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OVERVIEW

Citrus crop ranks first with respect to its area and production in the Punjab among all fruits. It is grown on an area of 1, 92,832 hectares with the production of almost 23,95,550 tons. (Source: Fruit & Vegetable condiments statistics of Pakistan 2014-15). When we look towards the breakup of citrus varieties, it reveals that kinnow mandarin is dominant due to its popularity in local market and its export potential. Citrus Research Institute, Sargodha is now focusing on seedless cultivars of citrus. These varieties include seedless Kinnow, Salustiana, Taracco & Shamber. This Institute has successfully conducted different research trials on Cultural, Pathological, Entomological, Soil science and Post-harvest aspects during the previous year. The contribution of this institute towards control of citrus fruit fly is also admirable because citrus fruit fly is a threat from export point of view. For the purpose of diversification, this institute has established a block comprising on exotic varieties of citrus i.e. Daizy Mandarin, Kishu mandarin, Cavin mandarin, Harward Blood, Ryan Navel, Mc Mohn Valencia, Cara Cara Naval & Ornard Blood to study their adaptability. This Institute has launched a campaign with the collaboration of Agri. Ext. In the form of trainings for capacity building of the farmers. This institute has also established overall four Screen Houses for producing disease free citrus nursery. The institute has also imported a Mechanical Citrus Tree Pruner for its demonstration. This Institute is committed to work for the progress of citrus sector and farming community by rendering valuable technical guidance.

HORTICULTURE DIVISION

1-Effect of different root stocks on yield and quality of kinnow mandarin.

The main objective of this experiment was to produce the healthy and vigorous plants and to get better quality and yield of Kinnow through selecting better rootstock for kinnow. Performance of Kinnow mandarin was tested by budding it on six different root stocks i.e. cleoptra mandarin, troyer citrange, Sour orange, Cox mandarin hybrid, Rough Lemon & Carrizo citrange. There were six replications & six treatments comprising on 36 plants in total. Growth & yield data taken during the year 2017-18 indicated that there was no problem of incompatibility between the root stocks & the scion. Vigorous growth of Kinnow was observed on cleoptra, sour orange, rough lemon followed by other root stocks. Maximum height (2.8 m) each was recorded on budding with rough lemon followed by Carrizo citrange (2.73m). Maximum yield (310 fruit/plant) at initial stage was found in Kinnow where it was budded on sour orange followed by (308 fruit/plant) when it was budded on rough lemon.

2- Performance of different exotic varieties under Sargodha condition on local root stock.



The main objective was to evaluate the performance of various exotic varieties on local root stock i.e. Rough Lemon under soil and climatic condition of Sargodha. Plants of these exotic varieties were shifted in the field from screen house during the year 2015 & their performance remained under observations in the form of experiment. There were eight treatments/varieties viz Daizy mandarin, Harward blood, Ryan navel, Mc Mohan Valencia, Cara Cara Navel, Kishu Mandarin, Arnald Blood & Cafin. The experiment includes eight treatments with six replications & one plant in each treatment making 48 plants in total in the experiment. Flowering appeared on five varieties out of eight. Physio chemical analysis of fruit showed that Harward Blood attained maximum fruit weight (213.6 gm), juice weight (105.8 gm), maximum TSS (8.7). However, maximum juice% (50.9%) was recorded in Daizy mandarin as compared to the other varieties included in this experiment.

3- To evaluate the performance of different strains of seedless kinnow (citrus reticulata blanco) under soil & climatic condition of Sargodha.



The main objective was to find out best strains of seedless Kinnow.

The detail of the treatment is as under

T₁=Strain-1 (BW source-Dr. Shujat orchard R-9, P2), 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 Tiwana Farm Fsd), T₇=Strain-7 (BW source-Dr. Shujat orchard GFT Sgd) & T₈= Strain-8 (BW source Asad Tiwan Farm GFT Sgd). The plant height taken during the year 2017-18 is given to assess their comparative performance under the prevalent condition. Maximum height (150.4 cm) was observed in the plants included in T₅ followed by the height of the plants (140.9 cm) observed in T₃. After verification of their seedless status this plot will act as multiplication block for seedless kinnow for registered nurseries.

