IDENTIFYING COFFEE NURSERY RISKS WITH GENERATIVE PROPAGATION TECHNIQUES

Annisa Ariestia[1], *Endang* Tri Astutiningsih, and *Neneng* Kartika Rini
[1] Department of Agribusiness, Faculty of Agriculture, University of Muhammadiyah Sukabumi, Indonesia

Abstract. Seedling is an important early phase in the coffee cultivation process, where the success of the nursery greatly determines the productivity of the coffee plant. High-quality seedlings are produced through optimal and minimal risk seeding stages. This study aims to identify various risks that arise at each stage of coffee breeding with generative propagation techniques. Identification is carried out starting from the seed seeding stage, planting in polybags, maintenance, to harvesting. Data was obtained through a questionnaire containing 39 risk statements, with an assessment of two aspects, namely possibility and impact. The method used in this study is quantitative descriptive by calculating the final risk score. The results of the study show that there is a high risk at the seeding stage, which includes poor quality coffee beans resulting in seeds being difficult to germinate in the seed seeding phase, seedlings attacked by pests and diseases in the planting phase in polybags, as well as extreme weather and excessive weed growth in the maintenance phase. With such conditions, it is hoped that the company can improve quality control, pest and disease prevention, as well as extreme weather and weed mitigation. In addition, this research can be a foundation for coffee nursery business actors to implement good risk management, so that the seeds produced have good quality.

Keywords: Risk; Coffee Nursery; Generative Propagation

1 Introduction

Seedling is an important stage in the production of coffee plants that directly affects long-term quality and productivity. Generative propagation of coffee plants using seeds as a source of planting material has advantages and disadvantages. The advantages are that the root system is strong and resistant to drought, [1]While the disadvantage is that it requires a relatively long germination time for the seeds, thus affecting the production of coffee plants [2]. Increasing crop productivity can be pursued through the provision of quality planting materials, as it plays an important role in the success of increasing plantation businesses [3].
In the process of cultivating coffee seeds, of course, it cannot be separated from various risks. Risk is a phenomenon that creates uncertainty whether an event will occur in a certain period of time and cause losses, where losses are a form of uncertainty that needs to be understood by the organization as part of the strategy and managed effectively so as to be able to optimize the achievement of an organization's goals [4].
Risk management is used to identify, classify, and manage risks that may occur in business activities. The goal is to reduce the likelihood of occurrence as well as the negative impact of adverse events on the organization [5].
Agricultural risk identification methods have been developed and applied in various studies. For example, in the study of kreshtanti (2022) [4] identify the risks of coffee farming using the HOR (Hazard and Operability Risk) approach. HOR is effective in systematically

[1] Email: annisaariestia060@ummi.ac.id

identifying potential hazards but has limitations in quantitatively measuring the level of risk. Compared to the HOR method, this study adopts a risk matrix approach to identify risks that combine two main aspects, namely likelihood and Consequence. The novelty of this research lies in the mapping of coffee nursery risks specifically at the stage of seed seeding, planting in polybags, maintenance, and harvesting. This structured identification is expected to help business actors understand risks more clearly and develop mitigation strategies based on the most dominant risk urgency.

2 Research method

This study uses a quantitative descriptive approach to identify and analyze risks in the production of coffee seeds by generative propagation techniques. Risk assessment was carried out using a likelihood and consequence matrix.

2.1 Population and Sampling

This research was conducted in the garden of PT Daya Merry Persada, Purabaya Village, Purabaya District, Sukabumi Regency, which is a business unit for cultivating coffee seeds using generative propagation techniques. The population in this study is all activities and elements involved in the production process of coffee seeds in the company, starting from the seed seeding stage, planting in polybags, maintenance, to harvesting. To obtain relevant data, samples were selected purposively by considering parties who have direct knowledge and experience related to the coffee seed cultivation process and its potential risks. Purposive sampling is a method for selecting samples with certain criteria and considered appropriate by the researcher [6].
The sample in this study includes technical experts, field supervisors, and nursery farmers who play a direct role in daily operations. Sorting is carried out based on active involvement in production activities as well as an understanding of the risks that may arise.

