Commercialization of Organic Green House on Featured Melon Commodities as an Increase in National Horticultural Productivity Commercial Organic Green House on Melon Commodity

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Abstract. There was a decrease in melon production as shown by data on several commodities, especially melons and some vegetables from agricultural lands under the Gapoktan partnership, it was reported that almost 60% experienced crop failure due to extreme weather and also the presence of pests that reduced the quality of production. If this problem is not addressed, it will cause huge losses in the future, problems in agricultural land due to extreme weather at the end of each year will reduce crop yields. The long-term problem that will occur if this problem continues is a decrease in labor absorption, even though the absorption of labor in the agribusiness sector, especially horticultural vegetables, contributes quite a lot to the workforce in the village. Based on these problems, the research team from the State University of Malang initiated a sustainable solution to overcome this integrated problem through the development of organic green houses on commercial melon commodities as an effort to increase national horticultural productivity by collaborating with education and assistance in the form of organic green houses for Gapoktan Berlian Nusantara Farm. Organic green house is an agricultural processing technology through a closed space that can prevent the entry of pests and protect melon plants from extreme weather in collaboration with solutions to improve agricultural land conditions through the application of the results of the development of Standard Operating Procedures for organic farming on melons, as well as the use of MOLP (*Moringa oleifera* Leaf Powder) as a nutrient for biofertilizer fertilizer that helps in fulfilling melon plant nutrition.

Keywords: Melon · Organic · Green House · MOLP

1 Introduction

The export value of melons in 2019 reached US$ 26,438 with export destination countries such as Singapore, Malaysia, Brunei Darussalam, Timor Leste, Hong Kong, Saudi Arabia

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[1]. This figure has increased in 2020 to reach US$ 76,387 with the same destination countries as the previous year [2]. The island of Java, which is the center of melon production, contributes greatly to the production activities of the region as a whole. In 2019 melon production decreased to 12.99 tons/ha in East Java [3]. In 2021, tens of hectares of melon plants in Magetan Regency experienced crop failure due to the intensity of rain that fell every month reaching 105–557 [4, 5]. Melon fruit quality and fruit selling value also decreased due to anthracnose and fruit fly attacks [6, 7]. The occurrence of crop failure can be influenced by the intensity of sunlight, temperature, nutrients, climate change, [8, 9]. One alternative solution used to control microclimate conditions in plants is greenhouse technology [10]. The use of greenhouses in melon cultivation aims to protect plants during the rainy season, control nutrients and improve production quality [11].

Planting media that are often used in melon cultivation are sand, manure and cocopeat in polybags [12]. Media such as cocopeat contains many essential elements such as calcium, magnesium and potassium, while sand media contains organic C [12, 13]. However, the need for nutrients from the growing media is not sufficient to meet the needs of the plant as a whole. Generally, chemical fertilizers are used to increase the content of macronutrients in the soil [14]. The use of chemical fertilizers can cause several impacts, namely nitrate pollution, structural changes and soil compaction [12, 15]. This side effect can be overcome by using organic fertilizers to restore soil structure and properties [16].

Based on these problems, in the previous year researchers have conducted research on the use of Moringa leaf-based organic fertilizer with horticultural commodities through the funding program of the Center for Intellectual Property Rights Scheme PNBP State University of Malang, with research based on smart farming collaboration with experimental method research results resulting in increased plant productivity. 400% of the results in the conventional way, this research has registered 2 product patents on smart farming and organic moringa fertilizer processing, and produced an ISBN book, and was published in the Scopus indexed proceedings. The previous year, the researcher also conducted a research collaboration with PT Anak Indonesia Mendunia with Gapoktan Berlian Nusantara with funding from the company to conduct organic green house research on melon plants with an increase in production yields in quantity reaching a 200% increase from the usual method and being able to improve the quality of crop yields by increased 4x longer shelf life after harvest.

Based on this, the research team initiated the Commercialization of Organic Green House on Superior Melon Commodities as an Increase in National Horticultural Productivity. The purpose of this research is to increase the commercialization value of plants with a large market potential, and to make this program one of the goals of generating higher education income. The urgency of this research is to increase the productivity of melons in terms of quality and quantity and to increase the market value of this horticultural crop, in addition to meeting market needs that are still over-demand are of special importance before being taken by the import market.

