



# ANNUAL RESEARCH REPORT



# 2019-20

## CITRUS RESEARCH INSTITUTE

## SARGODHA

**INTRODUCTION:**

Pakistan is an agriculture-based economy. Agriculture is the lifeline of Pakistan's economy accounting for 21% of the GDP, 45% of labor force and supplying raw material to several value added sectors. Punjab is the most populated province and the largest agriculture producer in the country. The province of Punjab is major basket of fruits, vegetables and condiments; diverse in nature dominated particularly by fruits like citrus, mango and guava in which Citrus is the first important and largest fruit crop of the Punjab province. The Province of Punjab is contributing more than 94 percent in area and 97 percent in production of citrus crop of Pakistan largely consisting on Mandarin Kinnow (approximate 91%). Climatic conditions and edaphic factors of various areas of Punjab province are well supportive to the quality production of variety of fruits. It has been observed with concern that orchard based business of prime fruits is not as remunerative as it should have in view of the different pre-harvest and post-harvest factors. Moreover, the growers are not overcoming the production gaps i.e. the actual harvest of the fruits and the attainable potential of these fruits. Bridging these gaps is very necessary to increase the ultimate volume of these fruits and their availability throughout the year to the people. In this instance researchers of this institute endeavored to spread 09 approved citrus varieties throughout the province of Punjab. During the current year DUS test of four new promising varieties was completed to add up the citrus basket. Researchers of this institute also working to introduce and acclimatize new exotic citrus varieties from different citrus growing regions of the world. Promotion of Seedless Kinnow; a newly approved variety was carried out by providing its nursery plants by the use of newly established multiplications blocks throughout the Punjab province. The institute is providing field grown nursery plants and focusing to provide certified plants of the mentioned varieties to improve productivity ensuring quality standards with healthy orchards. Furthermore the certified nursery production would be consolidated through registered nurseries and GPU,s established under newly approved ADP project entitled as "Promotion of fruit crop production through provision of true to type/certified plants". Various field and lab trials encompassing Horticultural, Pathological, Entomological, Soil & nutrition management and Post-harvest handling aspects during the year were conducted. Introduction of high density plantation, mechanical pruning of orchards, water use efficiency, control of quarantine pest-disease complex and extension of citrus fruit shelf-life through proper storage conditions were few remarkable achievements. Ten different trial sites were established where old orchards rejuvenation was aimed through mechanical pruning carried out by newly introduced mechanical pruner. The researchers are joining hands with agricultural extension department for training and capacity building of citrus

community of the province. Advisory services were rendered through farmer gatherings, individual orchard visits, farmer field schools, mega farmer days and various citrus exhibitions. In this fashion, researchers of this institute played their role for promotion of citrus crop and development of citrus sector as a whole by bringing into service all available means and resources.

**THE MAIN OBJECTIVES ARE AS UNDER:**

- ❖ To introduce new citrus varieties (Early, mid and late season) to expand the availability period of citrus
- ❖ Promotion of seedless citrus varieties
- ❖ To conduct research for the improvement of yield and quality of citrus through suitable cultural and orchard management techniques (irrigation, plant protection, nutrition, pruning etc.)
- ❖ To identify the disease & pests present in citrus orchard and to find out the effective control measures
- ❖ To conduct studies for the reduction of post-harvest losses in citrus
- ❖ Raising of nucellar plants of promising citrus varieties and compare these with the performance of existing material
- ❖ Research on nursery management

## WEATHER AND ITS EFFECTS:

Meteorological data of the year indicated that maximum highest temperature (43<sup>0</sup>C) was recorded in July, 2019 and light rainfall was observed during this month. Scorching effects of temperature were seen on leaves and sun burn spots on fruits. Similarly minimum low temperature (2<sup>0</sup>C) was recorded during the month of December & January of this fiscal year. Average Maximum temperature was also observed in the month of July, 2019 while average minimum (4.5<sup>0</sup>C) temperature was observed in the month of December, 2019. Maximum rainfall i.e. 352 mm was recorded in the month of September, 2019 causing fruit drop in citrus and promoted fungal diseases in the area. 2<sup>nd</sup> maximum figure i.e. 226 mm of rainfall was recorded in the month of March, 2020 resulting in flower drop in citrus.

**Meteorological data for the year 2019-20**

<b>Months</b>	<b>Highest Temperature</b>	<b>Lowest Temperature</b>	<b>Av. Max. Temperature</b>	<b>Av. Mini. Temperature</b>	<b>Rainfall</b>
July	43	24	35.6	26.3	50
August	36	22	32	22	87
September	38	20	33	24	352
October	32	14	28.9	16.5	25
November	28	7	21.9	11.8	179
December	23	2	16.4	4.5	14
January	25	2	15.7	4.8	105
February	27	3	21.1	8.6	190
March	28	8	22.3	12.1	226
April	34	12	28.5	16.4	79.7
May	40	17	35.5	20.9	212
June	41	29	36.2	24.4	139.4

**(HORTICULTURE SECTION)****PROJECT -1**

**TITLE:** **EFFECT OF DIFFERENT ROOT STOCKS ON YIELD AND QUALITY OF KINNOW MANDARIN.**

**OBJECTIVE:** To produce the healthy and vigorous plants and to get better quality and yield of Kinnow Mandarin.

**RESEARCHERS:** Akbar Hayat

**DURATION:** 2011 - 2020

**LOCATION:** Citrus Research Institute, Sargodha

**TREATMENTS:**

	<u>Root stock</u>	<u>Scion</u>
T1	Cleopatra	Kinnow
T2	Troyer Citrange	Kinnow
T3	Sour Orange	Kinnow
T4	Cox Mandarin	Kinnow
T5	Rough Lemon	Kinnow
T6	Carrizo Citrange	Kinnow

These plants were planted on 24-02-2011 in the experimental orchard Citrus Research Institute, Sargodha.

<b>PLAN OF WORK:</b>	<b>Layout</b>	=	<b>RCBD</b>
	Replications	=	3
	Treatments	=	6
	Plants/Treatment	=	1
	Total Plants	=	18

**Parameters:**

1. Height of plant (m)
2. Spread of plant (m)
3. Scion/stock girth
4. Weight of fruits (g)
5. Size of fruit (cm)
6. Peel thickness (cm)
7. Peel% age
8. Juice% age
9. TSS
10. Acidity
11. Yield (No. of fruit/plant)

**Physical Growth**

Treatments	Sc-st Ratio	Height(m)	Canopy Vol.(m3)	Yield(No. of fruit/plant)
T1	0.78	2.86	14.66	241
T2	0.89	2.49	7.47	129
T3	0.90	3.08	20.73	306
T4	0.85	2.54	12.40	327
T5	0.87	3.03	16.32	375
T6	0.89	2.48	13.13	204

**Chemical Analysis**

Treatments	juice%	Fruit weight(g)	Fruit size(mm)	Peel thickness%
T1 Cleopatra	35.1	150.4	70	2.46
T2 Troyer	34.4	166.73	64.56	2.23
T3 Sour orange	24.96	195	66.63	2.94
T4 Cox mandarin	38	184	65	2.4
T5 Rough lemon	35.4	165.6	75	
T6 Carrizo citrange	36.4	75.8	49	2.2

Over all sour orange local rootstock in KPK performed good followed by cox mandarin. It is proved from the data that Cox mandarin could be a suitable and future rootstock for kinnow.

**PROJECT -2**

**TITLE:** PERFORMANCE OF DIFFERENT EXOTIC ORANGE VARIETIES UNDER SOIL & CLIMATIC CONDITIONS OF SARGODHA

**OBJECTIVE:** To evaluate the performance of various exotic orange varieties on Rough Lemon rootstock under agro ecological conditions of Sargodha.

