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RISK ANALYSIS OF HYDROPONIC SPINACH PRODUCTION AT SERUA FARM DEPOK CITY

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ABSTRACT

In this study, the causes and impacts of the risks caused will be identified, as well as determining the causes of risks that must be given preventive action first to control the risk of hydroponic spinach production at Serua *Farm*. The study was conducted by identifying the causes of risk using the *Fish Bone* diagram by detailing the causes of failure and the consequences of risk based on the source of production risk. The risk analysis uses *the House of Risk Phase* 1 and 2 methods, as well as the Pareto diagram to map the causative agents of risk that should be given a preventive strategy first. The risks of hydroponic spinach production faced by Serua Farm are grouped into 23 risk causes and 22 risk events. The results of the risk mapping that occurred in hydroponic spinach production at Serua Farm obtained a total of 12 risk causes that were priorities to be used as risk management and based on the Pareto mapping, 18 preventive risk prevention strategies were obtained to avoid these risks from happening again.

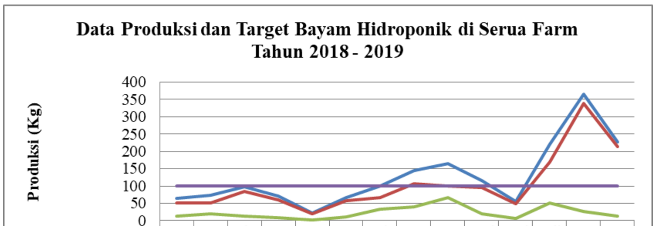
Keywords: *Hydroponics, Risk, House of Risk, Fishbone, Preventive Strategy*

INTRODUCTION

Spinach is one of the reliable vegetable commodities to meet the needs of vitamins and minerals it is relatively easy and cheap. Spinach is known as one of the highly nutritious vegetables and is loved by almost all levels of society in Indonesia. In some developing countries, spinach is used as a source of vegetable protein because it has a dual function, namely meeting nutritional needs and public health services so that consumer demand for spinach is always there. Therefore, spinach-producing companies continue to produce continuously so that the supply of spinach remains available.

In its production, spinach can be cultivated conventionally, namely through a cultivation system using soil media as a growing medium and cultivation without soil media such as hydroponics, aquaponics, and aeroponics. Hydroponics is a farming system without the use of soil media (Paeru, 2018: 65). The hydroponic system can be one of the solutions for the development of vegetable crops with various advantages compared to conventional agricultural systems. The cultivation of spinach with hydroponics is more efficient in the use of water and soil than conventional agriculture to save production costs. In addition, plants take less time to grow compared to crops grown in the fields because there is no mechanical obstruction to the roots and all nutrients are readily available to the plants (Anonymous, 2017: 3). Some plants that are often grown hydroponically other than spinach include lettuce, chili, tomato, pakchoi, broccoli, mustard greens, kailan, kale, onion, strawbbery and so on.

Serua *Farm* is an agricultural company that uses hydroponic technology in running its business. Established on January 15, 2017, with an area of 1200 M^2. The Serua *Farm* Garden has a production shelf of 12500 planting holes, a juvenile shelf of 12500 planting holes, and a seedbed of 15000 plants. The company chooses hydroponics with the aim of reducing production costs, minimizing risk and optimization of production. The vegetables produced by Serua Farm are green spinach and red spinach.



	Ags	Sept	Okt	Nov	Des	Jan	Feb	Mar	Apr	Mei	Juni	Juli	Ags	Sept
Panen Total	64.7	72.6	97.8	70	21.4	67.4	100	145	165	115	56.3	221	365	227
Rijek	13.4	20.8	14.3	9.8	2.2	10.3	34.2	39	66.1	19.8	7.3	51.1	26.3	13.7
Panen Bersih	51.3	51.8	83.5	60.2	19.2	57.1	65.9	106	99.1	95.6	49	170	339	213
Target	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Figure 1. Spinach Production data and Targets at Serua Farm in 2018-2019
Source: Serua Farm Annual Report 2018-2019, data processed.

Hydroponic spinach production in August 2018 - September 2019 there were fluctuations in the amount of production produced. Based on Figure 1, the spinach production target set by the company is 100 kg per month. However, the number of net harvest production that can reach the target is only 4 months, namely March, July, August and September 2019, the rest are still unable to reach the target set by the company. Meanwhile, the amount of consumer demand that enters every month can reach 300 kg of spinach.

