harvesting

- 1) Bag 2) Harvesting Kit / Tools 3) Uniform / Gloves 4) Soap 5) Nail cutter



Do not allow your nails to grow



Wash hands with soap after using a toilet



- Use sharp and clean tools for harvesting
- Use bandage to cover all wounds on body

Maturity testing

Existing Practices



- Fruit maturity is determined visually by farmers on basis of orange color ranging between 60-70%
- There are no measurable appliances available to farmers



Do not immerse refractometer in water. In case of any damage, provide it for services to the company

Recommended Practices



- Start monitoring fruit maturity by mid November
- Compare fruit color with fruit maturity color chart
- Fruit on top and external canopy position of tree matures earlier and should be harvested in first picking

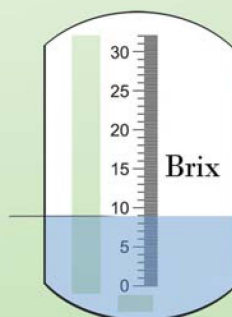
Using Refractometer



Add 2 or 3 drops of fruit juice on the prism



Close the lid and view the scale through the eyepiece



Turn the eyepiece to focus the scale indicating Brix



Clean prism before testing the next sample

Harvesting and field sorting

Existing Practices

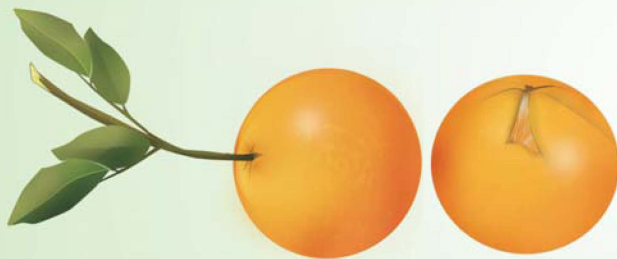


Leaning ladder against the tree will increase risk of damage to the tree and growing fruits. Harvesting in the rain raises the risk of fruit disease and contamination

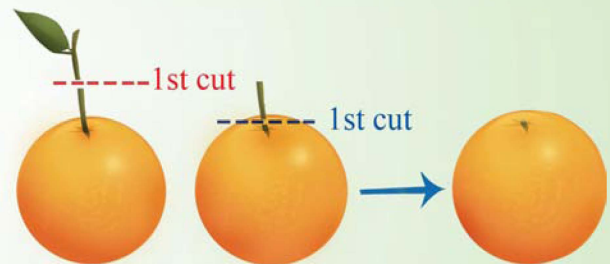
Recommended Practices



Use self supporting ladders of appropriate height and reach. Fruit on top and external canopy position of tree matures earlier and should be harvested in first picking



A careless cut damages the fruit which leads to fungal / bacterial infection. Fruits are collected in bags (Jholi) which are sometimes overfilled by the harvesters and fruit gets pressed causing de-shaping



- Cut the stalk with clean sharp cutters to a length of 2-4 inches
- Do not yank the fruit from the stalk
- Do not overfill the harvesting bags
- Do not drop fruits from height



Careless transfer of fruit from bag to plastic bin from height damage the fruit. Fruit of inferior quality is often placed on ground in bulk



- Weigh each basket to 20 kg
- Gently release fruit directly into plastic bins from picking bags and do not place fruit on ground. Maintain traceability record before loading fruit

Transportation (farm to packhouse)

Existing Practices



Field bins are rarely used or are mostly overfilled without covering them which may lead to physical injury. Rough handling leads to chances of fruit injury.

Recommended Practices



- Place fruits orderly in the bins
- Don not overfill the bins and carefully load onto the vehicle



Careless driving on bumpy farm roads can cause fruit injury.



- Do not drive on bumpy roads to avoid damage
- Select the most direct, smooth and safest route, where possible



- Sometimes vehicles are unnecessarily stopped by the drivers under direct sunlight
- Tractor drawn trolleys are used to transport fruit which have less suspension / shock absorbing ability



- During transportation, do not expose the fruits to direct sun or smoke and avoid unnecessary delays.
- Choose vehicles with good shock absorbing ability and keep air pressure in the tyres optimum / balanced

Arrival and unloading of fruit



Unload the fruits carefully by gently passing over the crates. Keep traceability of the block from where fruit was harvested.