**RESEARCHERS:** M. Raza Salik, Akbar Hayat, Abdul Rehman

**DURATION:** 2015-2022

**TREATMENTS:**

- T1 Salustiana (orange)
- T2 Harward Blood (orange)
- T3 Ryan Navel (orange)
- T4 Mc Mohn Valencia (orange)
- T5 Cara Cara (orange)
- T6 Arnold Blood (orange)

<b>METHODOLOGY:</b>	<b>Layout</b>	<b>RCBD</b>
	Treatments	6
	Treatment Unit	1
	Replications	4
	Total plants	24

**PARAMETERS:**

1. Plant Height (m)
2. Plant spread/ diameter (m)
3. Canopy volume (m<sup>3</sup>)
4. Yield/plant(Kg)
5. Fruit size (mm)
6. Fruit weight (gm)
7. Juice %age
8. TSS
9. Acidity %age
10. TSS/ Acid ratio

**Growth data recorded during the month of April, 2020**

Treatments	Av. Plant height (m)	Av. Plant spread (m)	Canopy volume (m <sup>3</sup> )
T1=Salustiana	2.51	2.07	5.71
T2=Harward Blood	2.41	2.31	6.9
T3=Ryan Navel	2.52	3.05	12.21
T4=Mc Mohn Valencia	2.75	2.75	10.98
T5=Cara Cara	2.45	2.3	6.62
T6 =Arnold Blood	2.1	1.6	3.15

Data regarding growth of plants indicated that the experimental units of Mc Mohn Valencia got maximum average plant height i.e. 2.75 m while Arnold Blood gained minimum figure of height i.e. 2.1 m. While analyzing the average spread of plants it was noted that Ryan Navel plants showed maximum growth towards spread i.e. 3.05 m followed by Mc Mohn Valencia i.e. 2.75 m. Ryan Navel vigorously expended with respect to its height and spread resulting in maximum canopy volume as compared to the other varieties present in the group, while plants of Arnold blood showed very slow growth under the local soil and climatic conditions of Sargodha.

**Physical chemical analysis of fruits**

Treatments	Av. Fruit size (mm)	Av. Fruit wt.	Av. Juice wt.(g)	No. of seeds/fruit	TSS%	Acidity	TSS/Acid ratio
<b>T1 Salustiana</b>	62.7	123.2	53.14	2	9	0.7	11.8
<b>T2 Harward Blood</b>	73.9	179.4	82.4	12	9	0.8	11.25
<b>T3 Ryan Navel</b>	88.06	340.5	65	0	7.5	0.32	23.43
<b>T4 Mc Mohn Valencia</b>	70.2	178.9	75.5	01	7	1.18	5.9
<b>T5 Cara Cara</b>	62.8	121.4	31.3	0	7	0.42	16.6
<b>T6 Arnold Blood</b>	62.3	126.9	55.6	02	7.5	0.65	11.5

Data regarding physiochemical analysis of fruit indicated that maximum fruit size i.e. 88.06 mm was attained by Ryan Navel followed by Harward Blood which showed fruit size as 73.9 mm. Similarly Average fruit weight (340.5 g) was also maximum in Ryan Navel. TSS percentage (9) was found maximum in Salustiana and Harward Blood while other varieties remained in the range of figure as 7-7.5.

**PROJECT -3**

**TITLE:** **TO EVALUATE THE PERFORMANCE OF DIFFERENT STRAINS OF SEEDLESS KINNOW (*Citrus reticulata* blanco) UNDER SOIL & CLIMATIC CONDITION OF SARGODHA.**

**OBJECTIVE:** To find out best strains of seedless Kinnow

**RESEARCHERS:** Muhammad Asim

**DURATION:** 2015-2024

**LOCATION:** Citrus Research Institute, Sargodha

**TREATMENTS:**

- T1= Strain-1 (BW source-Dr. Shujat orchard R-9, P-2)
- T2= Strain-2 (BW source Dr. Shujat orchard R-5, P-2)
- T3= Strain-3 (BW source Sultan Farm Vehari, Line 1 P-19)
- T4= Strain-4 (BW source Sultan Farm Vehari, Line 1 P-11)
- T5= Strain-5 (BW source Sultan Farm Vehari, Line 1 P-7)
- T6= Strain-6 (BW source Asad Tiwan Farm Fsd)
- T7= Strain-7 (BW source-Dr. Shujat orchard GFT Sgd)
- T8= Strain-8 (BW source Asad Tiwan Farm GFT Sgd)

**PLAN OF WORK**

<b>Layout</b>	=	<b>RCBD</b>
Replications	=	5
Treatments	=	6
Treatment Unit	=	1
Total Plants	=	30

**METHODOLOGY:** Bud wood of different strains of seedless kinnow was collected from the progeny block planted at Dr. Shujat chak no. 8 NB Sargodha, Sultan Farm Vehari & Asad Tiwana Farm Sargodha and grafted at Horticultural Research Institute Faisalabad. Grafted plants were received from HRI, Fsd & planted at CRI, Sargodha on 7-10-2015 with plant to plant and row to row distance (20x20 feet) at plot no. 13-B/7, 8 at CRI, Sargodha. The evaluation of a different seedless strain in terms of their growth pattern, yield and quality characters will be the integral part of this study.

**PARAMETERS:**

1. Height of plant (m)
2. Plant spread (m)
3. Canopy Volume (m<sup>3</sup>)
4. Degree of compatibility



5. Leaf area
6. Time taken for 1<sup>st</sup> flowering
7. Yield/plant (no. of fruits)
8. Fruit size (mm)
9. Single fruit weight (gm)
10. Peel thickness (mm)
11. TSS %
12. Acidity%
13. TSS/ Acid Ratio

### PREVIOUS YEARS RESULT: 2019-20

Treatments	Plant height(m)	Plant Spread(m)	Plant Canopy Volume(m <sup>3</sup> )
T1=Strain-1 (BW source-Dr. Shujat orchard R-9, P-2)	2.04 ABC	1.48 B	2.42 B
T2=Strain-2 (BW source Dr. Shujat orchard R-5, P-2)	2.15 AB	1.62 AB	3.09 AB
T3=Strain-3 (BW source Sultan Farm Vehari, Line 1 P-19)	2.06 ABC	1.62 AB	2.88 AB
T4=Strain-4 (BW source Sultan Farm Vehari, Line 1 P-11)	2.00 ABC	1.62 AB	2.85 AB
T5=Strain-5 (BW source Sultan Farm Vehari, Line 1 P-7)	2.11 AB	1.67 AB	2.77 B
T6=Strain-6 (BW source Asad Tiwan Farm Fsd)	2.24 A	2.25 A	5.22 A
T7=Strain-6 (BW source Dr. Shujat orchard Farm Sgd)	1.71 BC	1.24 B	1.24 B
T8=Strain-6 (BW source Asad Tiwan Farm Sgd)	1.60 C	1.23 B	1.07 B

Maximum Height, spread and canopy volume of Plant was observed in T6 (Strain-6 BW source Asad Tiwan Farm Fsd) 2.24 m and 2.25 m and 5.22 m<sup>3</sup> which followed by T2= Strain- (BW source Dr. Shujat orchard R-5, P-2) 2.15 m in plant height. T1 =Strain (BW source-Dr. Shujat orchard R-9, P-2) 1.48 m in plant spread and T2= Strain (BW source Dr. Shujat orchard R-5, P-2) in canopy volume 3.09 m<sup>3</sup>

### Yield Data

Treatments	No of fruit /plant
T1= Strain-1 (BW source-Dr. Shujat orchard R-9, P-2)	0.20 B
T2= Strain-2 (BW source Dr. Shujat orchard R-5, P-2)	5.60 AB
T3= Strain-3 (BW source Sultan Farm Vehari, Line 1 P-19)	20.60 A
T4= Strain-4 (BW source Sultan Farm Vehari, Line 1 P-11)	12.00 AB
T5= Strain-5 (BW source Sultan Farm Vehari, Line 1 P-7)	3.80 AB
T6= Strain-6 (BW source Asad Tiwan Farm Fsd)	6.20 AB
T7= Strain-6 (BW source Dr. Shujat orchard Farm Sgd)	0.40 B
T8= Strain-6 (BW source Asad Tiwan Farm Sgd)	0.60 B

Maximum no of fruit per plant was observed in T3 (BW source Sultan Farm Vehari, Line 1 P-19) 20 no of fruit per plant which followed by T4= Strain- (BW source Sultan Farm Vehari, Line 1 P-11) 12 no of fruit per plant.

**PROJECT -4**

**TITLE:** **EFFECT OF DIFFERENT INTERSTOCKS ON GROWTH, FRUIT QUALITY AND YIELD OF MUSAMBI (ORANGE)**

**OBJECTIVE:** To enhance vegetative and reproductive life of Musambi on rough lemon rootstock by the use of different inter-stocks

**RESEARCHERS:** Faheem Khadija

**DURATION:** 2017-2025

**LOCATION:** Citrus Research Institute, Sargodha

**TREATMENTS:**

Treatments	Root stock	Inter stock	Scion
T0	Rough lemon	-----	Musambi
T1	Rough lemon	Kinnow	Musambi
T2	Rough lemon	Succari	Musambi
T3	Rough lemon	Casagrande	Musambi
T4	Rough lemon	CRI-7	Musambi

**Layout plan:**

Layout	RCBD
Treatments	5
Replications	6
Plant/treatment	1
Total No. of plants	30

**Methodology:**

One year old and healthy seedling of rough lemon were selected from Govt. nursery of CRI Sargodha according to the requirement of the experiment. Budding for inter-stocks was done during the month of 2017. Hoeing, weeding, fertilizer and irrigation practices were done. Later on budding on inter stock was done during the month October, 2018. Further parameters will be collected according to the experiment.

