National Vocational Certificate
Level 2 in
Agriculture (Citrus Production)

CBT Curriculum

NATIONAL VOCATIONAL & TECHNICAL TRAINING COMMISSION

NAVTTC نیوٹک

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1. Introduction

Citrus occupies an important position among fruits in Pakistan. It accounts for about 40 percent of total production of all fruits in the country. Among various species and cultivars, kinnow has distinctive position for Pakistan. Pakistan accounts for about 95% of the world total production of kinnow variety and is 6th largest producing and exporting country of citrus. Its market share in term of value is about 49,500 thousand USD annually. Of the total area under fruits 35% is under citrus of which 56% is used for citrus has been chiefly produced (95%) in Punjab. Kinnow has special importance because of easy to peel, high juice contents, very special flavor and high contents of vitamin C. Citrus production has been steadily increasing 199.4 thousand hectares with 2458.5 thousand tons but its export have been static 300 thousand tons(FAO, 2010)

Citrus is grown in all five provinces of the country. In Punjab it is grown in several districts which include Sargodha, Sahiwal, Toba Tek Singh, Lahore, Sialkot, Jhang, Minwali, Multan, and Gujranwala. In KPK six districts are well known including Mardan, Peshawer, Swat, Swabi, Noshera, and Hazzara. Province Sind has three districts (Sukkur, Khairpur, and Nawabshah) where citrus is grown and in province Balochistan, Mekran, Sibi and Kech are the three districts where citrus is grown. In Gilgit Baltistan different varieties of oranges are mostly reported.

Pakistan has average yield of citrus fruit far less (9.5 tons/ hectare) than other citrus producing countries of the world like Brazil, USA, China, Spain and Australia (More than 25 tons / hectare). Pakistan citrus industry is one of the advance citrus industry complying all international SPS compliance and guidelines. Currently more than 300 citrus processing units are working in the country mainly in Punjab in which more than 50,000 seasonal employees coming from all over the country are engaged for almost 4-6 months. It is single horticulture sector hiring about 10,000 fruit carriage vehicles and more than 12,000 permanent employees (PHDEC, 2012).

The main reasons for low productivity are poor management cultural practices, imbalance and substandard fertilization, limited canal irrigation and brackish underground water, alternate bearing due to late harvesting and out dated production technology. Standard fertilization and pesticide application, advance cultural practices through expert field workers are fundamental features always contribute productivity of citrus fruit.

1.1 Description of the Course Structure

This curriculum comprises 3 modules and 12 practicing units. Delivery of the course will be full time 5 days a week. This component of citrus course will be covered in 3 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follow:

Module Title and Aim	Theory	Practical / Workplace	Total Hours
Module 1: Citrus Orchard Management Module Aim: The potential objectives of this module are to develop evaluating of land preparation for new plantation, selection of new plantation, carrying out the orchard management practices including rotavator, cultivation, hoeing, basin formation pruning training trimming of citrus plants. Introduction of IPM including application techniques of pesticides.	48 hours	216 hours	264 hours

Module Title and Aim	Theory	Practical / Workplace	Total Hours
Module 2: Citrus Harvesting Module Aim: Evaluating of citrus picking and harvesting considering the maturity parameters and quality characteristics required for marketability of the fruit. Identification of different physiological characteristics of fruit required for picking, sorting at farm level to avoid duplication of work and waste of resources, dumping or burying of discarded fruit grade to minimize the incident of fruit fly in citrus groves.	12 hours	42 hours	54 hours
Module 3: Citrus Handling on the Farm Module Aim: Selection of technically recommended and cost effective packing material at farm level, filling of the baskets in given capacity and manual operation standards, managing transportation for carriage of fruit from farm to either processing unit or directly market.	04 hours	20 hours	24 hours

1.2. Duration of Course

Total Time 3 months

Total Training Hours: 400 hours

1.3. Distribution of Time (Theory/Practical)

Theory: (20%)

Practical: (80%)

Training day per week: 5 Days

1.4. Specific characteristics and Potential Objectives of Training Program

This modular curricular program is designed to strengthen the expertise of citrus field workers engaged in establishment of citrus groves, citrus quality production, processing and marketing in the country. This short course will cause to generate professional, skilled and technically well-equipped group of labor which is always very much demanded in citrus industry both at farm and post-harvest processing levels. It will cause enhancement of farm production, minimizing the fruit losses and will largely contribute in marketability of citrus which will ultimately cause the prosperity of community and the country.

Other salient characteristics and potential objectives of this training are as under:

- Regarding specific characteristics this practical modulus training will be specifically designed in citrus potential production areas e.g. Sargodha, Mundi Bhahauddine and Toba Tek Sing etc.
- Citrus demonstration plot having age of 10-15 years would be selected having good approach, focal location, near to the training venue, having good irrigation capacity and other input.
- This training program will be launched in deprived, ignored and needy areas to fetch good results of the activity. Area will be focused having potential to involve the target participant number with cooperative and adaptive farmer for the multiplication of knowledge and practices.

- Training on citrus quality production will cause to improve the quality by involving citrus expert involved at farm level attached with either single grower, with group of growers, association and cooperative society etc
- This training will furnish the expertise of citrus expert in designing and applying citrus inputs technically suggested and research based recommended. Research divulge that technical recommendation have great contribution in quality production and product management.
- It will equipped the trainee to plan the needed dosage and application timing of all input involved in citrus production which will guarantee the bumper fruit production having good export quality.
- Will guide both the trainee and stakeholder in planning the costs, timely inputs and operations. Timely inputs save extra budgets and make easy farm practices because supporting inputs like canal irrigation, hoeing, rutavate and land cultivation add efficacy of input.
- It will cause to lower down the input cost, lower down the product waste and automatically will add the profitability of growers.
- This modulus course will cause to improve the work proficiency of involved human and other resources. Opportunities of employment will be generated which will cause the prosperity in local community.
- Through getting this training export quality of citrus will be improved and complaints from customer will be reduced.

1.5 Entry Level for Trainees

- Matriculation
- ***Age:*** 18-35 Years

Trainee or worker should be self-confident, self-motivated, physically strong and very much willing to carry work with manually. He should be regular and punctual, honest, social and team player. He should be innovative, smooth and enthusiastic for analytical skills.

1.6 Minimum Teaching Qualification

It is expected that the trainer for this training course must have at least the qualification of bachelor degree in agriculture along with work experience in citrus production field.

1.7 Medium of Instruction

The medium of instruction for this course should be combination of Urdu and Local Language for good evaluating of the trainee.

1.8 Suggested Distribution of Modules

Module 1: Orchard Management

- Prepare the land
- Manage orchard plantation
- Fertilizer Application
- Operate rotavator and cultivator
- Irrigate the orchards
- Perform Pruning
- Apply insecticides, pesticides, fungicides and herbicide

Module II: Citrus Harvesting

- Perform citrus picking
- Perform citrus sorting
- Manage citrus waste

Module III: Citrus Handling at Farm

- Perform packing and filling
- Manage transportation

1.9 Definition of the Trade

Particularly, this curriculum is meant to generate a stuff of citrus production experts at farm levels which would be playing a key role in enlivening and promoting citrus trade. In Pakistan per acre production is far less than the developed countries like Brazil, Spain, China, Turkey etc due to lacking of technical expertise involved at farm levels which is not only causing to product substandard fruit but also adding the farm level losses acceding 20-40% (PHDEC).

1.10 Overall Objectives of the Course

This modular curricular program is designed to strengthen the expertise of citrus field workers engaged in establishment of citrus groves, citrus quality production, processing and marketing in the country. This short course will cause to generate professional, skilled and technically well-equipped group of labor which is always very much demanded in citrus industry both at farm and post-harvest processing levels. It will cause enhancement of farm production, minimizing the fruit losses and will largely contribute in marketability of citrus which will ultimately cause the prosperity of community and the country.

1.11 Competencies Gained after Completion of the Course

After completion of this course the trainee will be able to:

- Implement the basic principles of pre and post-harvest handling of citrus fruit.
- Manage orchard including site selection, selection and plantation of new groves, irrigation, fertilization and pesticide application, pruning, training, trimming and top working and other orchards cultural practices.

