Management and procurement of sweet orange production input research center for orange plants and subtropical fruit (Balitjestro), Batu city, East Java

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ABSTRACT: The purpose of this activity is to be able to manage the production process of sweet oranges and be able to carry out and organize production and post-production activities of sweet oranges. The activity was carried out for 3 weeks (starting from March 02–23, 2020) at the Tekung Experimental Garden (KP), Research Institute for Citrus and Subtropical Fruits (Balitjestro), Batu City, East Java. PKL activities at Balitjestro were planned to be carried out until May 9, 2020, but had to be stopped on March 23, 2020 due to the Covid 19 pandemic in Indonesia. PKL activities are continued with guided street vendors for 9 days starting from June 02–09, 2020, so that they meet the minimum number of practice hours of 60%. The conclusion obtained is that the activities of managing and procuring production inputs for sweet orange agribusiness are realized in Balitjestro with a literature study on sweet orange cultivation and leaf pruning on citrus seeds. The activities of managing the production process of the sweet orange agribusiness are realized in Balitjestro starting from the maintenance of citrus plants including the installation of mulch on citrus seed mounds, pruning of twigs on citrus plants, and thinning of citrus fruit plants. Other activities include planting beets and head lettuce.

Keywords: orange, post production, production

INTRODUCTION

Sweet orange is one of the most popular types of fruit by the community. Sweet orange (Citrus sinensis o) is also one of the fruit commodities that have an important role in the domestic market as well as in the domestic market world, both fresh and processed (Maramba, 2018). Citrus plants are fruit commodities that are included in this type of plant horticulture that is needed by humans for balanced nutritional needs as a source of vitamins, minerals and protein (Sutopo, 2013). The sweet orange plant is native to northeastern India, southern China. Sweet orange has grown in Indonesia, either naturally or cultivated, sweet orange plants that are in Indonesia is a citrus plant heritage of the Dutch (Nafisah, 2013). To meet the demand for fresh sweet oranges, a good organization is needed good and good, with the provision of nutrients and growth regulators, to change the process plant physiology (Setiono, 2014). Substances needed by citrus plants are very many, including elements to increase crop yields. Compost as well as inorganic fertilizers that are very much needed by plants, such as single fertilizers urea and compost. The provision of balanced fertilizers will be able to encourage growth and crop yields. Urea fertilizer is a type of fertilizer that contains very high levels of nitrogen. The element nitrogen contained in urea is one of the three elements: macros that plants need. Because of the content of urea fertilizer and its function (Julianto, 2015). This fertilizer is very popularly used by farmers, both palawija farmers and farmers plantation.

The institution that examines the development of citrus cultivation in Indonesia is the Research Institute for Citrus and Subtropical Fruits (Balitjestro). Balitjestro is one of the Technical Implementation Units (UPT) for research and development which is under the auspices of and is directly responsible to the Horticulture Research and Development Center (Balijestro, 2011). Cultivated commodities are oranges, apples, grapes, strawberries, longan and other subtropic fruits. Balitjestro has been established since 1958...
under the name of Malang People's Plantation Bureau, then got a name change until since 2006 until now it has become the Research Institute for Citrus and Subtropical Fruits (Balijestro, 2015). The purpose of this activity is to be able to manage the production process of sweet oranges and be able to carry out and organize production and post-production activities of sweet oranges (Balijestro, 2020) (Setiono, 2014) (Balijestro, 2015).

**METHOD**

The activity was carried out for 3 weeks (starting from March 02–23, 2020) at the Tlekung Experimental Garden (KP), Research Institute for Citrus and Subtropical Fruits (Balijestro), Batu City, East Java. PKL activities at Balijestro were planned to be carried out until May 9, 2020, but had to be stopped on March 23, 2020 due to the Covid 19 pandemic in Indonesia. PKL activities are continued with guided street vendors for 9 days starting from June 02–09, 2020, so that they meet the minimum number of practice hours of 60% (Balijestro, 2011).

**RESULT AND DISCUSSION**

**Management of Sweet Orange Production Process**

A. Applying mulch to citrus seeds

The installation of mulch on citrus seeds serves to suppress the growth of weeds. The tools and materials needed in the installation of mulch are black silver plastic mulch and 15-20 cm bamboo slats for each seedling. How to install mulch as follows (Balijestro, 2019):

1. Place the mulch on the bed with the black plastic surface facing down, while the silver plastic surface facing up.
2. Pull the two ends of the mulch and then strengthen it with bamboo slats that are bent to a U-shaped shape and stick them into the ground at each end of the bed.
3. Pull the ends of the mulch sheets on the right and left sides and then strengthen them with bamboo slats that are bent to a U-shaped shape and stick them into the ground on the bed.