**Parameters:**

1. Height of plant (m)
2. Spread of plant (m)
3. Stock girth (cm)
4. Inter-stock girth (cm)
5. Scion girth (cm)
6. Average fruit weight (g)

7. Average fruit size (mm)
8. Peel thickness (mm)
9. Peel %age
10. Juice %age
11. Acidity %age
12. TSS %age
13. TSS/acidity ratio
14. No. fruit/plant
15. Yield/plant (kg)

### Effect of different inter-stocks on growth, fruit quality and yield of Musambi cultivar

Treatments	Stem girth of Root stock(mm)	Stem girth of Inter-stock (mm)
Kinnow	27.34	24.39
Succari	28.32	24.70
Casa grandae	32.09	23.81
CRI-7	28.23	21.12

Growth data of the trial indicated that maximum stem girth of root stock was noted when grafted on casa grandae interstock. However, the minimum stem girth of rootstock was observed on Kinnow. The maximum stem girth of interstocks was measured on Succari while minimum stem girth was found on CRI-7 interstock.

Treatments	Shoot length of Scion (cm)	Shoot thickness of scion (mm)
Kinnow	122.33	12.23
Succari	111.00	16.77
Casa grandae	95.00	16.83
CRI-7	88.33	13.04

The maximum shoot length was observed on Kinnow while minimum shoot length was noted in CRI-7 followed by Casa Grandae. However, maximum shoot thickness was noted on sweet orange cv. Succari. While minimum shoot thickness was measured on Kinnow.

Treatments	No of shoots	Plant height (ft.)
Kinnow	5	5.67
Succari	4	5.67
Casa grandae	6	6.00
CRI-7	4	4.67

The result showed that interstock significantly affected on No. of shoots and plant height. The maximum No. of shoot was found on casa grandae while minimum No. of shoots was noted Succari followed by CRI-7. However, highest plant height was measured on Casa grandae while minimum plant height was found on CRI-7.

**PROJECT -5**

**TITLE:** **EFFECT OF DIFFERENT PLANTING DISTANCE ON GROWTH AND YIELD OF KINNOW**

**OBJECTIVE:** To standardize the best planting distance for better growth and yield of Kinnow.

**RESEARCHERS:** Faheem Khadija & Hira Tariq

**DURATION:** 2019-2029

**LOCATION:** Citrus Research Institute, Sargodha

**TREATMENTS****Row to Row & Plant to Plant distance**

T1	R × R and P × P = 20 × 10
T2	R × R and P × P = 20 × 12
T3	R × R and P × P = 20 × 15

**METHODOLOGY:**

<b>Layout</b>	=	<b>RCBD</b>
Replications	=	5
Treatments	=	3
Plants/Replication	=	1
Total Plants	=	15

**METHODOLOGY:**

Kinnow plants of uniform age and size will be selected from the citrus nursery, CRI, Sargodha. The experiment will be laid out according to RCBD and with 6 replications. The plant will be planted at distance of plant to plant 10, 12 and 15 ft. However, row to row distance will be same 20 ft for all treatment. The different parameters according to experiment will be measured

**PARAMETERS:**

1. Height of plant (m)
2. Spread of plant (m)
3. Canopy volume (m<sup>3</sup>)
4. Fruit set (%)
5. Fruit drop (%)
6. Weight of fruits (g)
7. Diameter of fruit (mm)
8. Peel thickness (mm)
9. Peel% age
10. Juice% age

11. TSS
12. Acidity
13. TSS/Acid ratio
14. Yield (No. of fruit/plant)

**Growth data taken during the year 2020 (Height of plant cm)**

Replications	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
R <sub>1</sub>	70	77	110
R <sub>2</sub>	84	82	72
R <sub>3</sub>	58	98	84
R <sub>4</sub>	80	122	86
R <sub>5</sub>	66	84	81
<b>Total</b>	<b>358</b>	<b>463</b>	<b>433</b>
<b>Mean</b>	<b>71.6</b>	<b>92.6</b>	<b>86.6</b>

**PROJECT -6**

**TITLE:**

**EFFECT OF GA<sup>3</sup> APPLICATION ON FRUIT SIZE, QUALITY & YIELD OF FEUTRELL'S EARLY (CITRUS RETICULATA)**

**OBJECTIVE:**

To improve the small fruit size & quality of feutrell's early

**RESEARCHERS:**

Hira Tariq, Abdul Aziz

**DURATION:**

2017-2020

**LOCATION:**

Citrus Research Institute, Sargodha

**TREATMENTS:**

T1 = Control  
 T2 = 10 ppm GA<sup>3</sup>  
 T3 = 20 ppm GA<sup>3</sup>  
 T4 = 30 ppm GA<sup>3</sup>

**PLAN OF WORK:**

Layout: RCBD  
 Treatments: 4  
 Replication: 4  
 No. of plants/treatment 1  
 Total plants: 16

**METHODOLOGY:**

Plants of uniform age and size was selected from the orchard of CRI, Sargodha. Four branches having desired number of fruits at pea size stage was selected and tagged from all sides of plant. 10,20 and30 ppm concentrations of GA<sup>3</sup> was prepared. The treatments were applied after fruit set at cell division stage (pea size) to get the desired results.

**PARAMETERS:**

1. Fruit weight (g)
2. Fruit size (mm)
3. TSS (Brix)
4. Acidity (%)
5. TSS/ ACID ratio
6. Peel thickness (mm)
7. No. of seeds per fruit
8. Yield per plant (kg)

Treatments	Fruit weight (g)	Fruit size (mm)	Peel thickness (mm)	Juice weight (g)	TSS (Brix)	Acidity	Yield/tree	No. of seed
T1 Control	104.5	60.1	2.92	36.20	8.1	0.66	981	13
T2 10 ppm	113.3	62.9	3.08	40.26	8.6	0.62	1122	15
T3 20 ppm	115.3	65.2	<b>3.28</b>	42.78	8.75	0.64	1564	16
T4 30 ppm	<b>125.5</b>	<b>67.3</b>	3.12	<b>45.81</b>	<b>9</b>	0.58	<b>1780</b>	18

**(PLANT PATHOLOGY SECTION)****PROJECT -7****TITLE:**

**EVALUATION OF DIFFERENT CHEMICALS AGAINST CITRUS CANKERS (*XANTHOMONAS AXONOPODIS* PV.CITRI.) IN KINNOW MANDRIN**

**OBJECTIVE:**

To evaluate the most effective chemical against citrus canker in Kinnow mandarin.

**RESEARCHERS:**

Abdul Rehman & Shafqat Ali.

**DURATION:**

2019-2021

**LOCATION:**

Citrus Research Institute Sargodha

**TREATMENTS:**

TREATMENTS	NAME OF CHEMICAL	DOSE
T1	Copper hydroxide	3gm / lit. of water
T2	Kasugamycin+ Copperoxychloride	3 ml +3gm/ lit. of water
T3	Bordeaux Mixture	1 % (1:1:100)
T4	Oxide – C (Oxine Copper)	2 ml / lit. of water
T5	Moltovin (Tri basic Copper)	2 ml / lit. of water
T6	Onion Extract	10 ml / lit. of water
T7	Sulphur	2.5 gm/ lit. of water
T8	<i>Baccillius Spp.</i>	3 gm / lit. of water
T9	<i>Control</i>	- -

**PLAN OF WORK:**

Layout:	RCBD
Treatments	9
Replication	4
No. of Plants/Treatment	1
Total no. of Plants	36

**METHODOLOGY:**

Spray will be done during the months of April and August. Disease data will be collected /recorded prior and after application of chemicals/non chemicals.

Data Collection:

- (1) Affected Leaf Area
- (2) Affected Fruit

**RESULTS (2019-20)**

Treatments	Disease Incidence (%) (Fruit)	Disease Incidence (%) (Leaf)
(T1) Copper hydroxide	0.15 CD	7 I
(T2) Kasugamycin+ Cuperoxychloride	2.25 B	21G
(T3) Bordeaux Mixture	0.00 D	5 I
(T4) Oxide – C (Oxine Copper)	1 C	29E
(T5) Moltovin (Tri basic Copper)	0.50 CD	33 D
(T6) Onion Extract	0.50 CD	27 F
(T7) Sulphur	2.25 B	43 C
(T8) <i>Baccillius Spp.</i>	2 B	54 B
(T9) <i>Control</i>	5 A	89 A
L.S.D	0.71	0.68

Maximum disease control was observed (leaves and fruit) in treatment T3 (Bordeaux mixture) followed by T1 (Copper hydroxide), T6 (Onion extract) and T4 (Oxide – C (Oxine Copper)). Other treatments exhibited equaling response as being non-significant with each other.