Collect fruit record slip from driver with all necessary details (Name of grower, block name, Number of crates loaded)



Randomly recheck the weight of fruit crates



Arrange the fruit crates on the pallets properly



Move pallets to the feeding area using hand jack or fork lift

Washing

Existing Practices

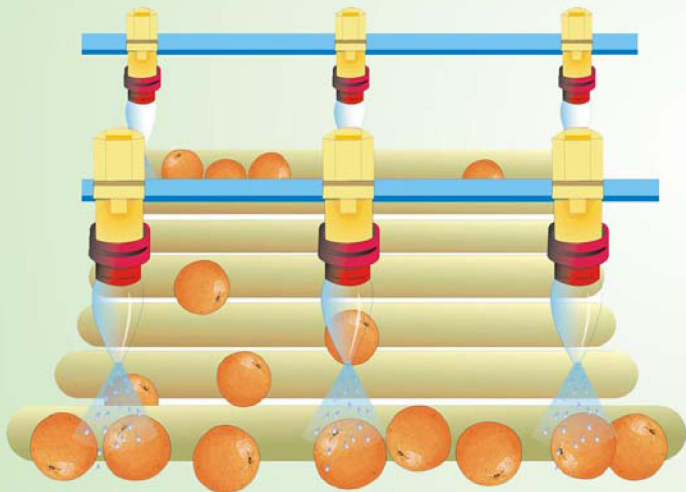


Careless loading of fruits on conveyer

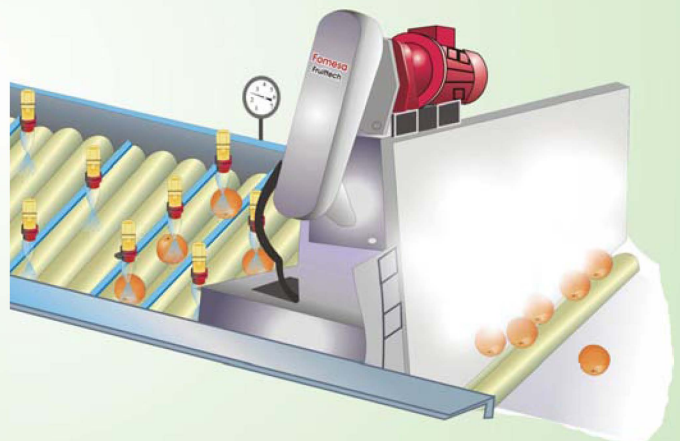
Recommended Practices



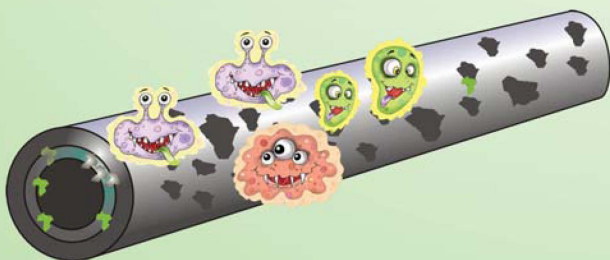
Do not drop the fruits from a critical height, lower the fruit basket and roll them gently



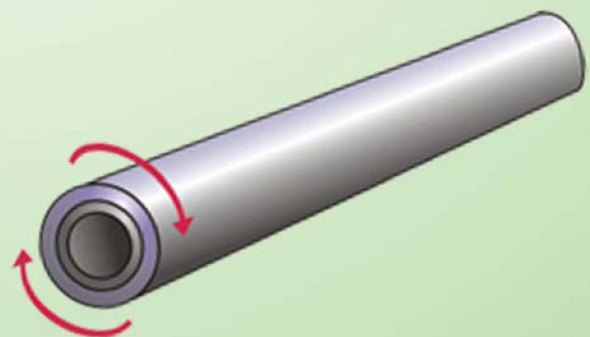
- Uneven water pressure and area of spraying of nozzles
- Number of nozzles are not uniform



- Adjust roller speed to 50-55rpm and the nozzle pressure at 35 PSI for disinfectant dilution of 1L TBZ per 200 L water
- Ensure an even spray of water jets on the fruits
Fruit pass through foamer prior to wash