The production of spinach produced by Serua *Farm* is always diverse and does not always reach the specified target and cannot meet the incoming consumer demand. The number of production failures or problems that occur is often caused by damage to hydroponic spinach products before the harvest period arrives, thereby reducing the number of net harvests produced. This causes losses to the company becauseit cannot meet consumer demand.

In this study, the study focused on the analysis of production risks. Production risk has an impact on crop failure or a decrease in the amount of harvest from the expected yield. The non-diverse production of hydroponic spinach due to production failures can be reduced or minimized by knowing the source and causes of risks during the process of planting, maintenance, harvesting and packaging. Based on the description, it is necessary to conduct research with the research title "Risk Analysis of Hydroponic Spinach Production in Serua Farm, Depok City".

RESEARCH METHODOLOGY

Data collection in this study used interview methods, questionnaires, observations, and literature studies. Interviews were conducted systematically with informants related to hydroponic spinach production where there were 4 speakers,

Agribusiness Journal

namely Charlie Tjendapati as the head of the garden, Een Jaenah as the person in charge of seeding, Rafika Putri Wulandari as the person in charge of the screen house, and Dian Ardiansyah as the person in charge of production. The analysis methods used in this study are *fishbone* diagrams, *House of Risk* (HOR) phases 1 and 2 and Pareto diagrams. In this study, the causes and impacts of the risks caused will be identified, and the determination of the causes of risks that must be given preventive action first.

RESULTS AND DISCUSSION

Risk identification is the first step to analyzing the risks that will occur. Risk identification is carried out using a *fish* bone diagram as shown in Figure 2.

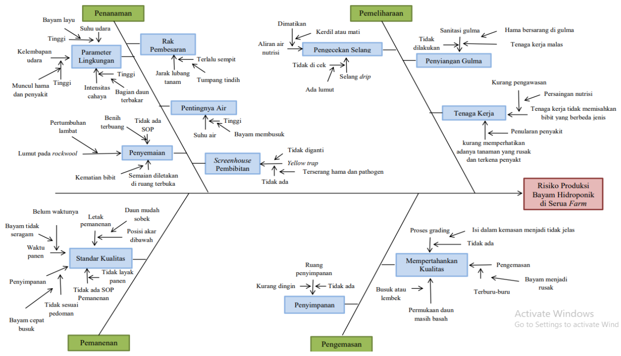


Figure 2. Identification of Risk Sources with *the Fish Bone* Method in Hydroponic Spinach Production at Serua Farm in 2019

Based on the risk events carried out by the *fish bone* method in each hydroponic spinach production process, the critical point of each process is known. The critical point of each process is that there are 22 risk events or *Risk Events* (E1), namely 9 in the planting process, 5 in the maintenance process, 4 in the harvesting process, and 4 in the packaging process. In addition, there are 23 risk causes, including 9 risk causes in the planting process, and 5 risk causes in the maintenance process, 4 risk causes in the harvesting process, 5 risk causes in the packaging process.

The risk event is carried out as a measure of the risk of spinach production at Serua *Farm* to determine the level of impact of the risk event or *severity* (Si) caused by a risk event for the continuation of the company's business processes. The highest severity value means that it has a big impact on the company, namely 4.00 – 5.00, the medium severity value means that it has a not-so-big impact on the company, namely 2.67 – 3.67, while the lowest severity value means it has a small impact on the company, namely 1.00 – 2.33.

After providing *a severity* value on each risk event, a risk event that has a major impact on the company is obtained in each sub-variable of production activities and can be seen in Table 1 below this.

Table 1. Results of Measuring the Level of Impact of Risk Events on the Hydroponic Spinach Production Process at Serua *Farm*

Code	Risk Event	Yes
E9	The growth of seedlings becomes slow	4.25
E12	Pests and diseases nesting in weeds	4.50
E16	Spinach is not worth harvesting will affect other spinach when packaged	4.25

Code	Risk Event	Yes
E21	Spinach becomes perishable/mushy	3.00

Source: Data In process.

The next stage is to determine which sources of risk are the priority to be given preventive actions. After the ARP value is known, mapping can be done by making a Pareto diagram. The Pareto diagram is obtained from the ARP value that has been obtained previously and then sorted from the largest to the smallest, then calculated cumulative presentation.

The results of the mapping of the manana process can be seen in Figure 3 which shows that there are 5 risk causative agents with the highest ARP value and a cumulative percentage of less than 80% which are the priority for countermeasures to be handled risk, namely, 1) the air temperature exceeds 30 ° C with an ARP value of 445.31 and a cumulative ARP of 19%, 2) the water temperature exceeds 25 ° C with an ARP value of 406.88 and a cumulative ARP of 36%, 3) the absence of a written seeding SOP with an ARP value of 351.00 and a cumulative ARP of 51%, 4) the distance between planting holes is less than 15 cm with an ARP value of 253.00 and a cumulative ARP of 61%, and 5) the growth of moss in Rockwool with an ARP value of 241.50 and a cumulative ARP of 71%.