**PROJECT -8**

**TITLE:** **COMPARATIVE STUDIES ON THE EFFICACY OF DIFFERENT CHEMICALS TO CONTROL CITRUS SCAB (*ELSINOE FAWCETTII*) IN KINNOW**

**OBJECTIVE:** To find out the most suitable fungicide against the citrus scab Disease in Kinnow.

**WORKER:** Shafqat Ali & Abdul Rehman

**DURATION:** 2017-2020

**LOCATION:** Citrus Research Institute, Sargodha

**TREATMENTS:**

Treatments	Name of Chemicals	Dose
T1	Azoxystrobin (Mycoguard)	1ml/lit. of Water
T2	Pyraclostrobin+metiram (CabrioTop)	1.5 Gm / lit. of Water
T3	Difenoconazole+Azoxystrobin	1 ml /lit. of Water
T4	Copper Oxychloride +Cymoxanil (Moltovin)	2 ml / lit. of Water
T5	Copper hydro oxide (Kocide)	2.5Gm/ lit. of Water
T6	Tebuconazole+Trifloxystrobin (Nativo)	0.5 Gm /lit. of Water
T7	Fluoxystrobin (Evito)	1 ml /lit. of Water
T8	Bordeaux mixture 1%	(1:1:100)
T9	Control	- -

**PLAN OF WORK:**

Layout	RCBD
Treatments	9
Replications	4
No. of Plants /Treatment	1
Total no. of plants	36

**METHODOLOGY:**

Spray will be done before flowering in Feb-March, after fruit setting in April and in the months of August and September. Disease data of the disease will be collected /recorded after one month the last spray of chemicals.

**Data collection:**

- (1) Affected Fruits
- (2) Yield Data



**RESULTS (2019-20)**

<b>Treatments</b>	<b>Disease Incidence (%) (Fruit)</b>
T1( Azoxystrobin)	<b>8 B</b>
T2 ( Pyraclostrobin+metiram)	<b>9 B</b>
T3 ( Difenconazole+Azoxystrobin)	<b>4 E</b>
T4(Copper Oxychloride+Cymoxanil) (Moltovin)	<b>7 C</b>
T5 (Copper hydro oxide) (Kocide)	<b>5 D</b>
T6 (Tebuconazole+Trifloxystrobin) (Nativo)	<b>8 B</b>
T7 Fluoxstrobin (Evito)	<b>7 B</b>
T8 (Bordeaux mixture 1%)	<b>3 F</b>
T9 (Control )	<b>25 A</b>
L.S.D	<b>0.72</b>

Maximum disease control was found in treatment T8 (Bordeaux mixture 1%) followed by T3 (Difenconazole+Azoxystrobin) & T5 (Copper hydro oxide), other treatment exhibited equaling response as being non-significant with each other.

**PROJECT -9**

**TITLE:** **SCREENING OF ORANGE VARIETIES AGAINST CITRUS CANCKER (*Xanthomonas axonopodis pv.citri.*)**

**OBJECTIVE:** To screen out the orange cultivars showing resistance against citrus canker disease.

**RESEARCHERS:** Abdul Rehman, & Shafqat Ali.

**DURATION:** 2016 – 2020

**LOCATION:** Citrus Research Institute Sargodha

**TREATMENTS:**

Treatments	Varieties
	T1(Musambi)
	T2 (Succari)
	T3 (Blood Red)
	T4 (Valencia late)
	T5 (Salustiana)
	T6 (Toracco)

	T7 (Jaffa)
	T8 (Kozan)
	T9 (Mars Early)
	T10 (Pine Apple)
	T11 (Casa Grande)
	T12 (Washington Navel)

**PLAN OF WORK:**

Layout:	RCBD
Treatments	12
Replication	4
Treatment Unit	1
Total no. of Plants	48

**METHODOLOGY:**

Plants of uniform age will be selected. Degree of tolerance or susceptibility about presence or absence of citrus canker lesions just after the emergence of new growth (April & August). Intensity of canker lesions will be measured both on foliage and fruit. The most tolerance/resistance varieties will be recommended for cultivations.

**Parameter to be studied.**

Disease Incidence on leaf  
Disease Incidence on Fruit

**RESULT (2019-20)**

Treatments	Disease Incidence % (Leaves)	Disease Incidence % (Fruit)
T1 ( Musambi)	2 I	0.00 G
T2 (Succari)	2 I	0.00 G
T3 (Blood Red)	4 F	0 E
T4 (Valencia late)	5 G	0 FG
T5 (Salustiana)	8 D	1 E
T6 (Toracco)	43A	31 A
T7 ( Jaffa)	1J	0.25 FG
T8 ( Kozan)	9 E	9C
T9 ( Mars Early)	17C	1F
T10 (Pine Apple)	3 H	0.50 FG
T11 (Casa Grande)	3H	7 D
T12 (Washington Navel)	25B	13B
L.S.D	0.67	0.68

Maximum citrus canker disease incidence (leaves and fruit) was observed in T6 (Taroacco) followed by T12 (Washington Navel), T8 (Kozan) and T9 (Mars early). Other oranges varieties exhibited equal response with each other.

**(ENTOMOLOGY SECTION)****PROJECT- 10**

**TITLE:** ESTIMATIONS OF FRUIT FLY POPULATION ABUNDANCE BY PHEROMONE TRAPPING SYSTEM IN CITRUS ORCHARDS OF SARGODHA

**OBJECTIVES:** Estimations of fruit fly pupation on per day per trap basis  
Estimations of fruit fly population dynamics  
Record of other animals trapped in the methyl eugenol traps

**DURATION:** 2019-2021

**LOCATION:** Farm (16 square and Campus area of CRI, Sargodha)

**LAYOUT AND PLAN OF WORK:**

Lay out	RCBD
Treatments (Locations)	3
Replications	5
Total No. of traps	15

**TREATMENT/ METHODOLOGY:**

- Five traps at each location (office campus, 16 sq block1 and 16 sqblock 1) were installed and remained operative throughout the experiment with pheromone and insecticide.
- Data was recorded and traps were recharged weekly.
- The data were taken from July-August.
- Population of fruit fly of fruit fly (species wise and pooled) was counted in the laboratory
- Other non-target arthropods captured in traps were also recorded.

**Result:**

Dates	Treatments	Av. fruit flies/trap/week	Flies/day/trap	<i>Bactrocera zonata</i> /trap/week	<i>Bactrocera dorsalis</i> /trap/week	Others
16.07. 19	T1 (S16B1)	32.66	4.66	32.66	Nil	Ants, Spider
	T2 (campus)	50.66	7.24	49.66	2	Ants
	T3(S16B2)	49.33	7.04	47.66	1.66	Ants
23.07.19	T1(S16B1)	49	7	47.33	1.66	Nil
	T2 (campus)	41.66	5.96	40.3	1.33	Ants
	T3 (S16B2)	50	7.14	48	2	Flies
30.07.19	T1(S16B1)	70.66	10.09	47.33	3.33	Spider, Roach
	T2 (campus)	51	7.28	40.3	2.66	Ants, Flies
	T3 (S16B2)	73.66	10.52	69.66	4	Ants
06.08.19	T1 (S16B1)	78.66	11.23	71.66	7	Ants, Spider
	T2 (campus)	67.66	9.66	63.33	4.33	Ants, Flies
	T3 (S16B2)	67.33	9.61	64.33	3	Ants, Spider

**PROJECT- 11**

**TITLE:** **EVALUATION OF DIFFERENT CITRUS VARIETIES AGAINST THE INFESTATION OF FRUIT FLY**

**OBJECTIVES:** To know the resistance/ susceptibility status of different Commercial varieties of citrus against fruit fly

**DURATION:** 2019-21

**LOCATION:** Citrus Research Institute, Sargodha

**LAYOUT AND PLAN OF WORK:**

Lay out	RCBD
Treatment	10
Replications	03
No of tree/replicate	01
Total No. of plants	30

**TREATMENTS/ METHODOLOGY:**

Some important commercial citrus varieties such as:

- T1:** Taracco
- T2:** Kinnow
- T3:** Washington Navel
- T4:** Shamber
- T5:** Salustiana
- T6:** Pine Apple
- T7:** Valencia Late
- T8:** Succari
- T9:** Grapefruit
- T10:** Jaffa

- The dropped fruits from each cultivar were counted and checked to find % infestation due to fruit fly.
- The data were taken from Sep-Oct on weekly basis and pooled to find average % infestation.
- The data will be analyzed by statistix software using RCB design.