4- Effect of GA₃ application on fruit size of feutrell's early (citrus reticulata).

The main objective of the trial was to overcome the problem of small fruit size in Feutrell's Early. The experiment was initiated in 2017-18. In this experiment four

treatments of GA₃ were used with four replications i.e. T₁ control, T₂ = 10 ppm GA₃, T₃ = 20 ppm GA₃ & T₄ = 30 ppm GA₃. Plants of uniform size and age were selected from the orchard of CRI, Sargodha. Four branches having desired number of fruits at pea size stage were selected and tagged from all sides of plant. The maximum fruit size was observed in T₄ plants (62.68 mm) as compared to control T₁ (60.81 mm) for the year 2017-18. Further results will be concluded after the completion of trial.

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

The main objective of this experiment was to enhance vegetative and reproductive life of Musambi by the use of different inter-stocks. Four inter-stocks viz kinnow, Succari, casa grande & CRI-7 were used as inter-stock.

Budding on inter- stocks was done during the month of March, 2018. Maximum sprouting was observed in T₁ (less seeded kinnow) = 40%, T₃ (Casa Grande) 20%, T₄ (CRI-7) = 13% & minimum in T₂ (Succari) = 7% in spite of the fact that proper after care (hoeing, irrigation & application of fertilizer) was carried out. Further parameters will be collected according to the schedule of the experiment.

ENTOMOLOGY DIVISION:

6- Efficacy of different insecticides against *Drosicha mangiferae* (Homoptera: Margarodidae) under laboratory conditions"

This research trial was conducted in the Citrus Research Institute, Sargodha. The

efficacy of eight different insecticides viz., acetamiprid, imidacloprid, profenofos, methidathion, bifenthrin, carbosulfan, buprofezin and spirotetramat was tested against the adult female mango mealybug *Drosicha mangiferae* in the laboratory using leaf-dip bioassay method. The insects were collected from citrus orchard of Citrus Research Institute, Sargodha and were tested on different insecticide doses during the year 2017. The mortality data was analyzed by split plot design under CRD using statistics 8.1 version software. Results indicated that methidathion (T₄) produced significantly higher mortality of 73.57% seven days after treatment while mortality due to bifenthrin (T₅) was 59.996% four days after treatment but it decreased to 20% seven days after treatment. Profenofos (T₃) produced higher mortality (58.07%) seven days after treatment but it was significantly less as compared to methidathion (T₄). Carbosulfan (T₆) showed good results four days after treatment with 59.81% mortality but mortality was decreased to 45.6% seven days after treatment. The order of effectiveness of insecticides is as: methidathion > profenofos > carbosulfan > bifenthrin. The insecticides, acetamiprid, imidacloprid, buprofezin and spirotetramat were found ineffective for the control of adult female mango mealybug. The judicious use of the insecticides methidathion, profenofos and carbosulfan is recommended to the citrus growers to control this important pest. **This research work was published in “Journal of Entomology and Zoology Studies” in 2018 in volume 6 and 2nd issue from page number 2855-2858 with title “Efficacy of**

different insecticides under laboratory conditions against *Drosicha mangiferae* Green (Homoptera: Margarodidae) collected from citrus orchards of Sargodha, Pakistan”.

PLANT PATHOLOGY DIVISION :

7- Evaluation of different fungicides against citrus canker (*xanthomonas axonopodius* pv.citri.)

The present study was initiated to evaluate the most effective fungicide against citrus canker. The experiment was laid down in RCBD involving 10 treatments, 4 replications. Different treatments with their respective doses were as T₁ Copperhydroxide @3gm / lit. of water, T₂ Baccillius Spp. (Bio.Magic) @ 3 gm / lit. of water, T₃ Streptomycin+Copperoxychloride @ 1 +3 gm / lit. of water, T₄ Bordeaux Mixture@ 1 % ,T₅ Validamycin @ 1 ml / lit. of water, T₆ Kasugamycin+ Copperoxychloride @ 3 ml +3gm/ lit. of water ,T₇ Copperoxychloride + Validamycin @ 3 gm +1ml/ lit. of water ,T₈ Sulpher @2.5 gm/ lit. of water ,T₉ Onion Extract @10 ml / lit. of water and T₁₀ control with no application. Four sprays were done during the month of April, July and August. To observe the response of individual treatment, the observations were collected for statistical analysis which indicated that the spray of T₄ (Bordeaux mixture) overall decreases the disease (on leaves as well as fruit) up to 90% as compared to the control. The 2nd best result were seen with the spray of T₈ (Onion Extract) with the result of 80% decrease in disease over control.