B. Planting beets

Beetroot is very good for health because it has a lot of nutritional content. Folic acid in beets is able to grow and replace damaged cells, potassium can facilitate fluid balance in the body, vitamin C which helps to grow tissues and normalize blood vessels, magnesium to maintain muscle and nerve function, and caumarin which can prevent tumors. Tools and materials used in planting beets are beet and tugal seeds. The method of planting are (Balibangtan, 2015):

1. Prepare beet seeds to be planted
2. Set the spacing of 15 cm x 15 cm
3. Tugal planting holes with a depth of 5-10 cm
4. Plant the beet seeds into the planting hole

C. Planting head lettuce

Head lettuce is a type of lettuce with large weevil and densely layered leaves. Head lettuce has a crunchy texture, after harvesting the head lettuce must be consumed immediately because it has a shelf life of about 24 hours. How to plant head lettuce is (Balijestro, 2014a):

1. Prepare the land to be planted. Put mulch on each mound with a spacing of 10 cm x 10 cm
2. Tugal planting holes with a depth of 5-10 cm
3. Prepare the seeds that have been sown and are ready to be planted
4. Seeds are planted in a zig-zag manner, this is due to the growth of the blooming head lettuce, so it is necessary to give some distance so that the growth of the head lettuce is not disturbed because it is too close
Pruning twigs on citrus plants
Pruning is also one of the quality controls in citrus plants. Pruning is the act of removing part of a plant part with the intention of growing or stimulating flowering and fruiting in the desired direction. Pruning is done with the 1-3-9 technique, meaning that in 1 main stem it has 3 primary branches, 9 secondary branches, and 27 tertiary branches. This is done to improve fruit quality and maintain plant health (Azelina Rizki et al., 2021).

Citrus fruit thinning
Fruit thinning activity is also one of the maintenance activities on plants. Citrus fruit thinning is an activity to reduce the number of fruits contained in each citrus tree with the aim of producing quality and uniform fruit. Fruit thinning is done if there are more than 3 oranges in one twig, then the fruit must be reduced by leaving 3 fruits of uniform size. This is effective for producing uniform citrus fruits and stimulating the growth of new flower buds for further fertilization.

Organizing Production and Post-Production Activities of Sweet Oranges
A. Calculation of sweet oranges
Citrus fruit counting is done in KP. Tlekung Land Genetic Resources (SDG). The SDG land was planted with 20 varieties of sweet oranges, 39 varieties of tangerines, 7 varieties of citrus in the aromatic group, and 8 varieties of citrus in the rootstock group. This calculation was carried out on 20 varieties of sweet orange. The population of sweet oranges in SDG land is 78 fruits, with each variety of sweet oranges there are 3 similar populations. The genetic resources (SDG) land layout at the Tlekung Balitjestro Citrus fruit counting is done to calculate the citrus yield that will be obtained. This was done because during the PKL period, the oranges in Balitjestro had not yet entered the harvest period, so street vendors could not calculate the amount of harvest they got. Another way to calculate the yield is to count the citrus fruits in each sweet orange tree. Tools and materials in counting citrus fruits are hand counters and workbooks. The counted citrus fruits are recorded in the workbook.

B. Measurement of diameter and length of sweet oranges
Measurements of the diameter and length of sweet oranges were carried out in KP. Tlekung, Land of Genetic Resources. It aims to be able to predict the yield of the harvest will be obtained. The tools and materials used in this activity are plant labels, markers, digital caliper and workbooks. The procedure for this activity is:
1. Write the citrus variety code, observation number, and date of observation on the plant label.
2. Based on the data on the results of the citrus fruit count on 26 varieties, then 10 varieties with the highest fruit production were selected.
3. After determining the variety, each plant is selected 3 fruits that are uniform in shape and then each fruit is given a plant label that has been written according to the variety and observation number.
4. Measure the diameter and length of the citrus fruit using a caliper and write the results in a workbook.
5. The results of measuring the diameter and length of citrus fruit samples can be seen in the Appendix

C. Sorting longan fruit
Sorting is done to separate the good longan fruit from the rotten, moldy, pest and defective fruit. Tools and materials used for sorting longan fruit are plastic crates, tarpaulins, and harvest shears. How to sort longan fruit, namely:
1. The longan fruit that has been harvested is placed on a prepared tarp
2. Cut the end of the long litchi stem and cut the fruit that is deformed, attacked by pests, and rotten.
3. Put the sorted longan fruit into a plastic crate
D. Calculation of production of sweet oranges

Taxation is an activity to estimate the production of crops that will be carried out in the next harvest activity. The purpose of production taxation or forecasting is to facilitate the arrangement and implementation of harvest work in plantations and factory processing. Production taxation activities are very important to be carried out because they affect the success of harvesting in terms of production, technical, and managerial. The production taxation will also affect the determination of the number of harvest workers, the determination of the amount of transportation transporting the crops, and the production to be produced (Pahan, 2008).