- Monitor all critical stages of citrus crop cycle including flowering, fruit setting, button drop, fruit development and maturation and picking and harvesting etc.
- Proficient in post-harvest management including sorting, transportation, processing and cold storage.
- Act as expert in data collection and stock keeping of citrus fruit.

1.12 Personal Requirements

Trainee or worker should be self-confident, self-motivated, physically strong and very much willing to carry work with manually. He should be regular and punctual, honest, social and team player. He should be innovative, smooth and enthusiastic for analytical skills.

1.13 Opportunities for Employment and Career Advancement

- **Government Projects and Matching Grants:** Pakistan is focusing on supply chain improvement of horticultural products especially potential fruits and vegetable in which citrus is always highlighted very much because of expanding production, processing and marketability. Many projects are working in Pakistan like Supply Chain Improvement Project, ASF-USAID, CSF and Value Chain Development etc. ASF is five years project working on supply chain improvement of citrus has to deliver more than 200 different grants on it. Citrus expert can play a very vital role in winning and implementation of matching grants. All applicants are aspiring for citrus consultants but in market none of the expert is available. So it is great opportunity for trainee of this course
- **Global GAP, Pak GAP and Organic certification:** Pakistan Horticulture Development & Export Company has introduced wonderful competitive trends of cooperative farming, corporative farming, Global GAP and Pak GAP and organic certification in Pakistan. These concepts actually have been made tremendous and essential quality production and export marketing tools. This is big career opportunity for citrus trainee which will definitely expand very much in coming future.

- **Citrus Consultant and Certification Bodies:** Along with government agencies there are many private consultant agencies and certification bodies are also working which are always needed citrus experts for system preparation and auditing of different systems like IFS, BRC, HACCP and ISO 22000:2005 etc.
- **Citrus Processing Industry:** In Pakistan citrus is growing on more 199.4 thousand hectares with 2458.5 thousand tons annually. More than 300 citrus processing and pack houses working having capacity of more than 10,000 tons / day for export. All units are well equipped and meeting all SPS standards needed for the marketing of citrus. For the implementation of these standards and their continuity industry always aspire for citrus experts but unfortunately there is none of expert working in the industry currently.
- **Citrus Private Farms:** in Pakistan there is emerging trend of developing modern citrus farm to resolve the quality issues. All farms are very much interested in hiring citrus because currently these are working with non technical and professional team member. According to a survey conducted by Pakistan Horticulture Development & Export Company currently more than 730 farms or citrus clusters are present which can engage the expert independently.
- **Fertilizer and Pesticides Companies:** Similarly different fertilizer and pesticide companies are also working in the field without citrus expert. Citrus expert will definitely a good choice for such companies to engage them for good impact and product marketing.

Participants of this training program would be capable of managing citrus production including all aspects from nursery shifting, establishing orchard groves and managing the orchards. The trainee will be able to manage all inputs and cultural practices and will be able to work as citrus supervisor, supervisor quality production, technical supervisor, and citrus farm manger etc.

2. Overview of the Curriculum

Module	Practicing Units	Duration
Module 1: Orchard Management	**LU 1:** Prepare the land	72 hours
	LU 2: Manage orchard plantation	48 hours
	LU 3: Apply fertilizer	30 hours
	LU 4: Operate rotavator and cultivator	48 hours
	LU 5: Irrigate the land	24 hours
	LU 6: Perform pruning	24 hours
	LU 7: Apply insecticides, fungicides and herbicides	36 hours
		Total time = 282 hours

Module	Practicing Units	Duration
Module 2: Citrus Harvesting	**LU 1:** Perform citrus picking **LU 2:** Perform citrus sorting **LU 3:** Manage citrus waste	24 hours 18 hours 18 hours **Total time** = 60 hours
Module 3: Citrus Handling on Farm	**LU 1:** Perform packing and filling **LU 2:** Manage transportation	12 hours 12 hours **Total time** = 24 hours

3 Modules = 366 hours

Module 1 assessment and revision time = 15 hours

Module 2 assessment and revision time = 05 hours

Module 3 assessment and revision time = 04 hours

Flexible hours for final course assessment & all leaning units selected by the trainer = 10 hours

Total time of complete course = **400 hours**

3. Teaching and Learning Guide

There is no specific methodology of teaching this curriculum. Preferable independent and responsible work action as the aim of the training are imparted in such fields of education, where it is part of the overall methodological concept. Thus every methodology can contribute to achieving the targeted objectives. Methods that directly promote the capacity building are particularly suitable and therefore should include appropriately in the teaching.

3.1 Module Title: Citrus Orchard Management

Objective of the Module: The aim of this module is to develop the basic knowledge, skills and evaluatings of practical citrus orchard management in local working conditions for field worker.

Duration of the Module

Total 264 hours **Theory** 48 hours **Practice work** 216 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Practicing Place
1.Land preparation	The trainee will be able to: 1. Identify characteristics of suitable soil 2. Select suitable Land 3. Ensure availability & fitness of Irrigation water 4. Identify the operational tools 5. Carryout various steps for land preparation including ploughing, leveling and dressing 6. Understand and draw orchard	1. The importance of site selection, site selection criteria, evaluating of soil types i.e., sandy loam etc, its topographical specifications highly suitable for citrus orchards. Irrigation water availability either canal, ground water its suitability i.e., pH, EC etc 2. General cultivation	Total: 72 hours Theory 14 hours Practical 58 hours	Mechanical tools i.e., tractor, cultivator, rotavator, leveler, digger. Hand tools for digging, back filling and leveling i.e., Spade etc. Hand sprayer. Sweet earth, farm yard manure, sand,	For the theoretical practicing: Class room either in field station or separate with facilities of white boards, charts etc For practical practicing:

	layouts 7. Dig pits for planting citrus plants 8. Prepare Compost and pit filling	practices i.e., weed eradication, cleaning, leveling etc. 3. Practice and draw different methods of citrus orchard layout, Pit preparation either manually or mechanically with digger, Plant to Plant distance= 18ft and Row to Row distance= 15ft. Pit specification (3' x 3' x 3'), time one month prior to plantation, anti termite/soil amendments to make it free from root and soil born pests. Pesticides may be used as per lable instructions and expert opinion, familiar about general compost preparation specifications i.e., one part sand, one part soil, one part well rotten and decayed farm yard manure, well mixed and fill the pits with compost upto the top and irrigate and leave it for 1-2 weeks.		pesticides, Fungicides, Termicides	Field, orchard (demonstration block)
2. Manage Orchard Plantation	The trainee will be able to: 1. Identify different citrus varieties 2. Select desired variety of citrus plants	1. Introduction to different varieties of citrus e.g., orange, mandarin, lemon, lime, grape etc. 2. Selection of desired	Total: 48 hours Theory 10 hours	Potentio meter = 01 No Spade = 1 for 5 trainees Khurpa = 1 for 5	For the theoretical practicing: Class room either in field

	3. Determine and assess pre plantation conditions (temperature, soil moisture conditions) 4. Observe the plantation timings 5. Transplant the plants 6. Carryout post plantation caring operations including watering, staking and making plants basin, hoeing etc	variety of citrus on the basis of health conditions, true to type, high budded/ grafted, well treated health, vigor, disease free etc 3. Understanding of required environmental conditions like *vatter*, time (morning and evening) of plantation avoiding transplanting shock. 4. Plantation of citrus plants as per layout with proper measurements with help of measuring tape, ropes and pegs. 5. Light watering to plants with bucket soon after plantation, staking of plants to make their roots firm and straighten plant growth, preparation of plants basin upto appropriate depth and width, regular hoeing for weed eradication, aeration of soil, removal of water shoots, maintenance of single stem and training of plants to make their canopy uniform.	Practical 38 hours	trainees Shovel= 1 for 5 trainees Choa ramba = 1 for 5 trainees Clipper/pruning scissor = 1 for 5 trainees Looper/ branch cutter=1 for 5 Bamboo sticks for staking = 1 for each plant Measuring tape=01 Ropes, thread, pegs as per requirement Showering cane = 1 for 5 trainees Citrus plants for plantation as per requirement	station/nursery or separate with facilities of white boards, charts etc For practical practicing: Field/orchard/nursery (demonstration block)