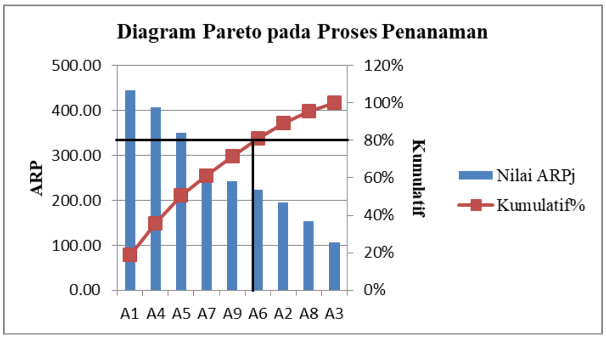


Figure 3. Pareto Diagram on the Planting Process
Source: Data In process.

The results of the mapping of the maintenance process can be seen in Figure 4 which shows that there are 2 risk causative agents with the highest ARP value and a cumulative percentage of less than 80% which are the priority of countermeasures to be used for risk management, namely, 1) the workforce pays little attention to the presence of damaged or diseased plants with an ARP value of 378.00 and a cumulative ARP of 38%, and 2) the workforce does not control the drip hose so that there is moss with an ARP value of 293.44 and a cumulative ARP of 68%.

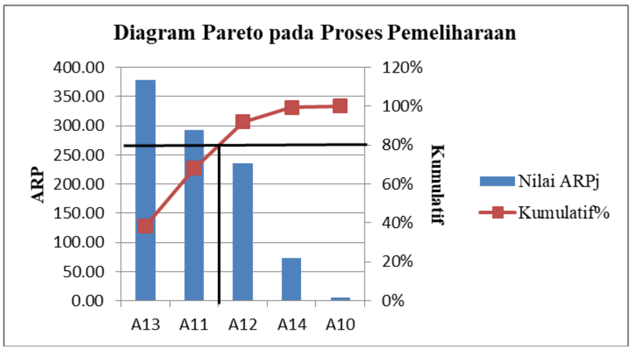


Figure 4. Pareto Diagram on maintenance process
Source: Data In process.

The results of the mapping of the harvesting process can be seen in Figure 5 which shows that there are 2 risk causative agents with the highest ARP value and a cumulative percentage of less than 80% which are the priority for countermeasures to be handled risks, namely, 1) the absence of written SOPs in determining the quality of spinach with an ARP value of 219.38 and cumulative ARP of 49% and 2) the age of spinach harvested before harvest time with an ARP value of 119. 25 and cumulative ARP of 76%.

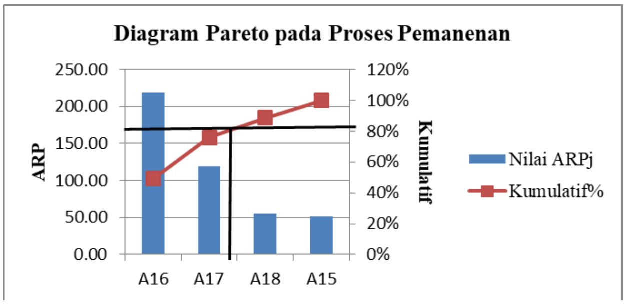


Figure 5. Pareto Diagram on the Harvesting Process
Source: Data In process.

The results of the mapping of the packaging process can be seen in Figure 6 which shows that there are 3 risk causative agents with the highest ARP value and a cumulative percentage of less than 80% which are the priority for countermeasures to be handled risk, namely, 1) there is no SOP for packaging spinach with an ARP value of 329.06 and cumulative ARP of 31%, 2) negligent labor in packaging with an ARP value of 285.19 and cumulative ARP of 57%, and 3) the surface of spinach leaves and stems are still wet with an ARP value of 244.13 and a cumulative ARP of 80%.