**Result**

Treatments	Date					Average Infestation (%)
	17.09.2019	25.09.2019	03.10.2019	10.10.2019	17.10.2019	
T1: Taracco	1.67	3.11	7.45	8.75	8.95	5.99
T2: Kinnow	0	0.33	0.98	1.35	4.88	1.51
T3: Washington Navel	0	0.1	0.17	0.15	0.45	0.17
T4: Shamber	0	2	1.8	2.63	2.79	1.84
T5: Salustiana	0.6	1.1	1.25	1.25	2.59	1.36
T6: Pine Apple	0.84	2.2	3.3	3.95	4.12	2.88
T7: Valencia Late	0	0	0	0	0	0.00
T8: Succari	1.13	1.54	1.96	2.17	2.19	1.80
T9: Grapefruit	1.1	2.33	4.39	4.71	5.12	3.53
T10: Jaffa	0	0	0	0	0	0.00

**PROJECT- 12**

**TITLE:** **PRE-HARVEST FRUIT BAGGING IN CITRUS AGAINST FRUIT FLY**

**OBJECTIVES:** To evaluate the beneficial effects of different types of bags in citrus against fruit fly.

**DURATION:** 2019-21

**LOCATION:** Citrus Research Institute, Sargodha

**LAYOUT AND PLAN OF WORK:**

Lay out	RCBD
Treatments	06
Replications	3

**Treatments:**

T1: Perforated transparent polyethylene bags	T2: Butter paper bag
T3: Muslin cloth bag	T4: Newspaper Bags
T5: Brown Paper Bags	T6: Non-bagged (control)

**Methodology:**

- The trial will be conducted in the research area of Citrus research institute, Sargodha, in RCB design, with three replicates of each treatment.
- Five types of bags will be used i.e. bagging of fruits (Kinnow mandarin, and Pineapple orange) will be done in September to November depending upon fruit maturity.
- Total 75 fruits will be covered against each treatment. The fruits of control treatment will be kept un-raped.
- The damaged bags by winds or rainfall will be replaced at regular interval.
- Data regarding fruit fly will be recorded throughout season by observing fruit fly infestation and fruit drop.
- The fruits will be harvested at maturity according to standardization maturity indices of each cultivar.
- Fruit weight and other parameters of fruits i.e. physical appearance (fruit color and blemishes) and chemical analysis (TSS, acidity etc.) will be recorded.
- The data will be analyzed statistically

**Results:****Table-1: Fruit drop, infestation and physical appearance in bagged and non-bagged citrus fruits.**

Treatments	Av. fruit drop	% Fruit fly infestation	Physical appearance and disease		
			Fruit colour	Fruit blemishes	Diseases
Perforated polyethylene bags	30	0	Orange	Yes	Canker
Brown paper bags	12	0	Yellowish	Nil	Nil
Muslin cloth bag	67	0	Greenish	Yes	Canker
Butter paper bag	22	0	Orange	Nil	Nil
Non-bagged	75	12.43%	Greenish Yellow	Yes	Canker

**(SOIL SCIENCE SECTION)****PROJECT-13**

- TITLE:** **EFFECT OF MACRO AND MICRONUTRIENTS ON THE QUALITATIVE YIELD OF KINNOW MANDARIN**
- OBJECTIVE:** To improve the yield and nutritional values of kinnow mandarin through balance fertilizer program
- RESEARCHERS:** Ahmed Raza and Imtiaz Ahmad Warraich
- DURATION:** 2018-22
- TREATMENTS:**
- T1: NPK @ 1000-500-500 g/plant
- T2: FeSO<sub>4</sub> @ 526 + ZnSO<sub>4</sub> @ 217 + CuSO<sub>4</sub>@ 200 + MnSO<sub>4</sub>@ 312 + Borax @ 136 (g/plant) through soil
- T3: FeSO<sub>4</sub> @ 200 + ZnSO<sub>4</sub> @ 240 + CuSO<sub>4</sub>@ 200 + MnSO<sub>4</sub> @ 200 + Borax@ 30 (g/100 L of water) through foliar
- T4: Blended commercial micronutrients fertilizers @ 500 g/acre for soil application.
- T5: Blended commercial micronutrients fertilizers @ 100 g/100 L water for foliar application
- PLANE OF WORK:** RCBD
- |                   |    |
|-------------------|----|
| Treatments:       | 5  |
| Plants/treatment: | 3  |
| Replication:      | 3  |
| Total Plants:     | 45 |
- METHODOLOGY:** Well rotten FYM @ 60 kg while P & K @ 500 g/plant each will be applied in Jan. Nitrogen will be applied in three splits 1<sup>st</sup> in Feb 2<sup>nd</sup> in April and 3<sup>rd</sup> in Aug/Sep. Micronutrients through soil will be applied with 1<sup>st</sup> dose of N while foliar application will be done after fruit formation and 2<sup>nd</sup> dose of foliar spray with 20 days interval.

**DATA TO BE RECORDED:** Fruit yield, nutritional values (Ca, Mg, Zinc and Iron), Fruit size, Juice % TSS and Acidity etc.

**Results:**

**Table 1. Yield and yield attributes**

Particulars	Fruit No (tree <sup>-1</sup> )	Fruit yield (kg tree <sup>-1</sup> )	Fruit weight (g fruit <sup>-1</sup> )	Fruit size (mm)
<b>T1</b>	658.22 D	96.88 C	147.12 BC	66.433 B
<b>T2</b>	701.11 C	97.26 C	138.32 C	68.193 B
<b>T3</b>	725.78 B	105.55 BC	145.34 BC	67.903 B
<b>T4</b>	<b>761.89 A</b>	<b>130.78 A</b>	<b>172.01 AB</b>	<b>73.563 AB</b>
<b>T5</b>	740.11 AB	<b>125.80 AB</b>	<b>175.23 A</b>	<b>77.113 A</b>
<b>LSD</b>	20.775	21.232	27.838	7.5421

**Results:** According to above table the treatments (T4 and T5) where Commercial micronutrients were applied either through soil or foliar performed better in term of fruit yield fruit weight and fruit size.

**Table 2. Physiochemical Analysis**

Particulars	Juice %	Peel thickness (mm)	TSS	Acidity
<b>T1</b>	42.492 C	2.6333	9.5	0.8433
<b>T2</b>	43.734 BC	2.77	9.833	0.9233
<b>T3</b>	44.534 AB	2.8133	9.833	0.9267
<b>T4</b>	<b>45.785 A</b>	2.64	10.833	0.9367
<b>T5</b>	<b>45.813 A</b>	3.1333 NS	10 NS	0.86 NS
<b>LSD</b>	1.8094	0.7717	2.133	0.16

**Results:** According to above table the juice % was found better in treatments (T4 and T5) where Commercial micronutrients were applied either through soil or foliar.

**Table 3 Mineral analysis of Juice of kinnow**

Treatments	P (%)	K (%)	Ca (%)	Mg (%)	Zn (ppm)	Fe (ppm)	Cu (ppm)
<b>T1</b>	0.018	0.182	0.048	0.012	7.3	12	0.41
<b>T2</b>	0.019	0.181	0.049	0.01	8.1	<b>15</b>	0.42
<b>T3</b>	0.019	0.191	0.048	0.01	8.2	12	0.42
<b>T4</b>	0.017	0.179	0.048	0.01	<b>8.9</b>	<b>15</b>	<b>0.45</b>
<b>T5</b>	0.018	0.186	0.05	0.014	8.8	13	0.43
<b>Initial data before treatments</b>	<b>0.016</b>	<b>0.18</b>	<b>0.046</b>	<b>0.01</b>	<b>7.5</b>	<b>12</b>	0.40

**Results:** According to above table the minerals contents in juice were found better in all treatments as compared control and initial data before experiment. However, Zn, Fe and Cu comparatively found better in treatment (T4) where Commercial micronutrients were applied through soil.