3. Fertilizer Applications	The trainee will be able to: 1. Identify fertilizers types on the basis of brands, chemical composition and formulation 2. Understanding of different methods of fertilizers application 3. Determine dosage of fertilizer and time of application 4. Prepare and apply the farm yard and green manure 5. Explain green manure application and its benefits	1. Identification and evaluating of organic and inorganic/chemical fertilizers, different types of chemical fertilizers on the basis of macro nutrients i.e., nitrogen, phosphorus, potash e.g. Urea, Nitrpshos, DAP etc and micro nutrients e.g. iron, magnesium, boran, sulphur etc 2. Utilizing organic fertilizer (Farm Yard Manure, Chicken Manure etc) and dosage of well rotten manure i.e. 40-60 Kg / plant having age more than 10 years 3. Understanding of different functions of nutrients available in different fertilizers e.g. nitrogen for vegetative growth, phosphorus for strengthening of root functions and potash for reproductive growth, functioning of micronutrients in regulating the physiological functions of plants and being used in traces. 4. Practicing different methods of fertigation	Total: 30 hours Theory 06 hours Practical 24 hours	Fertilizer one bag of each brand e.g Urea 01 Nitrophas 01 SSP 01 DAP 01 TSP 01 NPK 01 Nitrate (CAN) 01 SOP 01 FYM (Well rotten) 250Kg Chicken Manure 100Kg Seeds of green manuring crops e.g Janter 10Kg Goara 6Kg Measuring can 5Kg 01 Plastic sheet (10X10sft) 01 Shawal / Khurpa 01 / groups Shoulder fertilizer bag 01 / group	For the theoretical practicing: Class room either in field station with facilities of white boards, charts etc For practical practicing: Field/orchard (demonstration block)

		e.g., broad spreading either manually or mechanically (boom sprayer etc), water soluble either through flood irrigation or mechanical means (drip line, sprinkler etc) or manual sprayer, foliar application of normally micronutrients directly on the foliage through sprayer. 5. Understanding of fertilizer requirement by the plants e.g. nitrogen deficiency resulted in pale and yellow leaves of plants, deficiency of phosphorus resulted in stunted plant growth and deficiency of potash resulted in less and weekend fruit, time of fertilizer application (normally in the start of active growth phase) and exact dose of fertilizer (depending on the age, size and critical stage of plants). 6. Selection and understanding of different types of green manure (Janter, Arhar, *sangi*, beans and guara etc),			

		timing depending on variety of green manuring crop.			
4. Operate tools & equipments	The trainee will be able to: 1. Identify different operational tools 2. Ensure availability and workability of required tools 3. Confirm operational guideline and checklist 4. Identify and ensure tools safety measures	1. Introduction to tractor and tractor drawn implements like, rotavator, cultivator. Impact of operations utility on soil structure. 2. Categorizing the sequence and working order of every tool. 3. Understanding the operational guide and maintenance manual for efficient and trouble free use of each and every equipment 4. Interpretation of equipment trouble shooting and their immediate solutions at farm level 5. Observing human safety elements during use of each and every equipments during its operation 6. Perfrom post operation caring and safe parking under shed 7. Preparing the operational log book of each tool and data recording for regular maintenance	Total: 48 hours Theory 10 hours Practical 38 hours	Tractor = 01No Rotavator= 01No Cultivator= 01No Leveler= 01No Digger=01No Safety and operational manuals= 01 No for 05 trainee of each equipment White board =01No Marker = 03 No. of three different colors Spade = 1 for 5 trainees Khurpa = 1 for 5 trainees Shovel= 1 for 5 trainees Choa ramba = 1 for 5 trainees Clipper/pruning scissor = 1 for 5 trainees Looper/ branch cutter=1 for 5	For the theoretical practicing: Class room either in field station with facilities of white boards, charts etc For practical practicing: Field/orchard/ (demonstration block)
5. Irrigation	The trainee will be able to:	1. Identify the methods of	Total:	Magnifying lens =	For the

	1. Irrigate according to critical points 2. Streamline the effective time of irrigation 3. Workout field requirement of irrigation water 4. Ensure the fitness of irrigation water 5. Select the effective irrigation method needed 6. Quantify the quantity required on plant basis 7. Identify different tools of irrigation, their effective use and maintenance	irrigation systems 2. Selecting best available source of irrigation 3. Evaluating the effectiveness of each available source of irrigation water 4. Irrigation needs based on plant symptoms and soil conditions 5. Evaluating the methods of watering of the plants e.g flood irrigation, channel irrigation, basin irrigation, modified basin systems, sprinkler, drip systems etc 6. Irrigation needs based on critical stages and crop cycle. 7. Identifying the needs and quantity of irrigation water requirements based on plant leaf wilting, die back and drying up. 8. Determine the needs of water requirements based on field observations and potentio meter reading. 9. Determine the fitness of water based on nutrition level. 10. Analyzing the suitability of irrigation based on	24 hours Theory 04 hours Practical 20 hours	01 for 5 trainee Potensio meter = 01 for 5 trainee Spade = 1 for 5 trainees Khurpa = 1 for 5 trainees Choa Ramba = 1 for 5 trainees Rope 200 meter = 1 for 10 trainee Pegs = 4 for 5 trainee Shawel = 1 for 5 trainees	theoretical practicing: Class room either in field station with facilities of white boards, charts etc For practical practicing: Field/orchard/ (demonstration block)

		salts, pH level and EC value. 11. Evaluating the best available source of irrigation water e.g. canal water, subsoil water, rain water etc 12. Practicing the methods of water conservation in the field with covering crops and other mechanical methods e.g. plowing, planking etc. 13. Evaluating the effective use of different tools needed in irrigation, their safe use, maintenance and storage			
6. Pruning/ training and trimming	The trainee will be able to: 1. Identify and practice types of pruning 2. Identify the tools of pruning, training and trimming 3. Practice the benefits of pruning practices 4. Identify the branches to be pruned for balance canopy 5. Follow the guidelines and check list of each tool used 6. Practice the maintenance and storage of pruning tools 7. Follow Post operation treatment	1. Evaluating of types of pruning, trimming, training, raising, topping, thinning and making canopy balance. 2. Identify the effective time and critical stage of pruning and other practices 3. Identification of different tools used for different objectives and pruning levels e.g. pruning shears, clippers, pruning knife, pruning saw, chain saw, folding saw, long reach pruner, bypass hand pruner, pruning	Total: 24hours Theory 04 hours Practical 20 hours	Pruning Shears = 01 for 5 trainee Pruning Clipper = 1 for 5 trainee Pruning knife =1 for 5 trainee Pruning saw = 1 for 5 trainee Chain saw =1 for 5 trainee Folding saw =1 for 5 trainee Long reach pruner =1 for 5 trainee Bypass hand pruner = 1 for 5 trainee Pruning scabbard	For the theoretical practicing: Class room either in field station with facilities of white boards, charts etc For practical practicing: Field/orchard/ (demonstration block)

		scabbard, small bypass lopper etc 4. Analyzing the cultural and fruit quality benefits of pruning, trimming and training practices 5. identifying non productive branches and shoots 6. Identification of water suckers, off shoots, structurally unsound, unwanted and non productive shoots and their removal/ cutting 7. Evaluating the effective and safe working of each pruning tool following the guidelines and checklist provided 8. Prevent crowding of main scaffold braches of citrus 9. Remove shortens water shoots to prevent them for becoming too dominant. 10. evaluate the indirect benefits of aeration (Skirt pruning), light penetration and balance canopy formation 11. Analyze the benefits of reducing fruit damage, wind scar due to limb rubbing on developed fruit and improving its esthetic value		= 1 for 5 trainee Small bypass lopper = 1 for 5 trainee Measuring tap = 1 for 5 trainee Brush = 1 for 5 trainee Fungicide = 1000 grams for 100 mature plants or Bordo Past (1:1:12) for 50 plants	