8- Comparative studies on the Efficacy of different chemicals to control citrus scab (*elsinoe fawcettii*) and citrus melanose (*diaporthe citri*) in kinnow

On account of changing of weather patterns some fungal diseases in citrus growing areas are causing serious problems and economic losses to citrus growers. The prominent among them were citrus fungal scab and melanose. The experiment was started with the objective to find out the most suitable fungicide against the citrus scab and citrus melanose diseases. Different fungicides were tested with their respective doses as T₁ (Azoxystrobin) @ 1ml/liter of water, T₂ (Pyraclostrobin + Metiram) @ 1.5 gm / lit. of Water, T₃ (Difenoconazole + Azoxystrobin) @ 1 ml /lit. of Water, T₄ (Copper Oxychloride) @ 3 gm / lit. of Water, T₅ (Copper Hydroxide) @ 2.5gm/ lit. of Water, T₆ (Tebuconazole + Trifloxystrobin) @ 0.5 gm /lit. of Water T₇ (Fluoxystrobin) 1 ml/lit. of Water, T₈ (Chlorothalonil+Thiophente methyl) @ 1 ml /lit. of water, T₉ (Azoxystrobin+ Chlorothalonil) @ 1 ml/lit. of water and T₁₀ (control) with no application of fungicides. The data was subjected to the statistical analysis and it was observed that spray of T₃ (Difenoconazole + Azoxystrobin) proved most effective by decreasing disease up to 90% over control followed by the spray of T₅ (Copper hydroxide)

SOIL SCIENCE SECTION:

9- Studies on the foliar feeding of zn, cu and b on yield and quality of citrus cv. kinnow.

The experiment was initiated in 2015-16 with the objective of enhancing yield and quality of kinnow mandarin besides improving tree health. The deficiencies of micronutrients lead the plant toward

declining size and ultimately poor yield and quality. Treatments were as T₁: NPK (1000-500-500 g plant⁻¹) (control) T₂: T₁ + Zn foliar application @ 1000 ppm (0.3 % ZnSO₄, T₃: T₁ + B foliar application @ 60 ppm (0.05 % Borax), T₄: T₁ + Cu foliar application @ 500 ppm (0.2 % CuSO₄), T₅: T₁ + Zn+ B foliar application, T₆: T₁ + Zn+ Cu foliar application, T₇: T₁ + Cu+ B foliar application and T₈: T₁+ Zn + Cu + B foliar application. There were 8 treatments with 2 plants per treatments and replicated 4 times therefore, total 48 trees were constituted under this experimental study. According to study, along with soil application of NPK, Cu (0.2 % CuSO₄) and Zn (0.3 % ZnSO₄), Zn + Cu and Zn + Cu + B produced statistically no significant difference in-terms of yield. The leaf analysis showed that B concentration was found higher (81.83 ppm) in treatment T₇ where Cu + B were applied with foliar spray while leaf Cu concentration was found higher in treatments T₇ (18.26 ppm), T₆ (15.35 ppm), T₅ (15.25 ppm) and T₄ (18 ppm) where this nutrient was used alone or in combination with others. While Zn concentration was increased in T₆ (33.0 ppm) only.