2.2 Measurement and Data Collection

The data in this study was collected through field observation methods, structured interviews using questionnaires that assessed two main aspects, namely likelihood and consequence assessment. Risk assessment with likelihood and consequence is used to identify opportunities for risks that can occur in the coffee nursery process. Likelihood describes the degree of likelihood that a risk will occur, while consequence describes the severity of the impact that would be caused if the risk actually occurred [7]. The value of likelihood and consequence will be used to determine the risk rating or risk level [7]. Then the risk rating can be used to determine the level of risk using a risk matrix, with the classification of risks into very high, high, medium, and low categories [8].

2.3 Variable and Data Analysis

The analysis in this study is focused on the risk variables identified in the coffee seed production process, including the stages of seed seeding, planting in polybags, maintenance, and harvesting. Each identified risk was analyzed based on two main aspects, namely likelihood and consequence, which had been scored by respondents. The following are the steps in assessing the risk score using the likelihood and consequence risk matrix method:

a. Determine the likelihood and consequence risk matrix criteria.

Table 1. Likelihood and Consequence Criteria

Level	Criterion	Description
Likelihood		
1	Not Happening	Risk almost never occurs
2	Rare	Rare risks
3	Sometimes It Happens	Risks sometimes occur
4	Frequent Occurrences	Frequent risks
5	Always Happens	Risk is always present
Consequence		
1	Very Low	Risk of not interfering with the production process of coffee seeds
2	Low	The risk of slightly hindering the production process of coffee seeds
3	Keep	Risk of hindering the production process of coffee seeds
4	Tall	Risk of disrupting the coffee seed production process
5	Very High	The risk greatly interferes with the production process of coffee seeds

b. Multiply the likelihood and consequence values so that the risk level of danger is obtained in the risk matrix.

Tabel 2. Risk Matrix

Levels	Risk Level	Amount of Risk	Color
1	Very Low (VL	1 – 5	
2	Low (L)	6 – 10	
3	Medium (M)	11 – 15	
4	Height (H)	16- 20	
5	Very High (VH)	21 – 25	

Table 3. Risk Mapping

Likelihood	**Consequence**				
Label	**1**	**2**	**3**	**4**	**5**
5	5	10	15	20	25

4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

From the risk matrix, the risk score and priority can then be calculated to carry out corrective actions or evaluations. Here's the formula for calculating a risk score:

$$\text{Risk score} = \text{Likelihood (L)} \times \text{Consequence (C)}$$

3 Results and discussion

The first step in identifying risk is to understand the meaning of risk itself, namely the possibility of an event that can hinder the goal. This process is carried out systematically and continuously to find potential losses that have an impact on activities. The main focus is to identify important risks, so that they can be addressed from the planning stage to implementation [9].

Table 4. Identify Risks

Risk Categories	Code	Risk
Seed Sowing	R1	Low-quality coffee beans
	R2	Less than optimal seed selection
	R3	The condition of the land does not meet the set criteria
	R4	Coffee beans are affected by diseases (bacteria, fungi, and viruses)
	R5	Biij germination failure due to too long soaking
	R6	Incorrect or deep seed planting
	R7	Damage to planting media due to less loose soil
	R8	Planting media has an unbalanced moisture content
	R9	Weather conditions do not support the seeding process
	R10	Workers do not know the SOP or are negligent during sowing
	R11	Inadequate or damaged seedling equipment
Planting in polybags	R12	Seedlings grow slowly because the planting is too deep.
	R13	Pests and diseases attack coffee seedlings
	R14	Unsuitable environmental conditions cause seedling growth to be inhibited.
	R15	Irregular watering results in slow seedling growth