		12. Determining insect pest infestation control and balance vegetative proliferation of citrus plant. 13. technical use of different tools used for pruning and efficacy of each tool 14. Following the maintenance of tool and their safe storage mentioned in their operation guide. 15. Evaluating the post operation care of plants e.g using *Bordo* Past (1:1:12) for 50 plants using fungicide @ 200 grams for effective preventive treatment against fungus infestation.			
7. Pesticides, weedicides, herbicides, fungicides applications	The trainee will be able to: 1. identify the citrus diseases infestation at economic threshold and economic injury levels 2. Determine the citrus insect infestation at economic threshold and economic injury levels. 3. Identify the symptoms of all citrus insect pest attacks 4. Identify citrus weeds and herbs and their control. 5. Identify the beneficiary insect	1. Identification of different potential insects e.g. citrus psylla, whitefly, mealy bug, blackfly, fruitfly, nematodes, leaf miner, leaf roller, aphids, citrus thrips, citrus bud mites, red mites, red scales, snailes, cottony cousion scale and lemon butterfly etc 2. Evaluating the control of all potential insects through using different	Total: 36 hours Theory 06 hours Practical 30 hours	Spray kit = 1 for 5 trainee First aid kit = 1 for 5 trainee Spray machine = 1 for 5 trainee Beaker = 1 for 5 trainee Pipit = 1 for 5 trainee Measuring Can 1 Liter = 1 for 5 trainee Spatula = 1 for 5	For the theoretical practicing: Class room either in field station with facilities of white boards, charts etc For practical practicing: Field/orchard/ (demonstration block)

	pest of citrus 6. Practice the rearing of beneficiary predators for efficient biological control. 7. Practice first aid and preventive measure dealing any incident 8. Maintain the record of all chemical used 9. Use the spray kit and spray tools and machines properly	insecticides recommended for citrus fruit e.g Tracer, Amedachloprid, bifenthrin, Abamectin, amamectin etc 3. Identification of different potential diseases e.g. citrus phytophthora/ gomosis, citrus scab, greasy spots, citrus melanose, citrus canker, sooty mould, citrus greening, citrus tristiza, stem end rot and button rot etc 4. Evaluating the disease control compounds e.g. copperoxy chloride, copper hydroxide, thiophinate, methyl, copper Sulphate, benomil etc 5. Identifying damaging modes of each insect pest both at threshold level and economic injury level. 6. Identification of different beneficiary insects of citrus 7. Evaluating multiplication of citrus predators and beneficiary insect. 8. Identification of physiological disorders		trainee Citrus insecticides = 1 for 5 trainee Citrus fungicides = 1 for 5 trainee Herbicide = 1 for 5 trainee Weedicides = for 5 trainee	

		abiotic and genetic e.g. Chimera, frost injury, injury due to growth regulator, hail damage, surburn, mesophyll collapse, wind damage, phytotoxicity, minerals deficiencies etc 9. Identify the symptoms of all insect, pest and other physiological disorders in citrus 10. Identification of weeds and herbs affecting citrus groves and damaging plant available nutrition 11. Eradication of all these damaging weeds and herbs using weedicides and herbicides e.g. Roudup, Weeds cleaner, Champion and Chlor Plus etc 12. Formulating and mixing following standard recipe of different insecticides, pesticides, weedicides and other chemical application selected for spray application. 13. Identification of different tools needed for spray formulations e.g. spray machine, beaker, tank, pipit, cylinder etc 14. follow the safety			

		measures while dealing any chemical either foliar application, flooding and drenching etc 15. Perform the Integrated pest management of citrus and recommendation in the light of SPS compliances 16. Follow Food Safety Management Systems (FSMS) and Quality Management Systems (QMS) involved in the safety of citrus fruit. 17. Follow the basic knowledge of Global Good Agricultural Practices (GAP), GMP (Good Management Practices) and (BMP) Best Management Practices 18. Practice the storage and safe operation of all tools needed in field operation. 19. Use spray kit and operation of all tools and machines involved in spray treatments 20. Practice the first aid treatment at farm level in case of any emergency incident. 21. Identification of emergency contacts to			

		deal any incident effectively. 22. Maintain inventory of all chemicals like FIFO (First In First Out) and FILO (First in Last Out) etc and record keeping of all chemicals			

3.2 Module Title: Citrus Harvesting

Objective of the Module: The intended objectives of this module is develop the basic information, knowledge, skills and evaluatings of citrus harvesting for a field worker in local working conditions on citrus farm.

Duration of module

Total: 54 hours **Theory**: 12 hours **Practice**: 42 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Practicing Place
1. Citrus Picking / Harvesting	The trainee will be able to: 1. Identify the quality of fruit maturity. 2. Examine and find rind colour development and harvesting charts 3. Determine the ideal time of harvesting, marketing and destination time and quality requirements 4. Identify the harvesting tools and effective use of picking kit 5. Follow the personal safety and hygiene 6. Follow weighing methodology and standards 7. Calibrate the weighing machine	1. Selecting the quality of citrus fruit based on: - Rind colour break aesthetic value, nutrition level - Flavor and aroma development - sound and Compactness - shape and size - ripeness and maturity - Brix and Total Soluble Salts development - Grade specification and number of seeds 2. Introduction of harvesting charts based on: - Harvesting time - Method of harvesting - Pattern of harvesting - Selection of fruit for picking - Technical skills and expertise for harvesting team	Total: 24 hours Theory 05 hours Practical 19 hours	Harvesting tools i.e. 1. Picking scissor 1for each 5 trainee 2. Picking bags 1 for each 5 trainee 3. Plastic basket 1 for each trainee 4. Calibrated Weighing machine 1 (It will be used during all activities of sorting and waste management) 5. Picking uniform 1 for each trainee 6. Spade 1 for each group 7. First aid kit 1 for	For the theoretical practicing: Class room either in field station or separate with facilities of white boards, charts etc For practical practicing: Field, orchard (demonstration block)

		- Selection of weather for harvesting - Plant and fruit conditions at harvesting time - Physical fitness of picking labor 3. Introduction of harvesting tools and equipments including: - Fruit picking knife - Harvesting scissors - Harvesting bags - Picking stands and stair - Picking baskets - Maintenance of picking tools and equipment 4. Follow of personal hygiene and safety including: - Hand washing and gloves usage - Nails and hear cutting - Healthy and active zero infection - Picking uniform having head cover, goggles, gloves, shoes, bag and picking tools - First aid kit its utilization and information about emergency treatment nearly available		each group	

		5. Maintenance of harvesting tools: - Storage of harvesting tools - Disinfection of harvesting tools - Sharpening and covering of tools after operation - Storage of picking tools and record keeping 6. Harvesting of selected fruit e.g. mature and ripen fruit, outer layer fruit having good rind colour development, compact, disease, insect and injury free fruit, compact and blemish free, marketable size and grade, using sharp cutter leaving button on collar end to avoid any infestation, using standard balanced low height stairs for upper canopy harvesting, avoid dropping of fruit to ensure any mechanical and physical fruit injury, using picking bags of standard capacity, avoid dropping and over filling of baskets etc			

1. Perform Citrus Sorting	The trainee will be able to: 1. Identify post harvesting operation at farm 2. Grade citrus depending on quality 3. Identify the fruit biological infestation 4. Identify different types of injuries 5. Follow standard filling and temporary storage of citrus at farm 6. perform the shading and covering of citrus at farm level 7. Develop the data sheets of fruit	1. Introduction of post harvest operations at farm level e.g. shifting fruit, sorting, weighing, filling, temporary storage and covering etc. 2. Identify the best way of shifting from plant to sorting/weighing station. 3. Evaluating utilization of picking plastic baskets @ 18-20 kg. 4. Introduction of grading / sorting parameters e.g. physical mature and complete ripen, sound and compact, rind colour developed, required size 54-110mm etc 5. Introduction of different injuries guiding in sorting of citrus e.g. mechanical injury caused during picking, thorn injury, wind scars, hail injury, chilling injury, birds biting and sun burn etc. 6. Identification of physical injuries and problems e.g. deformed shape, peduncle attached, oblong shape, de greening, affected and dried sac tubes, blemished and dried fruit. 7. Identification of biological effected fruits e.g. fruit fly	Total: 18 hours Theory 04 hours Practical 14 hours	1. Plastic baskets 2 for each group 5 trainee 2. Stand for baskets 2 for each group 5 trainee 3. Sorting gloves one set for each trainee 4. One big cloth for covering the sorted fruit	For the theoretical practicing: Class room either in field station or separate with facilities of white boards, charts etc For practical practicing: Field, orchard (demonstration block)