Production results can be calculated using two methods, namely the tile-based method and the population-based method. The tile-based method is used to calculate the yield of food crops such as corn, sweet potatoes, vegetable tomatoes, and others. The population-based method is a way of estimating crop yields for plants that are or are classified as trees, one of which is citrus. The taxation formula based on the population method is as follows (Tan, 2018).

\[ T_h = \left( L_a \times H_s \times P_t \right) / J_t \]

Information:
- \( T_h \) = Estimated yield (kg)
- \( L_a \) = Plant area (m²)
- \( H_s \) = Average yield of plant samples (kg)
- \( P_t \) = Percentage of plant growth (%)

Production estimation was carried out by selecting 1-10% plants from the population randomly or systematically and then counting the fruit on the sample plants based on the size of the fruit length with the criteria of size >20 mm, 90% success in planting, 15-20 mm in 60%, and size <15 mm, the success of planting is 10% (Wachjar et al., 2009). The results of the measurement of the diameter of the sweet orange fruit in the genetic resource field, Tlekung experimental garden are in Table 2 (Setiono, 2014).

<table>
<thead>
<tr>
<th>No</th>
<th>Variety</th>
<th>Length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MO1</td>
<td>66.1</td>
</tr>
<tr>
<td>2.</td>
<td>M.51</td>
<td>80</td>
</tr>
<tr>
<td>3.</td>
<td>M.56</td>
<td>59.2</td>
</tr>
<tr>
<td>4.</td>
<td>M.88.8</td>
<td>62.1</td>
</tr>
<tr>
<td>5.</td>
<td>M.88.9</td>
<td>71.8</td>
</tr>
<tr>
<td>6.</td>
<td>M.88.10</td>
<td>56.5</td>
</tr>
<tr>
<td>7.</td>
<td>M.India</td>
<td>54</td>
</tr>
<tr>
<td>9.</td>
<td>M.Roberton Navel</td>
<td>69.6</td>
</tr>
<tr>
<td>10.</td>
<td>M26</td>
<td>36.4</td>
</tr>
</tbody>
</table>

Table 2 shows that the 10 samples observed on sweet oranges had fruit lengths > 20 mm, so the percentage of success in growing crops was set at 20%. Other things that need to be known in calculating the estimated production are land area, spacing, and yields. The spacing of sweet oranges is 5 m x 6 m, there are 26 varieties of citrus fruit in the Genetic Resources Land with each variety having 3 trees, so that the land area of 2,340 m² is obtained (Nubatonis, 2016).

Harvest and post-harvest implementation of sweet oranges

A. Harvest

Harvesting is the activity of collecting agricultural products. The right citrus harvesting activity is to use sharp harvest shears and leave 2-3 mm of fruit stalks to avoid damage. Oranges that are harvested by hand
(not using harvesting shears) can cause the skin on the stem to peel off so that the fruit is easily infected with fungus and rot. Harvesting oranges should be done in the morning before sunrise, because fruits that are exposed to sunlight will experience shrinkage of orange juice and accelerate the process of evaporation of citrus fruits (Sundari & Utami, 2012) (Sutopo, 2013) explains the flow of handling citrus harvests in order to produce high-quality oranges, namely:

1. Harvesting oranges is done when the oranges are perfectly ripe with the criteria that if you press it not too hard, the bottom of the fruit feels soft and if you click your finger it doesn't make a loud sound.
   Fruit stalks that are too long will injure other citrus fruits so they must be cut, leaving about 2 mm from the fruit.
2. Harvesting fruit on tall trees must use a ladder, so that branches and twigs are not damaged.
3. The citrus fruit container is made of soft material (e.g., plastic crates), clean, and the fruit is placed slowly.
   This is done to prevent the oranges from becoming deformed due to the hard container.
4. Avoid harvesting fruit by climbing trees, because dirty feet can spread disease on trees.

The results showed that oranges were harvested carefully and stored at room temperature of 23-31°C for 3 weeks the number of rotten fruit reached 7%. If the fruit is picked wet, then the number of rotten fruit is 21%. When the fruit is picked too ripe (it is characterized by the fact that when the fruit is touched, it is easily detached from the stalk), the number of rotten fruit reaches 29%. Fruit exposed to sunlight for one day, the number of rotten fruit is 38% (Jemadi dan Siti, 2011)

B. Post-harvest
Post-harvest is an activity carried out by producers to maintain fruit quality. These activities include washing, sorting, degreening, packaging, and storage. Post-harvest activities that are not carried out properly can cause yield loss of 2-10% (Saputra, 2019).