2 Literature Review

2.1 Cultivation of Conventional Melon Plants

Cultivating melons conventionally or in large areas requires going through many stages, such as the process of preparing the land, applying basic fertilizer, installing plastic mulch, preparing high-yielding melon seeds, planting, fertilizing, irrigation and harvesting [17]. Melon plants also need quite a lot of water from irrigation canals and not rainwater [17]. The growth of melon plants in the lowlands which have a high average daily temperature can produce melons with high characteristic quality and taste [18].

The conditions for growing melons are cool and dry temperatures between 25-30 °C and not less than 18 °C with a soil pH of around 5.8–7.2 [12]. Continuous rain can abort fruit candidates that have been formed, can form favorable environmental conditions for pathogens and can reduce sugar levels in fruit when the plants are approaching harvest. In addition, melon plants also require full sun exposure during their growth.

Disease attacks on melons on conventional land will increase during high rainfall such as wilt disease. High rainfall also affects the process of pollination of flowers, fruit ripening and causes fruit rot, thereby damaging fruit quality [19]. Drastic climate change will cause melon production to decrease. In addition, conditions of high rain intensity also cause erratic planting and harvesting seasons [9]. The result is plant damage and flower fall which affects the productivity of melon plants and reduces the selling value of the melons themselves, especially in several central areas such as Central Java, West Java, DI Yogyakarta, Bali and East Java [20, 21].

2.2 Melon Plant Cultivation with Greenhouse

Greenhouses are generally used in the cultivation of horticultural crops such as vegetables and ornamental plants. Construction buildings with translucent roofs that function to regulate incoming solar radiation, and manipulate environmental conditions such as air temperature, air circulation and watering duration [22, 23]. The use of greenhouses can provide many advantages for plant cultivation, which can protect and control temperatures by using natural and controlled ventilation covered with screens (nets) that can reduce insect and pest attacks [22].

In addition, the production of horticultural crops in greenhouses can be carried out throughout the year so as to avoid the potential for rain which often causes excess water and the risk of fluctuating temperature and humidity changes and failure of the flower pollination process [24]. The production of melon plants carried out in greenhouses is known to increase the optimization of the number of fruits with an average weight of 2.5 kg-3 kg per plant and with the number of fruits per plant reaching 1–2 fruits [25].

2.3 Use of Polybags in Melon Cultivation

The concept of planting in polybags allows the volume of growing media to limit plants in absorbing water and nutrients so they don't overdo it [26]. The use of polybags is considered more efficient because of the small volume of media [27]. Polybags have

advantages such as being waterproof, lightweight and relatively inexpensive, making them easily affordable by all groups of people [28].

Several studies on the yield of horticultural crops such as tomatoes show that polybags have a significant effect on soil temperature and an increase in plant size. The use of polybags can also increase the amount of fruit that grows, where the number of fruits from plants planted in the size of the polybag is the most [29]. In melon plants, the combination of polybags and organic fertilizers can increase fruit weight, length and diameter with more controlled nutrient levels [28].

2.4 Organic Fertilizer in Melon Cultivation

Organic fertilizers are fertilizers derived from organic matter which are broken down by microbes, so that the end result can provide the nutrients needed by plants. Types of organic fertilizers include manure, rice husk, compost and several other organic materials [30]. Organic fertilizers affect soil physical properties by improving soil structure, increasing water holding capacity, improving soil aeration and helping to stimulate root growth [16]. In addition, organic fertilizers can also help increase nutrient content and increase phosphorus solubility [16, 31]. The use of organic fertilizers also increases the activity of soil microorganisms [32].

Conventional organic fertilizers that are easy to find and commonly used are manure which has the advantage of helping neutralize soil pH, loosening the soil, increasing water availability, and helping nutrient absorption [31]. It is known that this can be maximized by using cocopeat growing media, cocopeat growing media which contains high levels of nitrogen and potassium [13]. Application of manure to horticultural crops such as caisin, lettuce, and pakcoy produced in greenhouses is known to increase the number of leaves, stem weight, root weight and plant root length [33]. In addition, applying organic fertilizer to melon plants can also increase fruit weight and fruit circumference and accelerate flowering [34].