		maggots, bacterial and viral infestation, citrus melanose and birds biting. 8. Evaluating farm level sorting e.g. sorting of picked fruit into A, B and C grades, filling in to separate baskets in standard weight, electronic weighing into separate baskets, storage of baskets at farm under shade and covering with cloth sheet to avoid rodent, pest and other foreign items' entry. 9. Developing data sheet and inventory of baskets at farm level e.g. empty baskets, filled baskets, weight per baskets, total weight of fruit picked on specific farm, name and complete date of the farm, number of A,B and C grade baskets and weights of discarded fruit. 10. Storing and placing the weighed baskets into shade on leveled, clean and smooth surface. 11. Stocking baskets avoiding damaging of fruits due to pressing or over filling of baskets 12. Covering the dumped			

		stored baskets under cover to avoid any climatic effect and foreign particles e.g. rodents, dust, infected leaves and controlling direct contact of harvested product with sun light to enhance the shelf life, lowering the respiration and stopping the shriveling etc			
2. Managing Waste	The trainee will be able to: 1. Identify different waste grades (C and D) of citrus fruit 2. identify different qualities and characteristics and marketability of each fruit grades 3. Identify the causes of fruit spoilage and dropping 4. Follow the methods of burying 5. Chart preparation of each grade	1. Identification of C and D grade citrus fruit based on physical characteristics and visual quality e.g. dropping fruit under canopy, dropping and rotten due to early wind storms, fruit fly incident, dried and stunted fruit, mechanical and physical injured fruits 2. Identification of different grades based on marketability and selling potential e.g. good in physical appearance, compact, sound and eatable in low paying poor markets etc. 3. Evaluating of different causes of fruit deterioration, dropping and spoilage e.g. wind	Total: 18 hours Theory 04 hours Practical 14 hours	1. 2 baskets for each group 5 trainee 2. Spade for burying of waste fruit 1 for each group 5 trainee	For the theoretical practicing: Class room either in field station or separate with facilities of white boards, charts etc For practical practicing: Field, orchard (demonstration block)

		storms, hail storms, insect pest attach, mechanical operation in the field, improper harvesting techniques and after effects of imbalance nutrition application. 4. Arranging C grade fruit direct for value added industry or sorting separate into open carts or vehicles for direct supply 5. Collection of dropping and rotten fruit separately for different transportation e.g. for cattle feed manufacturing companies, value added processing companies. 6. Collection and burying of farm discarded fruit into the soil 2-3 feet deep to wipe out the maggots and larvae of fruit fly. 7. Installation of fruit fly traps in case of late harvesting to avoid fruit fly incident for coming crop			

3.3 Module Title Citrus Handling on the Farm

Objective of the Module: The potential objective of this module to develop the basic knowledge, skills and evaluating citrus handling after harvesting at farm level for a farm worker

Duration of Module:

Total time 24 hours, **Theory** 04 hours and **Practice work** 20 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Practicing Place
1. Perform Packing and filling	The trainee will be able to: 1. Identify the types of farm packing materials 2. Determine the packing capacity of packaging material 3. Determine packing methodology of citrus fruit 4. Know the human/ labour weight carrying capacity. 5. Follow citrus fruit post harvest handling and quality management 6. Stake packed baskets, crates and other packaging 7. Follow personal hygienic and food safety guidelines	1. Identification of different packing materials technically recommended for citrus fruit packaging at farm levels e.g. wood, plastic, and paper board. 2. Determining packaging capacity of each packing type e.g.10, 16 and 20 etc Kilogram based on different packaging material. 3. Evaluating the packing methodology and filling of packaging e.g. packing to avoid button damage and to avoid weight effect on lower fruit pieces, 4. Evaluating packaging based packing e.g. 80-120 fruits in 16kg wooden crates, 100-150 fruits in 20 kg plastic	Total: 12 hours Theory 02 hours Practical 10 hours	1. Packaging crates different sizes at least one of each material for one group 5 trainee 2. Calibrated weighing machine 3. Separation sheets for 20 crates 4. Stickers one leaf for each group transportation 5. Small hammer 1 for each group 6. Covering sheets for 20 crates 7. Spade 1	For the theoretical practicing: Class room either in field station or separate with facilities of white boards, charts etc For practical practicing: Field, orchard (demonstration block)

		crates 5. determining of usage capacity of packing material and labour operation standards 6. Evaluating different packing and filling systems e.g. - Direct packing without quality sorting - Packing without grade and quality sorting - Packing without standard weighing - Filling of plastic baskets for further treatment and quality processing for export markets. - Packing for direct marketing and shipment - Packing for short and long time storage - Packing for local fresh market direct selling - Packing directly for value added units 7. Evaluating packing and filling of citrus fruits considering shelf life, physicochemical characteristics and aesthetic quality etc 8. Packing of citrus fruit considering the destination time e.g. for middle east 8-10 days,			

		for east 20-25 days, Iran 25-30 days Central Asian states 35-40 days etc. 9. Evaluating short time and long time farm storage maintaining and ensuring quality and weight 10. Preparation of field for staking and short storage of packaging 11. Analyzing the concrete benefits of staking and short storage of fruit at farm 12. Evaluating the potential benefits of staking of baskets, palletized storage and stacking of packaging at farm level. 13. Introduction of personal hygienic conditions and food safety guidelines 14. Evaluating benefits of food safety guidelines their implementation 15. Evaluating the importance of food safety guidelines for export markets			
2. Manage Transportation	The trainee will be able to: 1. Identify the best transportation facility 2. Determine the importance of transport facility 3. Perform the loading and staking of crates in the	1. Selection of best available transport suited for fruit transportation 2. Evaluating the characteristics of transportation on quality	Total: 12 hours Theory 02 hours Practical 10 hours	1. Good maintained 4 wheel rental vehicle – 1 2. Well maintained	For the theoretical practicing: Class room either in field station or separate with

	transport 4. Determine the loading capacity of transport vehicle 5. Select the best route for transportation 6. Maintain quality record of the fruit	maintenance of the fruit 3. Evaluating the impact of transport on shelf life of citrus fruit 4. Evaluating the impact of rapid and safe transportation on fruit processing and marketability e.g. fruit should be processes and pack with short time (2-4 hours) is assurance of longevity and presentation. 5. Evaluating the benefits of staked loading in transportation. 6. Determining the capacity loading and its benefits in post harvest handling. 7. Benefits of standard loading in record keeping and data maintenance 8. Benefits of capacity loading of transportation. 9. Determining the loading capacity of different transports considering road conditions, road route, destination and time interval 10. Evaluating the impact of good route selection for carrying fruit from farm to		rental open truck vehicle for C & B grade for local markets	facilities of white boards, charts etc For practical practicing: Field, orchard (demonstration block)

		processing unit or fresh market e.g. poor road conduction causes fruit shocks and fruit quality deterioration. Short rout selection gives guarantee of fruit quality and timely post harvest handling 11. Evaluating and arranging direct transportation for B grade directly to local fruit markets 12. Evaluating and arranging direct transportation of C & D grade into value added processing units 13. Preparation of fruit data base e.g. - Farm production details - Quality details - Details of filled and empty baskets - Details of fruit grades and weight - Farm certification and registration - Time date and specification of harvesting etc			

4, General Assessment Guidance

Assessment is mostly refers to as the process of discussing and collecting the information from multiple and diverse sources in order to develop a deep evaluation of what students know, understand and can do with their knowledge as a result of their educational experiences. The process culminates when assessment results are used to improve subsequent practicing.

Assessment of student practicing is a participatory, interactive process that provides data/information you need on your students' practicing, engages you and others in analyzing and using this data/information to confirm and improve teaching and practicing, produces evidence that students are practicing the outcomes you intended, Guides in making educational and institutional improvements, evaluates whether changes made improve/impact student practicing and documents the practicing and your efforts.