10- Development of economical fertilizer programme to increase the qualitative yield of kinnow

The experiment was initiated in 2015-16. The objective of this study was to make the nutritional program cost effective besides improving the yield and quality of kinnow mandarin. Treatments includes as T₁: NPK (1000-500-500 g plant⁻¹), T₂: 75 % N (urea) + 25 % N (FYM), T₃: 50 % N (urea) + 50 % N (FYM), T₄: 75 % N (FYM) + 25 N (urea),

T₅: 75 % N (urea) + 25 % N (poultry manure), T₆: 50 % N (urea) + 50 % N (poultry manure), T₇: 75 % N (poultry manure) + 25 % N (urea), T₈: 75 % N (urea) + 25 % N (compost), T₉: 50 % N (urea) + 50 % N (compost), T₁₀: 75 % N (compost) + 25 % N (urea). According to data, the higher yield (196.25kg/plant), Number of fruit/plant (808) and fruit weight (179.67 gm) were observed in T₅ where 75 % N was fulfilled from Urea and remaining 25 % N from Poultry manure but results were statistically insignificant. However, a significant difference was observed between the treatments in case of juice % and TSS. The juice % (48.06) & TSS (12.24) was found better in T₅ followed by T₂ where 75 % N was obtained from Urea and remaining from FYM.

POSTHARVEST DIVISION:

11- Influence of storage conditions on keeping quality of different mandarin varieties.



This research study was conducted to explore and compare the influences of storage conditions on physico-chemical and organoleptic properties of different new Mandarin varieties. Among them Willow leaf, Wilking, Ponkan, Honey Mandarin, Pixie were selected to compare with existing dominating variety of Kinnow. To conduct the research work, the fruit was harvested, washed and dried. Properly

dried fruit was coated with commercial wax (Fomeca) according to given treatment plan and placed in corrugated cartons, kept at cold atmospheric chamber and ambient conditions for shelf life studies. For this purpose Brix, Acidity %, B/A Ratio, Weight Loss %, Firmness, Fruit Decay %, Juice %, Seed number, yield and Visual Sensory Evaluation were tested. Kinnow excelled in fruit size and weight followed by Ponkon and Willow leaf; but juice percentage was excellent in Kinnow followed by its relative varieties wilking and willow leaf. Least fruit weight and size was attained in Clementine while least juice percentage was found in Ponkon and Pixie. TSS and TSS/acid ratio was excelled in Kinnow followed by Willow leaf. While impact of storage conditions was assessed on quality and found Kinnow, Willow leaf and Wilking at par in storage stability while least storage life was observed for Honey Mandarin and Ponkon both at ambient conditions and at cold atmospheric chamber (3-5 °C). Fruit was best stored for 8 days at ambient conditions while 45 days at cold atmospheric chamber.

12- Estimation of post-harvest losses, price spread and marketing loss in kinnow mandarin supply chain in Punjab.

Consecutively two years study was undertaken starting from citrus season (2016-2017) and current season 2017-18. Different operations from harvesting, transportation to marketing at different levels i.e. farmer orchards, pack houses and fruit market (Sabzi Mandi) have been observed. Different areas of improvement have been identified and pragmatic strategy has been suggested for consideration to

uplift the citrus sector. Following stages have been observed crucial for occurrence of postharvest losses.

- a. Harvesting, field handling and transportation
- b. Pack-house
- c. Fruit Markets (Sabzi-Mandi), retailers & others
- d. Processing factories

It can be summarized that when fruit is handled under internationally specified code of standards (GMPs, quality & Food safety etc.) then postharvest losses of citrus fruits accounts only 12.5 - 18.5%, whereas under conventional harvesting and handling practices one third (21.5 - 34%) of the farm produce finds its way to waste before reaching the end consumer.

SALIENT ACHIEVEMENTS:

- CRI, Sargodha succeeded to get approve five new citrus varieties during the year 2017-18.
- This institute made two new Screen Houses for production of disease free citrus nursery.
- This institute has imported mechanical citrus tree pruner for the purpose of pruning & demonstration.

OTHERS:

- Soil & water samples analyzed = 369
- Disease sample analyzed = 159
- Radio Talks delivered = 20
- TV Talks delivered = 02
- Popular Urdu Articles = 05
- Research Paper published = 06
- Training delivered = 29
- No of workshop = 02
- Training received = 12
- Seminar/Exhibition = 02

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