**Table 4 Mineral analysis of leaves of kinnow**

<b>Treatments</b>	<b>B (ppm)</b>	<b>Zn (ppm)</b>	<b>Cu (ppm)</b>	<b>Fe (ppm)</b>	<b>Ca (%)</b>	<b>Mg (%)</b>	<b>P (%)</b>	<b>K (%)</b>	<b>N (%)</b>
<b>T1</b>	168	17.5	9.5	245	6.3	0.6	0.13	1.1	2.14
<b>T2</b>	172	18.5	11.5	255	6.2	0.58	0.12	1.23	2.24
<b>T3</b>	170	19	11	256	6.4	0.59	0.14	1.34	2.49
<b>T4</b>	172	19.5	11	258	7.1	0.6	0.14	1.15	2.52
<b>T5</b>	<b>172</b>	<b>19.5</b>	<b>12.5</b>	257	6.1	0.61	0.15	1.25	2.37
<b>Initial data before treatments</b>	<b>155</b>	<b>15</b>	<b>9.0</b>	<b>250</b>	<b>7.5</b>	<b>0.6</b>	<b>0.11</b>	<b>0.8</b>	<b>2.0</b>

**Results:** According to above table the minerals contents in kinnow leaved were found better in all other treatments where micronutrients were applied either through soil or foliar as compared control and initial data before experiment

#### **PROJECT-14**

**TITLE:** **COMPARISON OF SOLUBLE AND TRADITIONAL FERTILIZERS ON QUALITATIVE YIELD OF KINNOW**

**OBJECTIVES:** To compare the qualitative yield of kinnow through different fertilizer sources

**RESEARCHERS:** Ahmed Raza and Imtiaz Ahmad Warraich

**DURATION:** 2018-20

**TREATMENTS:** T1: Traditional Fertilizers (DAP, SOP and Urea)  
T2: Soluble Fertilizers (Soluble DAP, Soluble SOP, and Urea)

**PLAN OF WORK:** Lay out: RCBD  
Treatment: 2  
Replication: 5  
Plant/Treatment: 2  
Total plants: 20

**METHODOLOGY:** Treatment (T1): recommended dose of NPK will be maintained, P and K will be applied during the month of Dec/Jan, while nitrogen from urea will be applied in three equal splits (end of Feb., end of April and end of August). Treatment (T2): In 200 L water, 4 kg soluble DAP + 4 Kg Soluble SOP + 20 kg urea will be applied to 50 plants with each six different irrigation intervals i.e. Six irrigation intervals will be

1. Mid of Feb
2. 1st week of April
3. Last week of April
4. Mid May
5. Mid August
6. Mid September

All other practices will be remained same in both treatments. Soil samples will be collected at initiation of experiment. Treatment will be applied according to the schedule and data will be collected at the time of harvesting.

**DATA TO BE COLLECTED**

1. No. of Fruit
2. Fruit weight (g/fruit)
3. Fruit dia. (mm)
4. Fruit yield (kg/plant)

Initial soil analysis

Soil depths (inches)	EC (dS/m)	pH	Av P (ppm)	Av. K (ppm)
0-6	1.19	8.0	6.7	190
6-12	1.16	8.0	4.8	148
12-24	0.74	7.9	-	-
24-36	1.22	8.0	-	-
36-48	1.0	8.0	-	-

**Table 2. Yield and yield attributes**

Treatments	Fruit No/plant	Fruit Dia. (mm)	Fruit weight (g)	Yield (kg/plant)
Traditional Fertilizer	559	68.64	150.59	84.22
Soluble Fertilizers	621 NS	67.18 NS	139.99 NS	86.84 NS

**Results:** No any difference observed between traditional and soluble fertilizers.

**PROJECT-15**

**TITLE:** **EVALUATION OF DIFFERENT RATIO OF BAGASSE + SOIL (MEDIA) FOR CONTAINER GROWN NURSERY PLANTS**

**OBJECTIVES:** To search out a media which could be easily available and must be cheap.

**RESEARCHERS:** Ahmed Raza and Imtiaz Ahmad Warraich

**DURATION:** 2019-20

**TREATMENTS:**

<b>T1:</b>	<b>Garden Soil + Silt + Sand (1.5:1.5: 2)</b>
<b>T2:</b>	<b>Bagasse + Silt (2: 1)</b>
<b>T3:</b>	<b>Bagasse + Silt (3: 1)</b>
<b>T4:</b>	<b>Bagasse</b>

**PLAN OF WORK:**

Lay out:	CRD
Treatments:	4
Replications:	3
Plants/treat:	2
Total pots:	24

**METHODOLOGY:** Fresh bagasse was first dried, crushed and then dumped under soil pit. It was kept under moist condition and applied 2 kg urea/10 kg bagasse with 20 days interval followed by irrigation. When it was turned into brownish/black colour, it was air dried. Then different ratios of bagasse + silt were proposed and were further treated with farmlin aldehyde. Treated media was covered with plastic sheet for 24 hours and then used for experimental purposes.

**DATA TO BE COLLECTED**

1. Physical and chemical properties of media will be studied
2. Plant growth data and budding/grafting time etc.

**Table. 1 Analysis of media**

Treatments	EC dS/m (1:10)	pH	Av. P (ppm)	Av. K (ppm)
Garden Soil + Silt + Sand (1.5:1.5: 2)	1.2	7.6	7.15	120
Bagasse + silt (2:1)	1.95	7.3	8.1	220
Bagasse + silt (3:1)	2.4	7.4	14.47	240
Bagasse	3.15	7.6	26.35	460

**Results:**

Treatments	Height of Plant	No. of Leaves	Budding %	Irrigation interval
Garden Soil + Silt + Sand (1.5:1.5: 2)	36.1	105	40	3-7 days
Bagasse + silt (2:1)	30.6	101	40	15-30 days
Bagasse + silt (3:1)	<b>36.5</b>	<b>105</b>	<b>100</b>	<b>20- 30 days</b>
Bagasse	24.5	100	0	20-30 days

**Results:** According to above table, plants transplanted in potting media of bagasse + silt (3:1) are performing better as compared to other media.

**PROJECT-16**

**TITLE:** **SCREENING OF DIFFERENT ROOTSTOCKS AGAINST DIFFERENT SALINITY LEVELS**

**OBJECTIVES:** To find out salinity resistant rootstock for citrus nursery

**RESEARCHERS:** Ahmed Raza and Imtiaz Ahmad Warraich

**DURATION:** 2019-22

**TREATMENTS:** **Rootstocks:** 4 (Rough lemon, Rangpur lime, Cleopatra mandarin and Volka meriana)  
**Salinity levels:** 4 (2, 4, 6 and 8 dS/m)

<b>PLAN OF WORK:</b>	Lay out:	CRD split plot
	Treatments:	4
	Salinity levels:	4
	Replications:	3
	Plants/treat:	10
	Total plants:	480

**METHODOLOGY:** Different patches of the same field were 1<sup>st</sup> identified/observed, then analyzed in the lab for EC & pH. The desired soils were collected, dried, ground, sieved and then filled it in the container size of 3 x1 x 1 feet. From the different container, again samples were collected and analyzed for EC, pH, OM %, P, K and micronutrients (Zn, Fe, Cu and Mn)

#### DATA COLLECTED

1. EC, pH, Texture, OM %, P, K etc
2. Performance of plants will be observed i.e. Survival Rate, Growth rate etc.

**Table 1 Initial soil analysis**

Salinity levels (dS/m)	EC (dS/m)	pH	OM %	N %	Av. P (ppm)	K (ppm)
2	1.8	7.7	0.42	0.010	13.22	100
4	3.6	7.7	0.14	0.013	11.83	220
6	5.5	7.8	0.21	0.010	8.7	100
8	8.3	7.8	0.77	0.010	9.0	100

#### Results:

##### Plant height after 1 month

Treatments detail	EC levels			
	2	4	6	8
Rough lemon	15.70 ABCD	11.4 D	3.6 EFG	1.9 FG
<b>Rangpur lime</b>	<b>21.5 A</b>	<b>11.9 CD</b>	<b>13.5 C</b>	<b>10.5 DE</b>
Cleopatra mandarin	20.8 AB	11.4 D	8.6 DEF	2.5 FG
Volka meriana	18.56 AB	14.4 ABCD	0 G	0 G

##### Survival rate after 1 month

Treatments detail	EC levels			
	2	4	6	8
Rough lemon	100	23.53	11.76	5.88
<b>Rangpur lime</b>	<b>100</b>	<b>62.5</b>	<b>50</b>	<b>25</b>
Cleopatra mandarin	100	40	13.33	6.66
Volka meriana	100	6.66	0	0

Results: According to above tables, The Rangpur lime has more survival rate than other rootstocks against above salinity levels. The height of Rangpur lime was also stood better as compared to other rootstocks.