Types of General Assessment

1. Formative Assessment/ Sessional Assessment
2. Summative Assessment / Final Assessment

In Pakistan there are two types of assessments which are being carried out commonly in such participatory and practical based trainings namely formative sessional assessment and summative or final Assessment.

1. Formative Assessment/ Sessional Assessment

Formative assessment is some sort of sessional assessment done at the beginning or during a training program or module thus providing the opportunity for immediate evidence for student practicing in a particular course or at a particular point in a training program. Classroom assessment is one of the most common formative assessment techniques. The purpose of this technique is to improve quality of student practicing and should not be evaluative or involve grading students. This can also

lead to curricular modifications when specific courses have not met the student practicing outcomes. Classroom assessment can also provide important training information when multiple sections of a course are taught because it enables programs to examine if the practicing goals and objectives are met in all sections of the course.

2. Summative Assessment / Final Assessment

Summative assessment is comprehensive in nature, provides accountability and is used to check the level of practicing at the end of the program. For example, if upon completion of a training students will have the knowledge to pass an accreditation test, taking the test would be summative in nature since it is based on the cumulative practicing experience. Program goals and objectives often reflect the cumulative nature of the practicing that takes place in a program. Thus the program would conduct summative assessment at the end of the program to ensure students have met the training course goals and objectives. Attention should be given to using various methods and measures in order to have a comprehensive plan. Ultimately, the foundation for an assessment plan is to collect summative assessment data and this type of data can stand-alone.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to practicing outcomes or practicing content can be conducted. For work place lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process. Methods include direct assessment, which is the most desirable form of assessment. For this method evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of a Citrus producer include:

- Work performances, for example land preparation and digging the holes for transplanting nursery plant, ensuring and selecting the disease free plant, without damaging the root system, timely transplanting without yellowing foliage growth.

- Demonstrations, for example demonstrating the planting the plant in well prepared hole having standard dimensions and after planting care including pressing of surface soil, basin formation, weeds eradication, sprinkler irrigation and protection against environmental stresses.
- Direct questioning, where the assessor would ask the student where water or off shorts are produced and how can be managed either through manual operations like d budding, cutting and picking, pipe covering or chemical application etc.
- Paper-based tests, such as multiple choice or short answer questions nursery production, orchard management, harvesting, hygienic and safety issues and working in team.

Direct and Indirect assessment

In direct assessment actual sample of work is observed produced during the training program while in indirect assessment different information collected through other means rather than looking for the actual sample of work produced during training program or unit.

Advantages and Disadvantages of Indirect Assessment

Advantages

- Indirect method are easy to administer
- Indirect methods may be designed to facilitate statistical analysis only
- Indirect methods many provide clues about what could b assessed directly
- Indirect methods are particularly useful for ascertaining values and beliefs
- Surveys can be given to many respondents at a same time
- Surveys are useful for gathering information alumni, employers and graduate program representatives

- Exit interviews and focus groups allow faculty to question students fact to face
- External receivers can bring a degree of objectivity to the assessment
- External reviewers can bring a degree of objectivity to the assessment;
- External reviewers can be guided either by questions that the Department wants answered or by discipline-based national standards.

Disadvantages

- Indirect methods provide only impressions and opinions, not hard evidence
- Impressions and opinions may change over time and with additional experience;
- Respondents may tell you what they think you want to hear;
- The number of surveys returned are usually low, with 33 percent considered a good number;
- You cannot assume those who do not respond would have responded in the same way as those who did respond;
- Exit interviews take time to carry out;
- Focus groups usually involve a limited number of respondents;
- Unless the faculty agrees upon the questions that are asked in exit interviews and focus groups, there may not be consistency in the responses.

Examples for indirect assessment of a citrus field worker:

a. Pruning of citrus fruit tree: branch cuttings observation will disclose the actual knowledge and practicing levels of trainee worker e.g. sharp cutting will avoid die back and penetration of fungal infestation in the tree.

b. Citrus fruit quality and size assessment gives indirectly assessment that how much pruning from inner side of plant has been carried out to facilitate for light penetration and aeration.

Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the work products were produced by the person being assessed.)

Assessing Qualities of trainee

When choosing assessment items, it is useful to have one eye on the immediate task of assessing student practicing in a particular unit of study and another eye on the broader aims of the program and the qualities of the graduating student. When considering assessment methods, it is particularly useful to think first about what qualities or abilities you are seeking to engender in the practiceers. There are eight broad categories of practicing outcomes which are listed below.

- Thinking critically and making judgements
- Solving problems and developing plans
- Performing procedures and demonstrating techniques
- Managing and developing oneself
- Accessing and managing information
- Designing, creating, performing
- Demonstrating knowledge and evaluating
- Communicating

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

1. **Reliability** means that the assessment is consistent and reproducible. For example if the work performance of preparing a compost for filling whole during transplanting a citrus nursery plant method adapted and assessed another assessor (e.g. the future employer) should be able to see the same work performance and witness the same level of achievement.

2. **Validity** means that a valid assessment assesses what it claims to assess. For example, if the ability to harvest citrus fruit from fruit tree in the orchard is to be assessed and certified, the assessment should involve selection and performance criteria that are directly related to citrus fruit and orchard. An interview about harvesting and picking of different crops would not meet the performance criteria.

3. **Fairness** means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

4. **Flexibility** means that the assessor has to be flexible concerning the assessment approach. For example, if there is a power failure during the assessment the assessor should modify the arrangements to accommodate the trainee needs.

Assessment Strategy for the Citrus Production Curriculum

This curriculum consists of 3 modules and 12 learning units:

- **Module 1: Orchard Management**

  LU 1: Prepare the land

  LU 2: Manage orchard plantation

  LU 3: Fertilizer applications

  LU 4: Operate rotavator and cultivator

  LU 5: Irrigate the land

  LU 6: Perform pruning

  LU 7: Apply insecticides, fungicides, pesticides and herbicides

- **Module 2: Citrus Harvesting**

  LU 1: Perform citrus picking

  LU 2: Perform citrus sorting

  LU 3: Manage citrus waste

- **Module 3: Citrus Handling on Farm**

  LU 1: Perform packing and filling

  LU 2: Manage transportation

Sessional assessment

The sessional assessment for all modules shall be in two parts: theoretical assessment and practical assessment. The sessional marks shall contribute to the final certificate qualification. Theoretical assessment for all practicing modules must consist of a written paper lasting at least one hour per module. This can be a combination of multiple choice and short answer questions. For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

Final assessment

Final assessment shall be in two parts: theoretical assessment and practical assessment. The final assessment marks shall contribute to the final qualification. The final theoretical assessment shall consist of a 3 hour paper, consisting of multiple choice, short answer questions and MCQs etc covering all three modules. In final practical assessment, class will be divided into five groups comprising five members in each group and one group will be assessed a day so consuming five men days for carrying final assessment of the modulus training. This represents a total of five sessions totaling 25 hours for a class. During this assessment period each student must be assessed covering all modulus course learnt during the training.

The assessment team

The number of assessors must meet the needs of the students and the training provider. For example where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 25 students shall therefore require assessments to be carried out over a five days period.

Planning for assessment

Sessional assessment: assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to decide ways to combine modules into a cohesive two-day final assessment programme for each group of five students. Training providers must agree the settings for practical assessments in advance.

Planning aid for sessional assessment

Duration: 15 hours **Theory:** 3 hours **Practical:** 12 hours

Module: 1 Orchard Management				
Learning Units	**Theory Days Hours**	**Practical Days Hours**	**Description / Recommended Sessional Assessment**	**Schedule Dates**
LU 1: Prepare the land	30 Minutes	120 Minutes	Each trainee will be evaluated through theoretical assessment by asking short questions and MCQs etc. For practical assessment trainee go through practical performance and identification the method which assessor think better. He may ask for identification of land preparation tools or may ask different questions e.g. What is the importance of land preparation? How much operations involved in land preparation? Which elements are used for soil conditioning? How land preparation for citrus orchards may differs from land prepared for agronomic crops? etc. Each trainee would have to perform the tasks allotted by the assessor.	