	R16	Too close a distance between polybags results in stunted growth
	R17	Unbalanced composition of planting media
	R18	Workers do not know the SOP or are negligent during planting in polybags
	R19	Equipment in the planting process is damaged or inadequate
Maintenance	R20	Root rot due to overwatering
	R21	Seedlings wither due to dry planting medium
	R22	Yellowing of the leaves due to excessive light intensity (>30%)
	R23	Seedlings become dwarfed due to lack of light intensity (<30%)
	R24	Excessive weed growth in the nursery area
	R25	Improper fertilizer or drug administration techniques
	R26	Leaf and stem damage due to pest and disease attacks
	R27	Extreme weather conditions that interfere with maintenance
	R28	Delays in maintenance
	R29	Workers do not know the SOP or are negligent during maintenance
	R30	Inadequate or damaged maintenance tools
Harvesting	R31	Misidentification of seedling quality during inspection
	R32	Errors in packaging
	R33	Mislabeling of seed information
	R34	Damaged seedlings due to improper accumulation or placement
	R35	Leaf and stem damage caused by pest and disease attacks at harvest time
	R36	Extreme weather conditions disrupt the harvest stage
	R37	Late harvest time or demand delay
	R38	Workers do not know the SOPs or are negligent during inspection, packaging, and labeling
	R39	Equipment in the harvesting process is inadequate or damaged

Data source : Primary (processed 2025)

Based on the identification results presented in table 5, there are 39 types of risks spread across various stages of coffee nurseries through generative techniques. These risks are then analyzed based on two main parameters, namely likelihood and consequence.

The risk score was obtained from the results of a questionnaire distributed to workers involved in coffee nurseries. The questionnaire included 39 types of risks that had been identified, each assessed based on likelihood and consequence with a value range of 1-5 according to the criteria in tables 1 and 2. The average values of both aspects are used to calculate the level of risk, as shown in table 6 below.

Table 5. Rating of Risk Analysis Results

Code	Risk	C	L	Risk Level	
R13	Pests and diseases attack coffee seedlings	5	4	20	H
R1	Low-quality coffee beans	4	4	16	H
R24	Excessive weed growth in the nursery area	4	4	16	H
R27	Extreme weather conditions that interfere with maintenance	4	4	16	H
R26	Leaf and stem damage due to pest and disease attacks	5	3	15	M
R37	Late harvest time or demand delay	5	3	15	M
R4	Coffee beans are affected by diseases (bacteria, fungi, and viruses)	4	3	12	M
R2	Less than optimal seed selection	4	3	12	M
R35	Leaf and stem damage caused by pest and disease attacks at harvest time	4	3	12	M
R11	Inadequate or damaged seedling equipment	4	3	12	M
R17	Unbalanced composition of planting media	4	3	12	M
R25	Improper fertilizer or drug administration techniques	4	3	12	M
R20	Root rot due to overwatering	4	3	12	M
R34	Damaged seedlings due to improper accumulation or placement	4	3	12	M
R36	Extreme weather conditions disrupt the harvest stage	4	3	12	M
R15	Irregular watering results in slow seedling growth	4	3	12	M
R10	Workers do not know the SOP or are negligent during sowing	4	3	12	M
R39	Equipment in the harvesting process is inadequate or damaged	4	3	12	M
R9	Weather conditions do not support the seeding process	4	3	12	M
R3	The condition of the land does not meet the set criteria	4	3	12	M
R21	Seedlings wither due to dry planting medium	4	3	12	M
R18	ekerja does not know the SOP or is negligent during planting in polybags	4	3	12	M
R8	Planting media has an unbalanced moisture content	4	3	12	M
R29	Workers do not know the SOP or are negligent during maintenance	4	3	12	M
R28	Delays in maintenance	3	3	9	L
R19	Equipment in the planting process is damaged or inadequate	3	3	9	L
R5	Biij germination failure due to too long soaking	3	3	9	L
R16	Too close a distance between polybags results in stunted growth	3	3	9	L
R22	Yellowing of the leaves due to excessive light intensity (>30%)	3	3	9	L
R23	Seedlings become dwarfed due to lack of light intensity (<30%)	3	3	9	L
R14	Unsuitable environmental conditions cause seedling growth to be inhibited.	3	3	9	L
R32	Errors in packaging	4	2	8	L
R31	Misidentification of seedling quality during inspection	4	2	8	L
R38	Workers do not know the SOPs or are negligent during inspection, packaging, and labeling.	4	2	8	L
R30	Inadequate or damaged maintenance tools	4	2	8	L

R12	Seedlings grow slowly because the planting is too deep.	4	2	8	L
R33	Mislabeling of seed information	4	2	8	L
R7	Damage to planting media due to less loose soil	4	2	8	L
R6	Incorrect or deep seed planting	3	2	6	L

Data source : Primary (processed 2025)

Risk assessment is essential to determine the varying severity, ranging from low to high, as well as the need to implement appropriate mitigation measures to address potential risks that may occur [10].