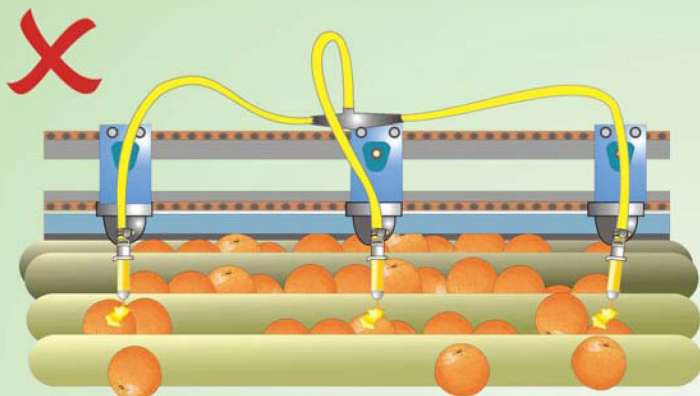
- Dirty rollers and brushes are a good source of bacteria and fungus causing disease contaminants
- Speed of the conveyer rollers is not measured



- Soft nylon brushes are recommended
- Roller speed should be adjustable / measurable at every stage

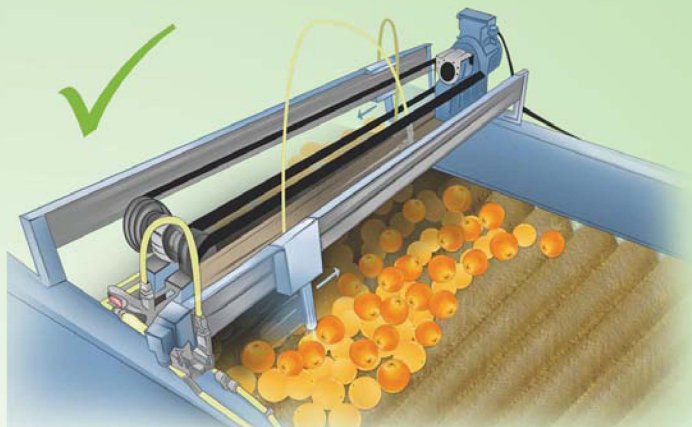
Waxing

Existing Practices



This system of waxing lacks a control panel and the nozzles do not exhibit motion

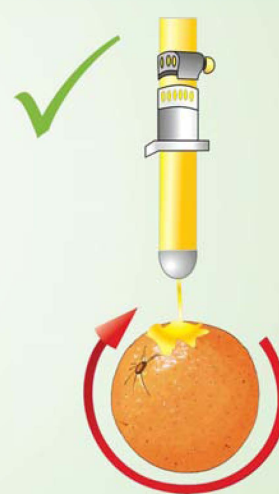
Recommended Practices



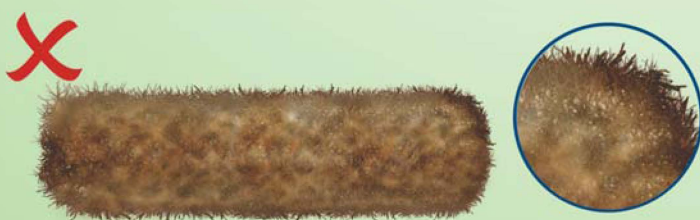
Fruit are waxed by nozzles moving in alternate directions to ensure uniform spread at a pressure of 30-35 psi created through pump



- Uneven and unregulated wax spray will not provide the wax protection.
- Roller speed is not controlled enough to wax fruits with uniformity
- There are issues related to quality and dose of wax
- Fungicide dose in wax is not proper and is not mixed thoroughly



- Ensure that wax spray pressures are correctly calibrated
- Adjust roller speed (70-75rpm) to allow fruit to be evenly waxed
- Ensure complete and even mixing of fungicide and wax using mechanical means
- Wax dilution is calculated at 1L/1 ton of fruit load
Fungicide dilution
- TBZ = 2.2 L / 200 L wax Imazilil = 1 L / 200 L wax