LU 2: Manage Orchard Plantation	30 Minutes	120 Minutes	After theory assessment trainee will go through practical assessment by asking different short question verbally or he may asked for performance. He may be evaluated by performing the selection of different verities of citrus plants? What is recommended age of the plant to be planted for new groves? What is top working? What is difference between budding and grafting? In citrus which method is best for maintaining specific characters of the mother plants? What are the specific characteristics of nursery plant recommended for transplantation? What is standards dimension of pit prepared for nursery plant? What is ratio of compost preparation for filling the pit? What are cultural practices of citrus plant newly transplanted? etc.	
LU 3: Apply Fertilizer	30 Minutes	120Minutes	Trainees will be assessed theoretically asking different short questions regarding fertilizer specification like what types of fertilizers used in citrus groves? What are main functions of fertilizer in plant science? Elaborate different percentages in different fertilizers? What is difference between organic and inorganic fertilizers? What is recommended method of fertilizer application in citrus? Similarly class will be evaluated practically by asking to perform different task and verbally description like give the sample of hoeing for fertilizer? What is drenching give the sample of at least two plants? What are cultural practices after fertilization? etc.	
LU 4: Operate rotavator and cultivator	15 Minutes	60 Minutes	Trainee will be assessed theatrically by asking different short questions regarding rutavator and cultivators and their impact in citriculture. After theoretical evaluation class will go under practical assessment by asking different task with verbal elaboration like identification of different cultivator tools, operation requirements of different tools, safe use of tools and their maintenance and storage after operation etc.	

LU 5: Irrigate the land	15 Minutes	60 Minutes	In theoretical assessment participants may asked different questions regarding irrigation e.g. enlist different means of orchard irrigation? How irrigation requirement is determined in the orchard? Elaborate different methods of irrigation existing in citrus orchards? Enlist disadvantages of flood irrigation? What are the parameters to test the fitness of irrigation water? Afterwards practical knowledge is evaluated amongst the trainee by asking different task like draw different methods of irrigation and give the sample of mostly adopted irrigation systems in Pakistan. Elaboration of tensiometer is also asked to the trainee.	
LU 6: Perform pruning	30 Minutes	120 Hours	Trainee may be asked to fill a questionnaire comprising different short questions regarding pruning for theoretical assessment e.g. define pruning and enlist different methods of pruning? Enlist the benefits of pruning and how minimize the post pruning side effects in orchards. What are characteristics of braches selected for pruning and trimming? What is top and what are its benefits? etc. After theoretical assessment trainees will undergo in practical evaluation by performing different task like trimming, skirt pruning and training of citrus plant, top working of diseased plant, removal of off shoots or water sprouts etc.	
LU 7: Apply pesticide / Herbicide / Fungicide etc.	30 Minutes	120 Minutes	Trainees may be asked different questions for theoretical assessment regarding foliar application of different pesticides e.g define and differentiate between pesticide, herbicide and fungicide, what are necessary precautions using any foliar chemical in citrus orchards, what is ppm, EC, W/V and concentration? etc. After this evaluation class will go in the field for practical assessment where assessor may ask different questions like what are the symptoms of fungus attach in citrus groves, what are potential pests of citrus and	

			how herbs affect the plant health etc. Practically each trainee would have to make concentration and sample spray on canopy of the orchard. Furthermore he has to wear the spray kit and should know the emergency dealing.	

Duration: 5 hours **Theory:** 1 hours **Practical:** 4 hours

Module: 2 Citrus Harvesting

Learning Units	Theory Days Hours	Practical Days Hours	Description / Recommended Sessional Assessment	Schedule Dates
LU 1: Perform citrus picking	30 Minutes	90 Minutes	Trainee class will assess through theoretical evaluation to confirm the impact of training and expertise improvement level. This assessment can be carried out by giving a comprehensive questionnaire on citrus picking covering all aspects of the picking like selection of mature citrus, required size and rind colour percentage, sound and injury free and greening free. After this evaluation trainee will go for practical assessment to perform the actual activity in the orchard. Each trainee my asked to give the sample picking of at least 10Kg using all necessary tools and equipment to avoid any mechanical injury ensuring personal safety and food safety managements systems. Class also may be asked different questions regarding practical dealing the emergency and first aid, working harvesting capacity of a worker and its farm handling etc.	
LU 2: Perform citrus sorting	20 Minutes	90 Minutes	After theoretical evaluation of trainee by asking different short questions and MCQs. After this all participants will go into practical assessment. Assessors will ask different question	

			regarding identification of different grades of citrus e.g. A, B and C. Grade needed for local markets and for different markets like Middle East, Far East, Europe, Central Asian States and Iraq Iran etc. Assessor can ask different questions regarding blemishes, mechanical injuries, bacterial infestations and fungus diseased fruits. During practical performance trainee may be asked to fill citrus fruits into different crates and baskets.	
LU 3: Manage citrus waste	10 Minutes	60 Minutes	For final learning units evaluation trainee will be assessed by asking different question regarding citrus waste management. After theoretical evaluation practical assessment will be carried out by performing filling of waste grade into separate baskets and storing into different deck.	

Duration: 4 hours **Theory:** 1 hours **Practical:** 3 hours

Module: 3 Citrus Handling on the Farm				
Learning Units	**Theory Days Hours**	**Practical Days Hours**	**Description / Recommended Sessional Assessment**	**Schedule Dates**
LU 1: Perform packing and filling	30 Minutes	120 Minutes	Trainee will be evaluated theoretically through asking different short questions and description like what are packing methods of citrus? What is filling capacity of citrus baskets? What are drawbacks of over filling of citrus baskets etc. Afterwards class will go into farm for practical assessment. Assessors may ask different questions to perform filling and packing based on grades and quality.	
LU 2: Manage Transportation	30 Minutes	60 Minutes	During theoretical assessment trainee may asked different questions regarding transportation for citrus shifting form farm to processing unit e.g. importance of transportation for	

			transporting citrus fruit, loading systems and methods, transportation time and storage area etc. similarly in practical component each trainee may asked to perform loading, stocking of citrus baskets into the vehicle. Open top is prohibited for citrus transportation etc.	

Suggestions for Final assessment

Final assessment shall be in two parts: theoretical assessment and practical assessment. The final assessment marks shall contribute to the final qualification. The final theoretical assessment shall consist of a 3 hour paper, consisting of multiple choice, short answer questions and MCQs etc covering all three modules. In final practical assessment, class will be divided into five groups comprising five members in each group and one group will be assessed a day so consuming five men days for carrying final assessment of the modulus training. This represents a total of five sessions totaling 25 hours for a class. During this assessment period each student must be assessed covering all modulus course learnt during the training.

The assessment team

The number of assessors must meet the needs of the students and the training provider. For example where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 25 students shall therefore require assessments to be carried out over a five days period. Few examples that examiner may use for the assessment are given below:

MODULES	PRACTICAL	THEORY
Module 1	**Citrus Orchard Management**	
LU-1: Land preparation	The trainee should be able to: • Identify the suitable soil for citrus • Understand the availability and fitness of Irrigation water • Identify the operational tools • To prepare the land including ploughing, leveling and dressing • Drawing of the orchard layouts • Dig the pits and compost preparation	The trainee will be asked to: • Importance of site selection • Selection criteria • Different types of soil suitable for citrus • Important steps involved in land preparation • Methods of weed eradication and site cleaning etc. • Layouts of citrus orchards • Pit preparation for new plants • Compost preparation for pit, care operations and filling • Importance of keeping unfilled pits for certain time • Possible issues of poorly managing the pits • Post pits preparation operation
LU-2 Manage orchard plantation	• Identify different varieties of citrus grown in Pakistan • Understanding of environmental conditions and timing suiting for citrus production • Observe the plantation timings • Transplantation of plants • Post plantation care operations	• Characteristics of citrus varieties • Physiochemical and phonological properties of different varieties • Selection criteria of citrus varieties • Selection of variety based on different characteristics of soil and environment • Selection characteristics of different varieties • Field conditions of citrus plantation