The results of the ranking of 39 types of risks into the risk matrix in table 6 show that the highest likelihood and consequence values are 4 types of risks with codes R13 R1, R24, and R27. Code R13 is «pests and diseases attack coffee seedlings » at the stage of planting in polybags. According to R. Sasmito et al (2023) [11] that the common pest that attacks coffee plants is green aphids, the symptom of the pest attack is by sucking liquid on the leaves, the population will increase if it is in the dry or dry season. Meanwhile, a common disease in coffee plants is leaf rust caused by fungi or fungi. As a result, yellow to brown patches appear on the leaves. Therefore, it is necessary to apply pesticides to plants and it is better to use natural pesticides according to the prescribed dosage.

Risks with the code R1 that fall into the high category are «Low-grade coffee beans ». To produce high-quality coffee seeds, high-quality beans are also needed in the process of propagating coffee seeds by generative techniques. The germination process of coffee beans is relatively long, because it is influenced by the climate. Germination time lasts 3-4 weeks if it is in lowlands with a hot climate, while in highlands with colder climates it takes 6-8 weeks germination time [12]. According to the results of research by I. Setiyawati, et al (2024) [2] Efforts to handle low-quality seeds are by utilizing plant regulatory solutions, proper seed soaking time, and monitoring the environmental conditions of the planting medium.

High risk with the code R24 «Excessive growth of weeds in the nursery area » at the maintenance stage. Weeds are unwanted plants and grow in cultivated plant areas, so they can interfere with the maintenance process. Because weeds have competitive properties that can compete with the main crops [13]. Therefore, weed control is needed both biologically, mechanically, and chemically. In addition, it is important to monitor regularly [14]. High risk with the code R27 «Extreme weather conditions thus interfering with maintenance ». Extreme weather due to climate change can lead to an increase in the spread of pests and diseases that attack coffee plants, causing losses [15]. So efforts in dealing with extreme weather can be done by adjusting the planting time, using shade, and choosing the appropriate planting medium.

Based on the results of risk mapping in table 6 above, there are also 20 types of risks included in the medium category, meaning that these risks need to be managed and supervised. Meanwhile, there are 15 types of risks included in the low category, meaning that even though these risks do not require immediate action, they need to be recorded.

Furthermore, the results of the risk analysis in the risk matrix table are presented in the form of risk mapping to make it clearer.

Table 6. Risk Mapping

Likelihood	**Consequence**				
Label	**1**	**2**	**3**	**4**	**5**
5					
4				R1, R24, R27.	R13

3			R28, R19, R5, R16, R22, R23, R14.	R4, R2, R35, R11, R17, R25, R20, R34, R36, R15, R10, R39, R9, R3, R21, R18, R8, R29.	R26, R37.
2			R6.	R32, R31, R38, R30.	
1					

4 Conclusion and recommendation

The identification results showed that the risks in coffee nursery cultivation with generative techniques were divided into three categories, namely high, medium, and low. There are 4 high risks that have been identified with two main aspects, namely likelihood and consequence, occurring at the stage of seed seeding, planting in polybags, and maintenance. This risk has a significant impact on the coffee seed cultivation process. Moderate risk as many as 20 types were found at various stages, while 15 risks were included in the low category.

The advice for companies is to prioritize risks with a high category. Then it is necessary to increase supervision and standard operating procedures, as well as regular monitoring so that it is controlled. This strategy is expected to improve risk management and the success of coffee nursery cultivation at PT Daya Merry Persada.

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