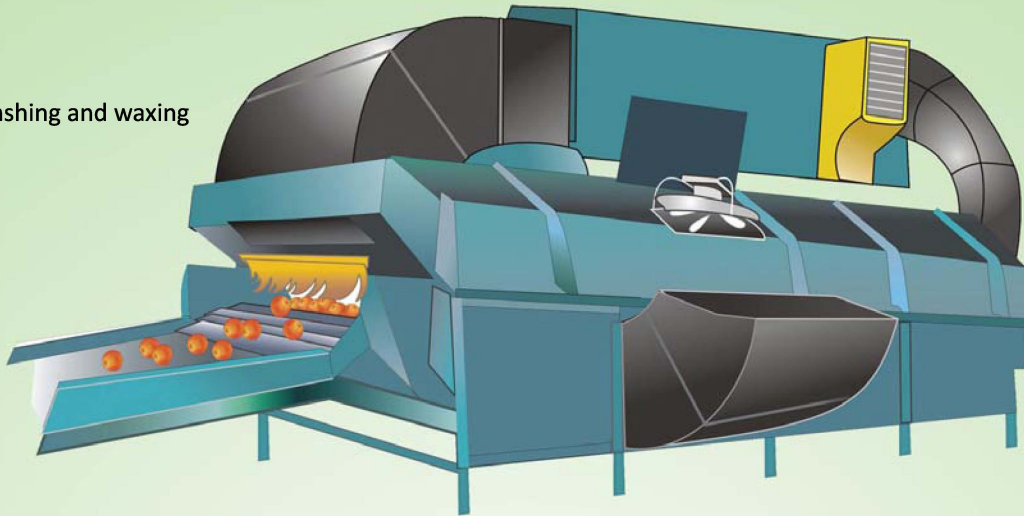
Brushes get harder by wax and are worn out that can be harmful for fruit skin



Hair of brushes should be very soft, specially made by horse tail hair

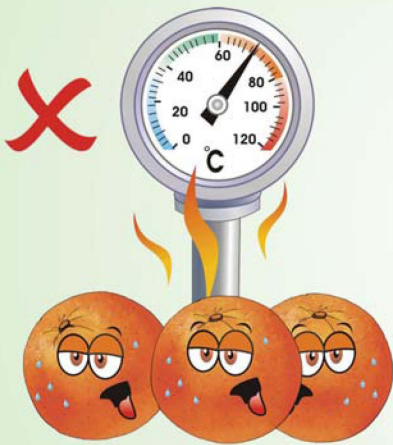
Drying

Drying after washing and waxing



Existing Practices

Recommended Practices



- Temperature maintenance is not achieved thoroughly
- Conveyor speed is not controlled enough to dry fruit uniformly
- High temperature can be injurious for fruits



- Calibrate drying process (heating unit, speed) manually
- After washing and waxing, maintain an optimum drying temperature (40-60°C) throughout the process
- Calibrate dryer temperature with respect to fruit moisture and atmospheric pressure
- Maintain an optimum fruit exposure time to drying process (dryer I and dryer II)








Diesel and gas heater produce ethylene gases which can be harmful for Kinnow due to its sensitivity.



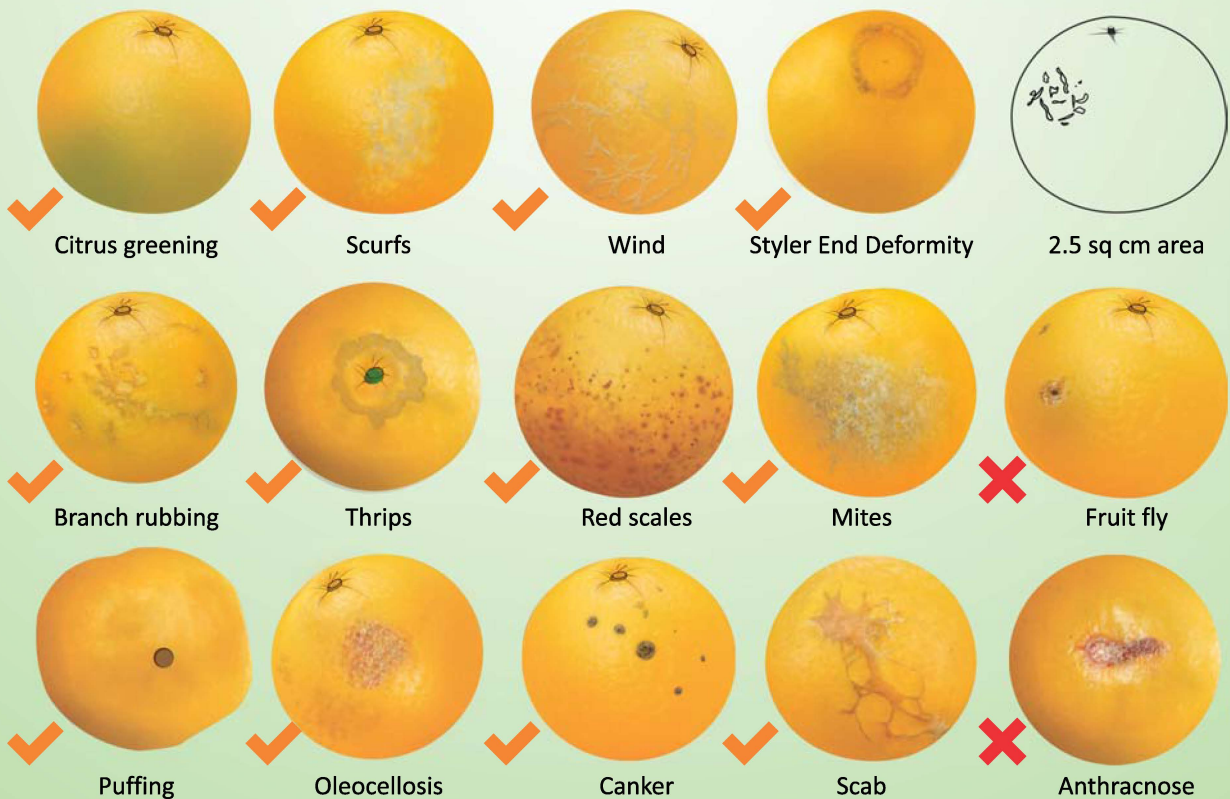
Monitor ethylene concentrations in heater chamber atmosphere and remove detrimental levels of ethylene gas