2.5 Use of Moringa Plants as Organic Fertilizer

Moringa (Moringa oleifera) contains compounds of Calcium (Ca), Magnesium (Mg), Phosphorus (P), Iron and Sulfur, so that the Moringa plant can be used in the manufacture of liquid organic fertilizer. The use of moringa fertilizer is proven to accelerate plant growth due to the presence of cytokinin compounds in it [35, 36]. Moringa leaves contain various kinds of amino acid compounds in the form of aspartic acid, glutamic acid, alanine, leucine, isoleucine, valine, histidine, lysine, arginine, phenylalanine, tryptophan, cysteine and methionine [37].

The use of liquid organic fertilizer (POC) from moringa leaves on horticultural crops such as pakcoy and mustard greens with a POC content of as much as 40% can increase the number of leaves, plant length, wet weight and dry weight [38, 39]. In addition, in research conducted by previous researchers, it was found that the use of Moringa foliar fertilizers can increase the content of K and Ca with a percentage of 58.7% and 34.6%.

2.6 Previous Research by Researchers

Researchers have carried out developments in various research schemes, the previous year they had carried out research development of moringa organic fertilizer on horticultural crops with smart farming and succeeded in increasing commodity productivity to reach 400% of commodities that did not use smart farming systems and organic fertilizers, through this research which was funded by PNBP program Competitive scheme Intellectual Property Center, State University of Malang. Researchers also continued this research in the previous year with a research and development collaboration with the company PT Anak Indonesia Mendunia by continuing the development of green houses as one of the smart farming implementations with yields that managed to increase the quantity by up to 2× and the quality based on the shelf life after harvest increased 4×, the research was funded by an R&D project jointly with the Farmer Group Association.

3 Method

The development and commercialization method used in this business is the business model canvas method [40], this business planning and implementation method is used because of its comprehensive nature in business planning needs and can be used flexibly because of its sustainable business planning nature [41]. The stages of business development based on the business model canvas are as follows:

3.1 Value Propositions

At this stage the company can determine the development of the service to be provided, the product to be provided to the customer later to the development of quality and product differentiation which is determined from the value developed by the company [42].

3.2 Customer Segments

At this stage the commercialization development team mapping potential customers from the values that have been formed in business products and their differentiation, the stages in this program are segmenting, targeting, positioning with the business to business system method developed in agriculture [42].

3.3 Key Activities

At this stage the team plans, maps, and implements key business activities, such as green house production, planting, partnerships, to product marketing, so that the value offered in stage 1 can be realized and achieved [43].

3.4 Key Resources

This stage is also carried out to support the company's main activities, at this stage business development has also carried out production procurement, procurement of the planting process to product care and harvesting, as well as total quality management so that maximum market penetration can be carried out according to market needs [42].

3.5 Customer Relationship

At this stage the company from the research team will map out strategies to maintain communication with customers, taking into account various aspects of the customer segment, at this stage the company will also develop marketing strategies to maintain customers, namely customer retention, customer pricing strategy, and how to reach customers [43].

3.6 Channels

At this stage the company will reach out to customers by determining the marketing methods to be used and marketing strategies. The marketing strategy used is Business to Business, where the strategy used is b2b strategy.

At this stage there are 4 core stages, namely analysis of business partner problems, exploration of business partner solutions, requirements building for business and sales partners and supplier selection. The business strategy used is the sale of crops to the industry to meet market needs [44].

3.7 Key Partner

At this stage, researchers develop partnerships that are carried out to increase the value propositions that have been carried out, key partners are usually in the form of implementing partnerships for the marketing, production, and long-term sustainability processes in the form of research and development [45].

3.8 Cost Structure

At this stage the company will carry out capital budgeting for the production, marketing, and business continuity processes. At this stage, the allocation of funds is carried out for the company's business operational processes and the planned development of commercialization [45].

3.9 Revenue Stream

At this stage the application of the results of business planning and business execution is determined from the business model that is run at the company through the customer stage segment and value proposition, so as to form a growing and sustainable business through a clear and sustainable revenue system as well [45].

4 Result and Discussion

This time the experiment was using an organic greenhouse made of real bamboo from the forest or local people's land of ori and petung bamboo varieties to support the robustness of the greenhouse for a period of 5 years. The profit projection for the first year is allocated 60% of the return on investment and 40% of it for subsequent investment. Prior to the

Fig. 1. Melon Planting Source: Research Document

experiment using a greenhouse, the author had planted in open land and the threat of failure was enormous, especially for planting in the fruit sector such as melons and horticultural vegetables such as tomatoes, chilies, and vegetables (Fig. 1).