### (POST HARVEST SECTION)

#### PROJECT -17

**TITLE:** INFLUENCE OF STORAGE CONDITIONS ON KEEPING QUALITY OF DIFFERENT MANDARIN VARIETIES

**OBJECTIVE:** Comparison of the influences of storage conditions on keeping quality and various physico-chemical properties of different mandarin varieties

**RESEARCHERS:** Ehsan Ul Haque & Akbar Hayat

**DURATION:** 2019-20

**LOCATION:** Citrus Research Institute, Sargodha

**TREATMENTS:**

- T1 Kinnow
- T2 Ponkon
- T3 Willow Leaf
- T4 Clementine
- T5 Wilking
- T6 Honey Mandarin
- T7 Pixie

**Plan of Work:**

To conduct the research work, waxed fruit was kept at cold atmospheric chamber for 60 days for shelf life study.

Layout Design	CRD
Number of treatments (Varieties)	07
Number of replications	04

**Data Collected:**

Analysis data was collected for the given parameters. Brix, Acidity %, B/A Ratio, Fruit Weight , Juice weight, Peel weight, Rag weight, Seed number, Disease incidence%, Weight loss% & sensory score

**Comparison of fruit characteristics**

Treatments	Fruit Wt.(g)	Juice wt.(g)	Peel Wt. (g)	Rag Wt. (g)	No. of Seeds
Kinnow	170.55	79.09	46.02	45.2	13
Ponkon	147.32	41.26	57.26	48.22	6
Willow Leaf	158.15	73.11	41.32	42.8	9
Clementine	61.51	24.12	19.14	17.707	11
Wilking	160.25	74.12	41.86	43.75	12
Honey Mandrin	95.06	33.93	32.36	28.25	14
Pixie	119.26	43.97	42.3	32.328	13

The results revealed that Kinnow was leading followed by Willoleaf and Wilking scion varieties which may perform better when grafted on the same (Rough Lemon) rootstock in the local climatic conditions

**Comparison of fruit characteristics**

Treatments	TSS %	Acidity %	Brix/Acid Ratio
Kinnow	11.4	0.58	19.7
Ponkon	8.2	0.62	13.2
Willow Leaf	11	0.6	18.3
Clementine	8.7	0.81	10.7
Wilking	10.9	0.68	16.0
Honey Mandarin	9	0.73	12.3
Pixie	7.5	0.78	9.6

The results revealed that Kinnow was leading followed by Willoleaf and Wilking scion varieties which may perform better when grafted on the same (Rough Lemon) rootstock in the local climatic conditions

**Comparison of Storage Studies**

	Treatments	TSS %	Acidity %	Disease %	Wt. Loss %	Sensory
T1	Kinnow	11.4	0.58	6.77	5.51	5.72
T2	Ponkon	8.2	0.62	10.66	7.15	4.17
T3	Willow Leaf	11	0.6	6.33	4.53	6.2
T4	Clementine	8.7	0.81	11.33	5.65	5.02
T5	Wilking	10.9	0.68	7.45	5.85	5.36
T6	Honey Mandarin	9	0.73	7.22	5.77	5.36
T7	Pixie	7.5	0.78	8.27	8.78	5

Results of storage studies of 60 days revealed that Willow leaf and Wilking Mandarin varieties performed at par with Kinnow in respect of keeping quality

**PROJECT-18**

**TITLE:** **STORAGE STABILITY COMPARISON AND KEEPING QUALITY OF KINNOW MANDARIN OBTAINED FROM DIFFERENT SOURCES**

**OBJECTIVE:** Comparison of the influences of storage conditions on physico-chemical and organoleptic properties of bio-fortified Kinnow Mandarin crop. Bio-fortified fruit through agronomic practices, grafted on different rootstocks, through soil applications of micronutrients and available three strains were tested for storage stability at optimum storage conditions.

**RESEARCHER:** Ehsan Ul Haque, Akbar Hayat, Muhammad Asim

**DURATION:** 2019-2022

**LOCATION:** Citrus Research Institute Sargodha

**TREATMENTS:**

T1	Kinnow on Rough Lemon	T2	Kinnow on Troyer
T3	Kinnow on Carrizo	T4	Kinnow on Cleopatra
T5	Kinnow on Cox Mandarin	T6	Kinnow on Sour Orange
T7	Kinnow Normal seeded	T8	Kinnow less seeded
T9	Kinnow Seedless		
T10	Kinnow enriched with micronutrients (commercially blended)		

**Data collected:**

Juice%, TSS, Acidity%, Disease incidence%, Weight loss%, Firmness kg & Sensory evaluation score

<b>Layout Design</b>	<b>CRD</b>
Number of treatments	10
Number of replications	04

**Comparison of fruit characteristics**

<b>Treatments</b>	<b>Juice %</b>	<b>TSS %</b>	<b>Acidity %</b>	<b>Sensory score</b>
T1	43.08	10	0.52	9
T2	47.38	11.9	1.06	9
T3	45.54	10.9	1.16	9
T4	44.14	11.3	0.54	8.7
T5	44.24	11	1.11	8.8



T6	43.15	11.1	1.14	8.8
T7	43.08	10	0.52	8.8
T8	43.2	10.4	0.5	8.9
T9	44.7	11.2	0.44	9
T10	47.2	11.5	0.95	9

Kinnow on Troyer citrange (T2) has performed best with respect to various fruit quality parameters followed by T10 (Kinnow enriched with soil micronutrients)

#### Comparison of Storage studies

Treatments	Fruit wt. Loss %	Firmness kg	TSS %	Acidity %	Disease incidence %	Sensory score
T1	4.21	1.3	10.1	0.5	5.3	5.8
T2	4.14	1.42	12.1	1	5	6
T3	7.53	1.24	11	1.14	6.1	4.5
T4	6.65	1.18	11.2	0.56	5.35	5.5
T5	7.95	1.24	11.1	1.13	5	5.1
T6	6.77	1.54	11.3	1.1	6.33	4.8
T7	5.78	1.44	10.2	0.54	5.25	4.7
T8	6.51	1.3	10.5	0.5	6.3	5
T9	4.15	1.4	11.5	0.46	4.85	6.1
T10	4.53	1.38	12	0.96	4.9	6.2

Storage studies revealed that Kinnow on Troyer citrange T2 has performed best followed by seedless Kinnow (T9) and Kinnow enriched with soil nutrients (T10) with respect to keeping quality

## **DETAIL OF ON GOING PROJECTS:**

### **1. DIVERSIFICATION TO HIGH VALUE CROPPING THROUGH PROMOTION OF HORTICULTURE**

#### **Targets for the year 2019-20:**

- 6000 seedless kinnow plants to be produced by CRI, Sargodha.
- Supply of 9000 bud wood of seedless kinnow to the private registered nurseries by CRI, Sargodha.
- Two trainings to the registered nurserymen on seedless kinnow.

#### **Achievements against the targets:**

- 6000 plants of seedless kinnow have been prepared at Govt. Model Nursery CRI, Sargodha.
- 7960 bud wood of seedless kinnow has been provided to the private registered nurseries so far.
- Two trainings has been given to the registered nurserymen.

### **2. PROMOTION OF FRUITS PRODUCTION IN PUNJAB THROUGH PROVISION OF CERTIFIED PLANTS**

#### **Targets for the year 2019-20:**

- Certified citrus nursery plants
- Supply of true to type and disease free scion wood to the registered nurserymen
- Provision of certified rootstock Seed

#### **Achievements against the targets:**

- Supplied true to type and disease free scion wood to registered nurserymen during the month of August & September per demand of nurserymen
- Survey for the selection of good quality fruit and yield potential citrus plants of approved varieties has been started
- Supplied certified root stock seed to the registered nurseries as per demand during the month of August & September

### **3. PARB PROJECT NO. 904 "NUTRITION ENHANCEMENT OF CROPS, FRUITS, VEGETABLES AND THEIR PRODUCTS UNDER CLIMATE CHANGE SCENARIO.**

#### **Targets for the year 2019-20:**

- Citrus orchard management practices at selected trials sites.
- Soil and leaf analysis of selected sites.
- Quality and nutritional analysis of fruit from all trial sites.
- Conduction of storage studies of Kinnow.
- Production of standardized citrus products.
- Visit and training at citrus research institute China (CRIC)
- Achievements against the targets:
  - Orchard management practices were performed on all selected five sites.
  - Soil and leaf analysis of all sites was completed for the current year.
  - Quality and nutritional analysis of kinnow fruit from all five sites completed for the current year.
  - Storage study of Kinnow fruit is being carried out for the current crop.
  - Products on lab scale were prepared for all targeted four products and kept for further evaluation.
  - NOC was issued for foreign training at CRIC but due to COVID-19 epidemic situation, visit could not be made possible.