Grading

	Extra Class	Class I	Class II
Quality	 Kinnow must be of superior quality and free of defects, with the exception of very slight superficial defects	 Kinnow must be of good quality with slight defects	 Kinnow which do not qualify for inclusion in the higher classes but satisfy the minimum requirements
Skin Defects	No or very slight superficial defects that do not effect the fruits quality or appearance	Slight skin defects upto 1cm ² are allowed (silver scurfs, russet, rubbing, hail damage, handling)  1cm ²	Defected skin upto 2.5cm ² of superficial healed skin alterations is allowed  2.5cm ²
Shape Defects	Shape is typical of the variety with uniformity in coloring	Slight defect in shape and color Permissible shape defect = 5% Permissible color defect = 10%	Fruit is deformed & has color defects Permissible shape defect = 20% Permissible color defect = 20%
Tolerance	5% by number or weight of Class I is allowed	10% by number or weight of Class II is allowed	10% by number or weight of produce free deterioration that is fit for consumption is allowed

✓ Local market

✗ Unremarkable



- Badly damaged, diseased or rotten fruits are totally unacceptable
- Mixed sizing and mixed color are not acceptable in one box

Packing

Existing Practices

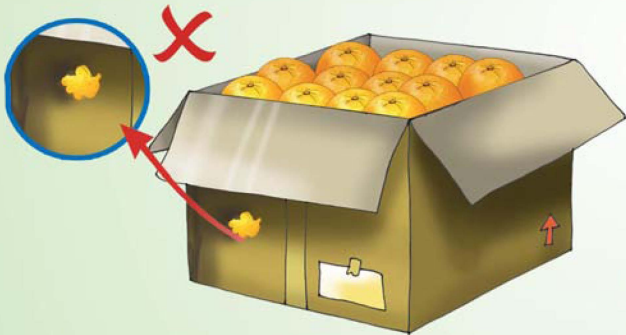


Fruits are packed tightly in the boxes that results in fruit deformation

Recommended Practices



- Do not over fill to avoid fruit pressing
- Ensure uniformity in fruit size for each box count
- Separate each layer of fruits with a soft, insert and non-toxic paper sheet (Guddi paper) to provide cushioning

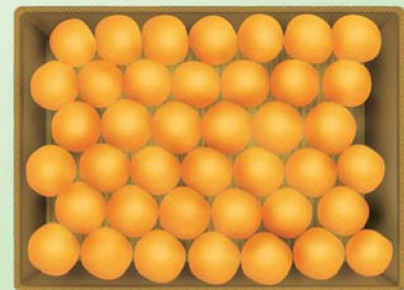
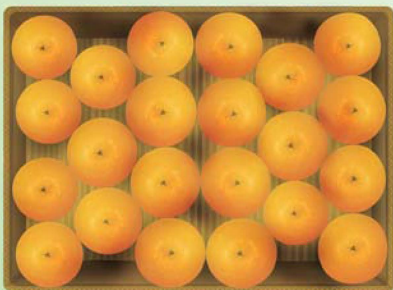