1. Washing
Washing citrus fruits can improve the appearance of the fruit so that it becomes cleaner, brighter, suppresses weight loss and mechanical damage. Orange cleaning can be done in two ways. The first way is to use clean running water and wipe with a clean and soft cloth, then dry it in a shady place. The second method is that the fruit is soaked in water mixed with 0.5-1% cleaning fluid, then rubbed slowly using a soft cloth, then rinsed with clean water and dried (Suratiyah, 2015).

2. Sorting
Sorting is one of a series of post-harvest activities carried out with the aim of separating fruit that is suitable for marketing and not suitable for marketing. Sorting is also done to meet the quality requirements set by the Indonesian National Standard (SNI) and the government (Jemadi dan Siti, 2011).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Super Quality</th>
<th>Quality A</th>
<th>Quality B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similarity of varietal traits</td>
<td>Uniform</td>
<td>Uniform</td>
<td>Not uniform</td>
</tr>
<tr>
<td>Fruit color</td>
<td>Even yellow</td>
<td>Even yellow</td>
<td>Greenish yellow</td>
</tr>
<tr>
<td>Fruit size</td>
<td>Uniform</td>
<td>Uniform</td>
<td>Not uniform</td>
</tr>
<tr>
<td>Fruit color</td>
<td>Even yellow</td>
<td>Even yellow</td>
<td>Greenish yellow</td>
</tr>
<tr>
<td>Max damage (number/number) (%)</td>
<td>5</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Dirt</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
</tr>
</tbody>
</table>

1. Yellowing of fruit (Degreening)
In the lowlands and tropical climates, some varieties of citrus fruits do not have a perfect yellow color. It is necessary to do quality control to make the skin color of sweet oranges more attractive without changing the taste of sweet oranges. Fruit yellowing (degreening) is a treatment with the addition of ethylene so that
the chlorophyll/green substance is damaged and citrus fruits appear yellowish or orange. The substance used is ethrel. This is done to attract consumers’ interest and increase competitiveness with imported oranges, because consumers like the yellowish or orange skin color of citrus fruits. Yellowing of fruit (degreening) is carried out when harvested and will be stored in cool storage (Balijestro, 2014b).

2. Candles

The wax coating on the fruit serves to replace and add to the waxy coating found on the fruit which is mostly lost during handling. The waxy coating on the fruit can suppress respiration and transpiration so that the fruit has a longer shelf life and a better selling value. Another benefit of wax is that it increases luster and covers cuts or scrapes on the surface of the fruit skin so that it looks better.

The wax used can come from plants, animals, minerals and synthetics, for example beeswax, paraffin wax, carnauba wax and shellac. The wax that is often used is beeswax which is emulsified with a concentration of 4-12%. Wax application can be done by spraying, smearing, or dipping (Sutopo, 2013).

3. Packaging

Fruit packaging aims to protect fruit from injury, facilitate management (storage, transport, distribution), maintain quality, facilitate special treatment, and provide aesthetics that attract consumers. Oranges that will be sent out of town are packed in wooden crates or plastic crates. The maximum weight of each crate should not exceed 30 kg (Balijestro, 2019).

4. Storage

Citrus fruit storage aims to accommodate an abundant harvest and provide citrus fruit throughout the year. The principle of storage treatment is to control the rate of respiration and transpiration, control or prevent diseases and changes that are not desired by consumers. Storage in a cold room by reducing respiratory and metabolic activity, softening, water loss, wilting of fruit, and damage due to microbial activity. Stored oranges are free from skin abrasions, bruises, and rot. This is because if one of the rotten oranges is stored with other oranges, it will make the other oranges rotten (Bulanta, 2019).

The optimum temperature for storage of citrus fruits is 5º - 10º, if the temperature is too low it can cause chilling injury. Storage in low humidity will wilt or shrivel and if it is too high it will stimulate the spoilage process, especially if there are variations in room temperature. A relative humidity of 85-90% is required to avoid wilting of citrus fruits. The right humidity will ensure the safety level of stored oranges against microbial growth (Setyawati & Wibowo, 2019).

CONCLUSION

The conclusion obtained is that the activities of managing and procuring production inputs for sweet orange agribusiness are realized in Balijestro with a literature study on sweet orange cultivation and leaf pruning on citrus seeds. The activities of managing the production process of the sweet orange agribusiness business are realized in Balijestro starting from the maintenance of citrus plants including the installation of mulch on citrus seed mounds, pruning of twigs on citrus plants, and thinning of citrus fruit plants. Other activities include planting beets and head lettuce.

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