#### **ACHIEVEMENTS:**

- Second year DUS tests of five citrus varieties i.e. Sweet lime, Kaghzi Lime, Succari, Ruby blood & Valencia late was completed as a first step towards variety approval
- Introduced Mechanical citrus tree pruner in the Farmer field during the year 2019-20
- 26000 true to type nursery plants have been prepared during the year 2019-20.
- Advisory services were rendered to the farmers who visited this office and through telephonic discussion.
- 12 trainings were delivered to the citrus growers on different aspect of citrus orchard management.
- 09 trainings were received by the Scientist of this Institute for the purpose of capacity building on different topics of service matter and professional skills

- Two Farmer days/Exhibition/Seminar were arranged by this institute for the technical awareness of citrus growers about citrus crop.
- This office participated in Exhibition of citrus fruit at Expo Center Lahore by arranging stalls of different varieties of citrus fruits 22, 23 January 2020.
- This institute has participated in Exhibition of citrus fruit at Mateela Kotmomen on 26-01-2020

#### **OTHERS ACHIEVEMENT:**

➤ Soil & water samples analyzed	150
➤ Disease sample analyzed	92
➤ Radio Talks delivered	22
➤ TV Talks delivered	02
➤ Popular Urdu Articles	08
➤ Research Paper published	15
➤ Research Paper submitted	06
➤ Abstract published	11
➤ Internship students	14
➤ Booklet/manual Published	01

#### **PUBLICATION FROM CITRUS RESEARCH INSTITUTE SARGODHA FOR THE YEAR 2019-20**

- 1- Khan, M. N., Hayat, F., Asim, M., Iqbal, S., Ashraf, T., & Asghar, S. (2020). Influence of citrus rootstocks on growth performance and leaf mineral nutrition of ‘Salustiana’ sweet orange [*Citrus sinensis* (L). obsek]. *Journal of Pure and Applied Agriculture*, 5(1), 46-53.
- 2- Muhammad Nawaz Khan, Naima Din, Muhammad Babar Shahzad Afzal, Misbah Ashraf, Ummara Khan, Zafar Iqbal, Faisal Hayat and Malik Abdul Rehman. 2020. “Antixenotic and antibiotic impact of synthetic and plant extracted chemicals against *Rhyzopertha dominica* (Fabricius) (Coleoptera: Bostrichidae) at different storage periods in stored wheat”. *Journal of Pure and Applied Agriculture*. 5: 52-58
- 3- Hayat, A., Khan, M. N., Haque, E. U., Raza, A., & Khadeeja, F. (2019). Suitability of different rootstocks to overcome the reduction of size problem in the feuter’s early (*Citrus reticulata*) mandarin. *JOURNAL OF INNOVATIVE SCIENCES*, 5(2), 115-120.
- 4- Abbas, G., Fatima, Z., Riaz, F., Iqbal, P., Hussain, S., Zakir, I., ... & Ahmad, S. (2019). Study of Sowing dates and Hybrids Effect in Maize-based Cropping System under Arid Conditions of Southern Punjab, Pakistan. *Pakistan Journal of Life & Social Sciences*, 17(1).

- 5- Andrade, J. C., Dos Santos, A. T., Da Silva, A. R., Freitas, M. A., Afzal, M. I., Gonçalo, M. I., ... & De Matos, Y. M. (2020). Phytochemical characterization of the *Ziziphus joazeiro* Mart. metabolites by UPLC-QTOF and antifungal activity evaluation. *Cellular and molecular biology (Noisy-le-Grand, France)*, 66(4), 127-132.
- 6- Aziz, A., Hayat, A., Ehsan-Ul-Haque, M. N. K., Raza, A., Khadeja, F., & Ahmed, M. (2020). Influence of rootstocks on plant growth and internal quality of sweet orange (*Citrus sinensis*) cv. Musambi. *Journal of Pure and Applied Agriculture*, 5(1), 62-68.
- 7- Ali, Q., Rasul, A., Akhtar, M. F., Aslam, A., Shakir, H. U., Rehman, M. A., ... & Umar, M. Y. (2020). Effect of insect growth regulators on fecundity, fertility and adult emergence of *Tribolium castaneum* (Herbst) and *Trogoderma granarium* (Everts). *Pakistan Journal of Agricultural Sciences*, 57(3).
- 8- Iqbal, Z., Ahmad, S., Asim, M., Rehman, M. A., Rehman, A., Raza, W., ... & Abid, H. U. (2020). Management of *Phytophthora* species associated with citrus decline in Pakistan. *Management*, 5(1).
- 9- Saeed, M., Mukhtar, T., & Rehman, M. A. (2019). Temporal fluctuations in the population of citrus nematode (*Tylenchulus semipenetrans*) in the Pothowar region of Pakistan. *Pakistan Journal of Zoology*, 51(6), 2257.
- 10- Mansoor, M. M., Raza, A. B. M., & Afzal, M. B. S. (2019). Fipronil resistance in pink stem borer, *Sesamia inferens* (Walker)(Lepidoptera: Noctuidae) from Pakistan: Cross-resistance, genetics and realized heritability. *Crop Protection*, 120, 103-108.
- 11- Naem, A., Afzal, M. B. S., Freed, S., Hafeez, F., Zaka, S. M., Ali, Q., ... & Nawaz, M. (2019). First report of thiamethoxam resistance selection, cross resistance to various insecticides and realized heritability in Asian citrus psyllid *Diaphorina citri* from Pakistan. *Crop Protection*, 121, 11-17.
- 12- Banazeer, A., Afzal, M. B. S., Ijaz, M., & Shad, S. A. (2019). Spinosad resistance selected in the laboratory strain of *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae): studies on risk assessment and cross-resistance patterns. *Phytoparasitica*, 47(4), 531-542.
- 13- Afzal, M. B., Shad, S. A., Ejaz, M., & Serrao, J. E. (2020). Laboratory selection, cross-resistance, and estimations of realized heritability of indoxacarb resistance in *Phenacoccus solenopsis* (Homoptera: Pseudococcidae). *Pest Management Science*, 76(1), 161-168.
- 14- Banazeer, A., Shad, S. A., & Afzal, M. B. S. (2020). Laboratory induced bifenthrin resistance selection in *Oxycarenus hyalinipennis* (Costa)(Hemiptera: Lygaeidae): Stability, cross-resistance, dominance and effects on biological fitness. *Crop Protection*, 132, 105107.
- 15- A. Raza, M. A. Zaka, T. Khurshid, M. A. Nawaz, W. Ahmed, and M. B. S. Afzal. 2020. "Different irrigation systems affect the yield and water use efficiency of kinnow mandarin (*Citrus reticulata* blanco.)". *The Journal of Animal & Plant Sciences*. 30: 1178-1186.

**SENIOR RESEARCH STAFF:****HORTICULTURE SECTION:**

**Muhammad Nawaz Khan, Director**

0301-6710434, [directorcitrus@gmail.com](mailto:directorcitrus@gmail.com)

**Javaid Iqbal Horticulturist**

0300-6685394, [directorcitrus@gmail.com](mailto:directorcitrus@gmail.com)

**Imran Muhammad Siddique, Horticulturist**

0333-6912169, [horticulturistsahiwal@gmail.com](mailto:horticulturistsahiwal@gmail.com)

**Muhammad Raza Salik, Assistant Horticulturist, 0345-8047454**

[razasalikcri@gmail.com](mailto:razasalikcri@gmail.com)

**SOIL SCIENCE SECTION:**

**Imtiaz Ahmad Warriach, Assistant Agri. Chemist.**

0334-7523292, [warrachimtiaaz66@gmail.com](mailto:warrachimtiaaz66@gmail.com)

**PLANT PATHOLOGY SECTION:**

**Abdul Rehman, Assistant Plant Pathologist,**

0300-6037325, [qalandar68@gmail.com](mailto:qalandar68@gmail.com)

**FOOD TECHNOLOGY SECTION:**

**Mr.Ehsan-ul-Haq,AFT,0300-9602855**

[awanehsan101@hotmail.com](mailto:awanehsan101@hotmail.com)

**ENTOMOLOGY SECTION:**

**Naima Din Assistant Entomologist**

0336-3311282, [naima\\_noor83@hotmail.com](mailto:naima_noor83@hotmail.com)



**Muhammad Nawaz Khan  
Director,  
Citrus Research Institute  
Sargodha**