Quality of material used for corrugated boxes is a serious issue because sometimes these are made from recycled paper



Ensure that the corrugated box is new with suitable quality of material

Packing Ideas



Size 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9	Size 10
78-100 mm	75-86 mm	72-83 mm	71-77 mm	68-74 mm	64-70 mm	63-67 mm	62-65 mm	60-65 mm	56-61

Pre-cooling Storage

Existing Practices

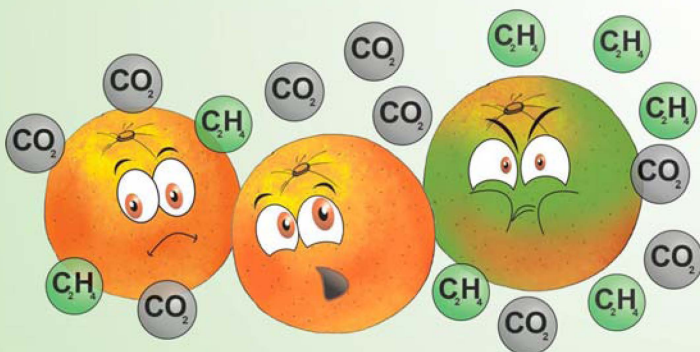


- Delay in cooling
- Improper placement of fruit boxes
- Temperature fluctuation
- Unavailability of ventilation system

Recommended Practices



- After packing fruits should readily be moved to blast chillers for pre-cooling
- Stack boxes should be placed in chillers with proper arrangement by maintaining equal distance of 1.5 ft between them



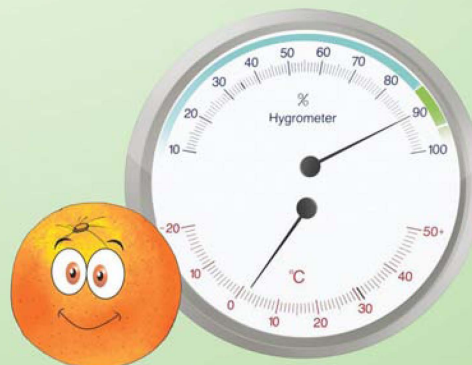
High level of gases may accumulate (CO_2 and ethylene) in cold store that reduces fruit quality and storage life



During storage, regularly monitor temperature, ethylene and CO_2 gas. Ventilate exhaust stores if necessary



Unsuitable temperature and RH during pre-cooling and storage will lead to excessive water loss



Maintain temperature at 2°C for pre-cooling and at 4°C for storage along with good RH (85-90%)

Labeling and traceability

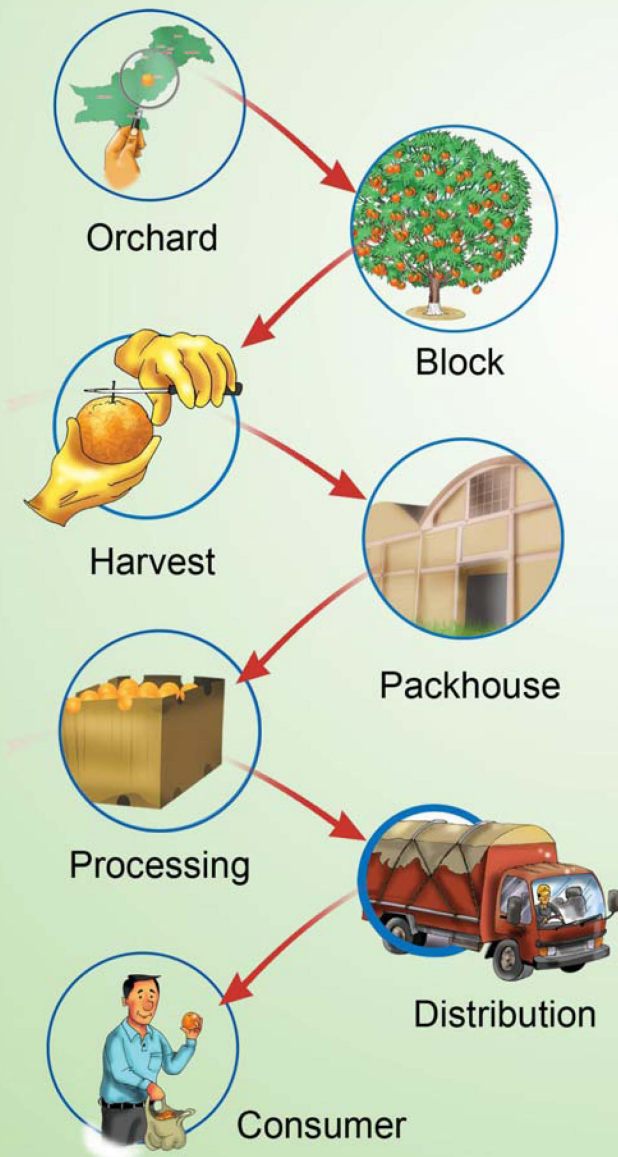
Cultivator
Orchard Name
Harvesting date
Fungicide
Date of Treatment
Size Grade
Weight Wax
Date of Packing