Making Organic Greenhouse with Gapoktan Berlian Nusantara Farm farmers. The briefing is carried out thoroughly to Gapoktan members who are counted as participants in community service activities. Research members provide planting samples on melon inthanon consisting of; selection of superior seeds, seeding, manufacture of planting media, greenhouse arrangement and also watering methods. Not only that, the researchers also provide a methodology for making organic fertilizers, considering that the use of chemical fertilizers should not be used as much as 100%, but must be balanced with the use of organic fertilizers that are more environmentally friendly.

The treatment is also directed by the committee, starting at 3 hst, 6 hst, and so on until the harvest period. The concentration of organic fertilizer application is 50% [46]. Regarding post-harvest, the research team also provides sales strategies and land management. Yields after the use of greenhouses in the planting strategy have been shown to produce good yields. In the 700 m2 greenhouse area, there are 700 polybags where each polybag contains 2 melon plants. Planting is able to produce an average of 1.5 kg of fruit, so that in one polybag it reaches a weight of 3 kg of melons, and a total harvest weight of 2100 kg. If the yield is multiplied by the partner company that supplies the crop with the lowest price (Rp 13,000.00/kg), then the result is Rp. 27,300,000.00 in the first harvest. 7 million is allocated for further investment and 20 million for saving the return on investment earlier. This is done repeatedly until the greenhouse is 5 years old, if the foundation has weathered then it is time to rebuild again.

Greenhouses are generally used in the cultivation of horticultural crops such as vegetables and ornamental plants. Construction buildings with translucent roofs that function to regulate incoming solar radiation, and engineer environmental conditions such as air temperature, air circulation and duration of watering [22, 47]. The use of a greenhouse can provide many advantages for plant cultivation, which can protect and control the temperature by using natural and controlled ventilation with a coated screen (mesh) which can reduce insect and pest attacks [22] (Fig. 2).

Fig. 2. Melon Harvesting

In addition, the production of horticultural crops in greenhouses can be carried out throughout the year so as to avoid the potential for rain which often causes excess water and risk of fluctuating temperature and humidity changes and failure of flower pollination [10]. Melon production carried out in a greenhouse is known to increase the optimization of the number of fruits with an average weight of 2.5 kg-3 kg per plant and with the number of fruits per plant reaching 1–2 pieces [48].

The concept of planting in polybags allows the volume of planting media to limit plants in absorbing water and nutrients so that they are not excessive [12]. The use of polybags is considered more efficient because of the small volume of media [13]. Polybags have advantages, among others, water resistance, light weight and relatively cheap price, so they are easily affordable by all people [14].

Several studies on yields of horticultural crops such as tomatoes showed that polybags had a significant effect on soil temperature and increased plant size. The use of polybags can also increase the number of fruits that grow, where the number of fruits from plants grown in the size of the polybag is the most [13]. In melon plants, the combination of polybags and organic fertilizers can increase the weight, length and diameter of the fruit with more controlled nutrient levels [12].

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weight and plant root length [18]. In addition, the application of organic fertilizer to melon plants can also increase fruit weight and fruit circumference and accelerate flowering [19].

5 Conclusion

This research was carried out with partners of Gapoktan Berlian Nusantara Farm and carried out according to the objectives, namely the establishment of an organic greenhouse and the use of organic fertilizers in its cultivation. The method applied is able to increase crop yields and the quality of post-harvest media is still feasible because it is not dominantly using chemical fertilizers. The provision of materials and practices includes the basic process of land management or planting media. Then a specific planting pattern or technique is given to the choice of plants to be planted. Researchers provide planting samples on melon inthanon consisting of; selection of superior seeds, seeding, manufacture of planting media, greenhouse arrangement and also watering methods. Not only that, the committee also provides a methodology for making organic fertilizer every 3 days after planting, 6 days after planting, 9 days after planting, and so on until harvest. Yields showed a significant increase from trial planting in open land. The distribution of the harvest results is also assisted to the company (buyer) receiving the harvest. Sustainable value is also achieved by using organic greenhouses which are more environmentally friendly and also more affordable. The greenhouse will last for a period of 5 years so that after harvesting to fulfill the return on investment, partners will then reap a net profit.

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