		• Plantation of citrus plants as per layout • Plantation tools • Post plantation carrying and maintenance
LU-3: Fertilizer application	• Identify the different types of fertilizers • Different methods of fertilizer application • Dosage and timing of different fertilizers • Difference between organic and inorganic fertilizers • Preparation of Farm Yard Manure and compost • Green manuring and its benefits	• Identification of different types of fertilizers • Differentiation between organic and inorganic/chemical fertilizers • Different between major and minor nutrients • Time and different key roles of fertilizers • Different methods of fertilizers application • Identification of different symptoms of nutrients deficiency in plant leaves • Means of organic fertilizers • Means of different green manuring • Tentative impact of green manuring and organic fertilizers on soil and citrus
LU-4: Operate tools and equipment	• Identify different tools needed in different operations • Tools guidelines and checklist • Ensure tools safety measures	• Identification of different tools needed in the field citrus production • Work plan of citrus production • Tools operation guidelines and safety • Maintenance of tools • Preparation of maintenance checklist of different tools • Trouble shooting and immediate solutions at farm level • Perfrom post operation caring and safe parking under shed

		• Preparing the operational log book of each tool and data recording for regular maintenance
LU-5 Irrigation	• Identification of irrigation critical stages of citrus orchards • Need base irrigation at each critical points • Ensuring of water requirements and fitness of irrigation water • Identify different tools of irrigation, their effective use and maintenance	• Identify different methods and tools used for irrigation in citrus orchards • Identification of plant symptoms of irrigation • Analyzing the suitability of different irrigation systems • Understanding of water pH level, EC value and microbial load. • Characteristics of best available source of irrigation • Practicing the methods of water conservation in the field. • Conservation of water with covering crops and other mechanical methods • Methods of meeting water requirement through spraying during very hot,
LU-6 Pruning, training and trimming	• Identify different types of pruning, trimming and training • Indentify different tools used in pruning, training and trimming • Identify the benefits of pruning, trimming and training • Understand different methods of pruning, trimming and training • Identify the types of different branches to	• Understanding of different types of pruning, trimming, training, topping, thinning and making canopy balance. • Pruning methodology and time • Identification of different tools used for pruning etc • Care and maintenance of pruning tools • Understanding the benefits of pruning, training and trimming practices • Identification of non productive branches and shoots • Scaffold braches management

	be pruned or trimmed • Post pruning care practices of the plants • Follow the guidelines and check list of tools	• Management of water shoots in citrus plants. • Understanding of aeration and light penetration of • Following the maintenance of tool and their safe storage
LU-7 Pesticides, fungicides, weedecides and herbicides	• Identify the citrus insect pest infestation • understand the threshold and economic injury levels of citrus plants • Identify citrus weeds and understand their control • Identify the beneficiary insect pest and their multiplication	• Identification of different insects pests and diseases of citrus • Chemical control of all insect pests • Different methods of insect pest control • Biological control of insect pest of citrus • Threshold damage level of each insect pest of citrus plants • Identification of different beneficiary insects pests of citrus • Identification of different physiological disorders • Identification of weeds and herbs effecting citrus groves and damaging plant available nutrition • Control of different weeds and time of control • Follow the safety measures during field activities • Perform the Integrated pest management • Introduction of GAP and GMP practices at farm levels • Practice the first aid treatment at farm level • Record keeping of inputs at farm levels

MODULE 2	• Citrus Harvesting	
LU-1 Citrus picking / harvesting	The trainee should be able to: • Identify the quality of mature and ripen fruit • Identify the good time of harvesting and marketing • Identify the harvesting tools and effective use of picking kit	The trainee will be asked: • Identification of quality fruit • Introduction of harvesting charts • Introduction and use of harvesting tools • Introduction of personal hygiene and safety conditions • Maintenance of harvesting tools • Harvesting of selected fruit • Identification of different grades of citrus fruit for local markets and export
LU-2 Perform citrus sorting	• Identify post harvesting operation at farm • Grading / sorting at farm • Identification sorting quality factors • Temporary storage at farm • Develop the data sheets of fruit	• Introduction of post harvest operations at farm level • Characteristics of fruit transportation from farm to pack house • Introduction of packing material at farm level • Introduction of grading / sorting parameters • Identification of different injuries e.g. mechanical, physiological and biological • Developing data sheet &inventory of harvested fruits • Weighing of harvested fruit • Stocking baskets avoiding damaging during transportation
LU-3 Managing waste	• Identify different waste grades of citrus fruit • identify different qualities and characteristics of different fruit grades	• Identification of different waste grades • Evaluating of different causes of fruit deterioration and spoilage. • Arranging waste or C grade for value addition industry

	• Identify different causes of fruit spoilage • Needs and methods of burying of diseased and injured fruits	• Benefits of burying of diseased fruit • Methods of burying of effected fruits • Usage of waste fruit • Installation of fruit fly controlling traps
MODULE 3	**Citrus Handling on Farm**	
LU-1 Perform packing and filling	The trainee should be able to: • Identify different types of farm packing materials • Determine the packing capacity and methodology of farm packaging material • Observe personal hygienic and food safety guidelines	The trainee will be asked to: • Identification of different packing materials for domestic as well as export markets • Determine the packaging capacity of different packing material • Packing methodology in different grades and materials • Evaluate of different packing and filling systems at farm • Arranging the staking and short storage of fruit at farm • Design and follow personal hygienic conditions and food safety guidelines
LU-2 Manage transportation	• Identify the best transportation facility from farm to pack house • Role of transportation in fruit quality • Perform loading and staking of crates in the transport • Determine the loading capacity of	• Select the best available transport suited for fruit transportation and its life • Evaluating the impact of rapid and safe transportation on fruit processing and marketability • Benefits of staked loading in transportation. • Determine the capacity loading and its benefits in post harvest handling.

	transport vehicle • Select the best route for transportation • Maintain quality record of the fruit	• Benefits of standard loading, record keeping and data maintenance • Evaluate the impact of good route selection for carrying fruit from farm to processing unit or fresh market. • Manage B grade directly for local market and C for value addition units • Preparation of fruit data base

5. Tools and Equipments

1. Farm Machinery
    a. Tractor 1

       Preferable 385 Ferguson especially designed for citrus orchards on rent on demand basis)
    b. Rotavetor 1

       Double attachment systems, standards model especially designed for citrus orchards on rent on demand basis
    c. Cultivator 1

       Double line of maximum rang on rent locally available
    d. Boom Sprayer 1

       500 liter capacity hydraulic system with auto filling and discharging systems
    e. Hand spray machine 1 (12liters) made of Indonesia 1
    f. Water tank of 400 liter capacity 1

       Especially designed for drop systems application of pesticides during flood irrigation
2. Pruning Scissors 5
3. Pruning Saw 5
4. ladder/stand 5
5. Spade 5
6. Rope 100 meter 5
7. Pole / peg 20
8. Hoeing tools 5

9. Pheromone traps 8
10. Tension meter 5
11. Thermometer 5
12. Moisture Meter 5
13. Picking knife (Light weight) 25
14. Picking fruit bags 25
15. Fruit baskets 25
16. Weight scale 1
17. Refrectometer 5
18. Fruit/pulp temperature meter 5
19. Magnifying Glass 5
20. Loading equipment 5
21. Fruit harvesting uniform 25
22. Field operation kit 25
23. First aid kit 1
24. White board with stand 1

6. List of Consumable Items

1. Fertilizers
    a. NPK 7 Bags for one acre demonstration block
    b. CAN (Calcium Ammonium Nitrate) 5 for demonstration block
       Fertilizer can be selected by the expert considering the soil pH and other age, time, irrigation method and type of citrus variety
    c. Farm Yard Manure (FYM) well rotten 50-60 kg per plant or chicken mature 20-25 kg per mature plant
2. Green Manuring
    a. Janter seed (10-12 kg/ acer) or Goara (5-6 kg/ acer)
3. Pesticides, pesticides, fungicides and herbicides recommended by the expert considering infestation and orchard need at different critical point
4. Micronutrient and hormones recommended by the expert on demand basis for good management of orchard
5. Bordo past (1:2:12) for past application on stem and wounded parts
6. Bordo mixture (1:1:100) as recommended by the expert
7. Stock register 1
8. Note pad 25
9. Pencils 25
10. Marker three different colors 3
11. Flip Chart Book 5

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