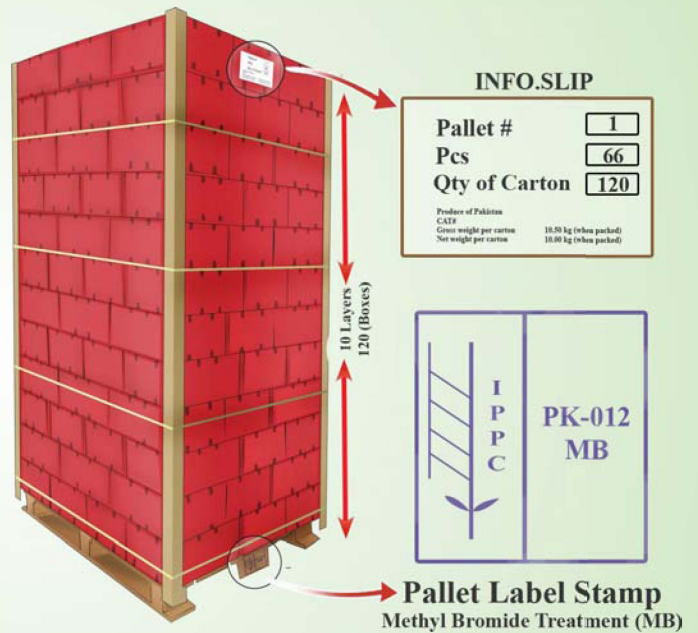
Information to be given on the box includes variety, orchard, harvest and packing date, processing treatment / fungicide, class, count and weight



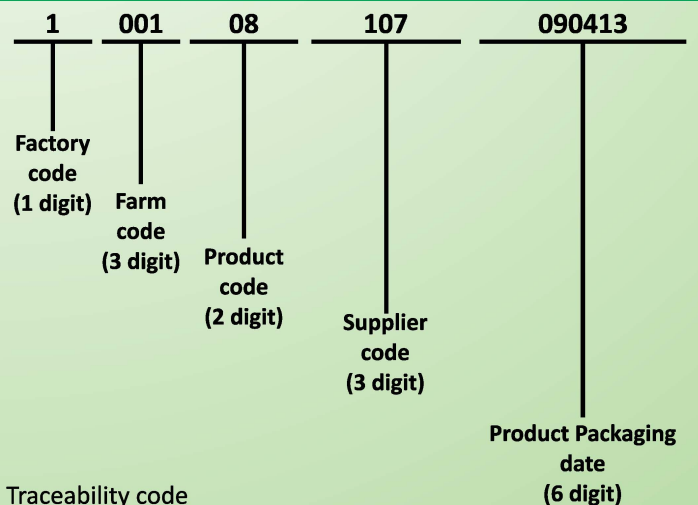
- Gum of fruit sticker must be non toxic and fruit grade
- Traceability must be ensured on the package



Traceability must be maintained at every level (farm to end customer)