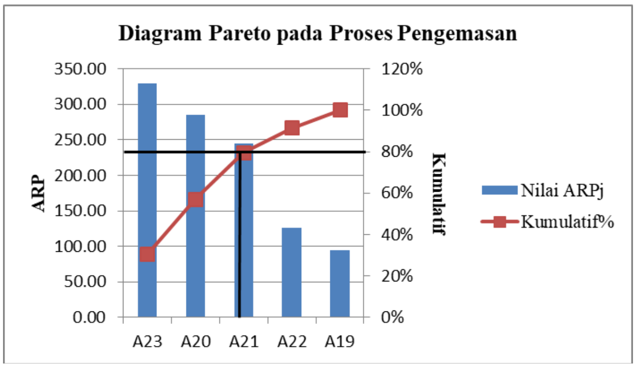


Figure 6. Pareto Diagram on the Packaging Process
Source: Data In process.

Based on the results of risk mapping in the entire production process at Serua Farm including the process of planting, maintenance, harvesting, and packaging, it produces risk agents that are a priority to be handled with risk prevention strategies. The prioritized risk agent can be used as a reference to determine the handling strategy to prevent the causes of risks that will reappear. Then these strategies are re-measured to find out what preventive strategy action priorities should be carried out first by the company. Based on the results of the calculation of the effective value of the degree of difficulty of each risk prevention strategy. The action of this preventive strategy aims to find out the sequencing of strategies that have important priorities in dealing with existing risks.

The order of priority for implementing preventive strategies for handling risks in the planting process is as follows: 1) Regular checking of water temperature and water nutrient content; 2) Making written SOP on planting; 3) Making jadwal the right planting pattern; 4) Providing blowers or fans on the screen house; 5) Routine roll supervision of workers; 6) Changing the distance between planting holes on the production shelf; 7) Calculating the number of spinach green to be sown.

The order of priority for implementing preventive strategies for handling risks in the maintenance process is as follows: 1) Regular checking of drip hoses so that they are not clogged with moss or leaves; 2) Cleaning and maintaining the production tools used; 3) Providing written jobdesc which is clear; 4) Regular pesticide on sprayers. The order of priority for implementing preventive strategies for handling risks in the harvesting process is as follows: 1) Make written SOPs for the quality of spinach ready /worthy of harvest and the harvesting process and 2) Make the right planting pattern.

The order of priority for implementing preventive strategies for handling risks in the grazing process is as follows: 1) Make a written SOP for bayam packaging; 2) Conduct a routine evaluation of each stage of production activities; 3) Supervisean by the head of the garden; 4) Place the harvested spinach into the faucet with uniform position; 5) Re-tata relocation of the packaging room.

CONCLUSIONS AND SUGGESTIONS

Based on the results and discussion of the study, it can be concluded that (1) There are 23 risk causes (*Risk Agents*) in the entire hydroponic spinach production process at Serua *Farm*, including 9 causes of risk in the planting process, 5 causes of risk in the maintenance process, 4 causes of risk in the harvesting process and 5 causes of risk in the packaging process. Meanwhile, risk events (*Risk Events*) in the production process totaled 22 events, namely 9 risk events in the planting process, 5 risk events in the maintenance process, 4 risk events in the harvesting process, and 4 risk events in the packaging process. (2) The results of risk measurement in the hydroponic spinach production process are indicated by the highest ARP value which means that it must be prioritized to be given a prevention strategy first. The highest ARP assessment in the planting process is the air temperature exceeding 30°C. Maintenance process is that labor pays little attention to the presence of damaged or diseased plants. There is a harvesting process which is the absence of written SOP in determining the quality of spinach. Packaging process is no SOP of spinach packaging. (3) The results of risk mapping that occur in hydroponic spinach production at Serua Farm obtained a total of 12 risk causes that are priorities to be used as risk management, including there, is a planting process have 5 priority risk causes, there is a maintenance process terdapat 2 priority risk causes, there is a have harvesting process 2 priority risk causes, and there is a packaging process there are 3 priority risk causes. (4) Based on Pareto mapping, which is a priority for risk management, 18 preventive risk prevention strategies were obtained to avoid these risks from happening again. A strategy that has the highest value means that it is considered the most effective and easy to implement. In the planting process there are 7 preventive strategies, pthere is a maintenance process there are 4 preventive strategies, there is a harvesting process there are 2 preventive strategies, and there is a packaging process there are 5 preventive strategies.

Based on the results and discussion of the study, it can be argued that (1) Serua *Farm* should make a written SOP related to hydroponic spinach production because the SOP will create a standard measure of performance for workers in completing their work and can reduce errors and omissions that may occur during the production process. (2) The owner should appoint one of the employees to perform the task of supervising the production of hydroponic spinach more strictly to the workers. (3) Further research can develop this research by conducting risk analysis using other methods and conducting risk analysis at the level of wider business actors both in terms of production and to the final consumers of hydroponic spinach products.

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