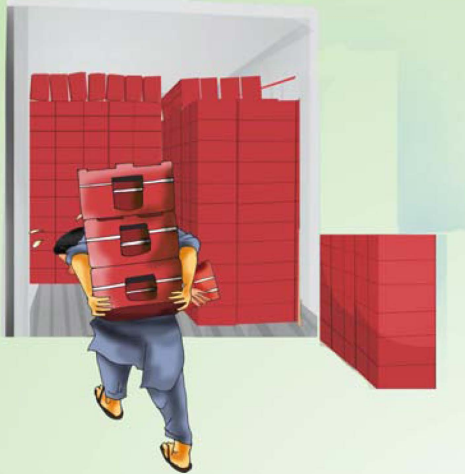


- SPS law requires a marked stamp on the side of pallet to highlight treatment of pallet against termite
- If HT is mentioned on stamp, it means heat treatment whereas MB shows Methyl Bromide treatment



loading and reefer transport

Existing Practices

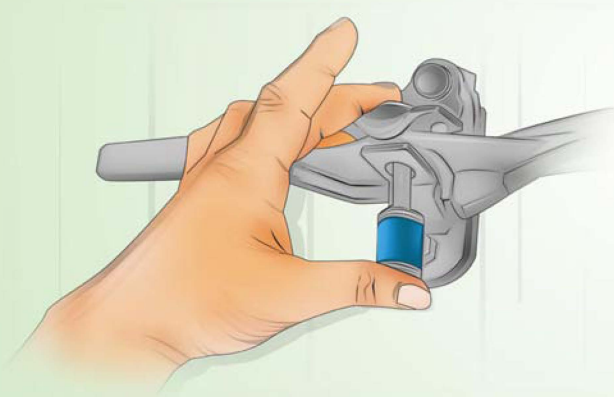


Shifting of fruit boxes to reefer after exposing to normal air temperature (condensation)

Recommended Practices



- Shift fruit boxes to reefer container instantly without exposing to high temperature
- Boxes should be placed in reefer by stacking sequence



- Start cooling system to achieve desired temperature before loading fruit boxes
- Turn off cooling system during loading and seal the container after loading



Reefer temperature should be maintained at 4°C with 90% RH

Maintain reefer temperature during road transportation from farm to sea-port by plug in at different stations



During transport / Shipping, ventilation for a 40ft container should be set at 25m³/h (cubic meter per hour)



- 1) Multan at processing facility
- 2) Sadiqabad
- 3) Karemabad near moor
- 4) Karachi port

Container must arrive at port 24 hours before cut off time

Sources of contamination that can effect fruit quality



Related Reading/References

The authors of these guidelines developed to address the CCPs along the entire Kinnow supply chain have benefitted from the work done by FAO and other international agencies. For further reading these sources may be referenced:

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<http://edis.ifas.ufl.edu/pdffiles/HS/HS118500.pdf>
2. Small-Scale Postharvest Handling Practices: A Manual for Horticultural Crops (4th Edition), Postharvest Technology Research and Information Center, University of California, Davis.
<http://ucce.ucdavis.edu/files/datastore/234-1450.pdf>
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<http://ucanr.edu/datastoreFiles/234-2088.pdf>
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http://www.nda.agric.za/doaDev/sideMenu/plantHealth/docs/ExportManual_SAfruitIndustryAug2010.pdf
5. Fertilizer use by crop in South Africa, Land and Plant Nutrition Management Service, Land and Water Development Division, Food And Agriculture Organization Of The United Nations, Rome, 2005.
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<http://www.fao.org/docrep/014/i1909e/i1909e00.htm>
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http://www.fao.org/fileadmin/user_upload/sustainability/pdf/Global_Food_Losses_and_Food_Waste.pdf

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11. PINEAPPLE: Post-harvest Operations, Food and Agriculture Organization of the United Nations, 2005.
http://www.apo-tokyo.org/00e-books/AG-18_PostHarvest/AG-18_PostHarvest.pdf
12. Good Agricultural Practices (GAP) on horticultural production for extension staff in Tanzania. Training manual. Food And Agriculture Organization Of The United Nations, Rome, 2010.
<http://www.fao.org/docrep/013/i1645e/i1645e00.pdf>
13. Training Manual For Management Of Citrus Greening (Huanglongbing) And Its Insect Vector The Asian Citrus Psyllid (Diaphorina Citri) In Jamaica. Prepared under The Citrus Greening FAO TCP Project
http://www.moa.gov.jm/PlantHealth/data/Training%20Manual_Citrus%20Greening.pdf



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