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RISK MITIGATION IN SUGARCANE PLANTING USING FAILURE MODE AND EFFECT ANALYSIS METHOD

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Abstract

Farming in cultivation always faces challenges, including land/land area, acquisition of superior seeds, fertilization, maintenance and labor. As a result of these uncertain risks, farmers are encouraged to always have high motivation, be creative and innovative, and dare to take risks by responding to existing opportunities. Therefore, it is necessary to make maximum efforts in providing understanding to farmers to carry out sugarcane cultivation. Problems inevitably arise because they dare to take unnecessary risks, so it requires questions in dealing with the impact, so risk mitigation is needed to reduce risk. Therefore, the purpose of this study was to determine the highest risk in the sugarcane planting process in increasing productivity. Data was collected by documentation through the distribution of questionnaires. The method used in this research is FMEA (Failure Mode Effect Analysis) based on ex ante, interactive and ex post strategies. The results of this study are Risk mitigation against the highest risk, the first is to make a good irrigation system, the second is to give pest control drugs in accordance with the provisions and the third is to pay attention to kletek time and carry out klentek properly.

Keywords: *Risk; Mitigation; FMEA*

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Introduction

The introduction of risk management and process improvement, reliability is important in production operations and management, particularly agricultural processes. Failure mode and effect analysis (FMEA) is considered one of the most powerful methods in this field. The high applicability and proper analysis of FMEA has become one of the most important system techniques for risk analysis and safety improvement. Risk management in all sectors is important, especially in the agricultural sector. Sugarcane is one of the industrial crops used as raw material for several large and small industries. Sugarcane productivity will increase if the attitude of farmers in entrepreneurship is higher (Jihad et al, 2021). Therefore, the government needs to take approaches/actions for farmers to increase their productivity.

Sugarcane production is severely affected due to stress during processing, thereby resulting in reduced sugarcane yield and low crop quality. Indeterminate growth habit, has a complex set of growth patterns that are considered highly susceptible to climate interactions as well as management techniques with differential response. Problems in

sugarcane cultivation pose uncertain risks that require risk identification in dealing with risk impacts so that risk mitigation is needed to reduce risk. Therefore, the planned output is that sugarcane farmers have study materials in increasing the productivity of sugarcane planting.

Risk is a result that occurs during the process or activity, so that if there is a risk that can be detrimental, risk control measures will be taken (Asrol et al, 2021). According to Suryaningrat et al (2019) controlling risks can reduce the losses that occur. The first is identifying risks, where this identification is carried out during the sugarcane planting process. Second, analyze the risks that occur. Third, evaluate the risk. And fourth, follow up on risks by taking precautions so as to reduce the risks and impacts that occur. Because this impact will be detrimental to the farmers if not immediately overcome. So for optimization, monitoring and control are needed (Darnhofer, 2014). The purpose of this study is to determine the highest risk in sugarcane planting in increasing productivity.

Research Methods

Data collection was done in several stages, including:

a. Problem identification
   Identification of problems from literature and real conditions in sidoarjo agriculture
b. FGD (Focus Group Discusion)
   Discussions with farmers and agricultural experts to determine risk points during the sugarcane planting period.
c. List the failure models and effects/impacts of the failure modes that occur (FMEA) a very powerful and effective analysis that is widely used in engineering projects to examine possible failure modes and eliminate potential failures during the cropping process.
d. Determine severity rating and occurrence rating
e. Calculating the RPN (Risk Priority Number) value
   RPN is obtained from severity x occurance x detection
f. Prioritize failure modes to provide corrective actions
g. Risk mitigation

Results and Discussion

The sugarcane planting process and its risks are as follows:

Ex Ante Strategy

a. Soil structure

The land required for sugarcane cultivation must be utilized as well as possible to obtain optimal results. Land elements including soil structure and water are the main factors for planting activities because they have a direct effect during the agricultural process. Effectiveness for soil depth so that roots are able to absorb water and nutrients properly.

The soil in the sidoarjo district mostly relies on rainfall, which greatly affects the soil structure. Irrigation systems are also in place for agricultural

lands. If there is a prolonged drought and sugar cane lacks water, farmers use water pumps to irrigate rice fields.

b. Seedlings

Sugar cane is suitable for planting in lowlands because sugar cane is classified as a type of grass - grass. From the research results there are 3 types of sugarcane seeds with 3 different planting methods. Here's how to plant sugar cane:

- Sugarcane shoot cuttings

  Sugarcane seedlings are taken from the shoots with a length of about 3-4 internodes. The leaves attached to the shoot are removed. Prepare a hole for planting first, then the sugarcane is planted by placing the shoot on the ground.

- Rayungan

  This sugarcane seed comes from young sugarcane that has grown into buds. Where each sugar cane must have eyes to be considered a seedling because each eye will become a bud. Then these seeds will be planted as needed. These seeds are also usually used for replanting. Replanting is where it is necessary to replant or new if there are dead seedlings or damaged plants so that later it will be able to harvest at the same time. For replanting, a hole is also needed for planting.

- Bonggol

  This stump seed is a seed taken from the remaining sugar cane that is cut down. The remaining stumps embedded in the soil will grow and have shoots. So these seeds will be taken and planted. Seed selection is also necessary. So this bonggol seedling is taken from sugar cane that has good quality.

Interactive Strategy

c. Fertilizer

There are several fertilizers used during the sugarcane growing period. Among them, ZA is a fertilizer that must be given because it does not have the effect of reducing sugar content (yield). ZA fertilizer can increase the production of sugarcane yield and yield and make sugarcane fresher. Then Phonska which is a fertilizer enriched with sullfur and zinc which contains 15% N, 15% P2O5, 15% K2O, and 10% S. The use of biocompost fertilizer accompanied by Phonska in sugarcane plants is expected to be able to meet the needs of nutrients and water in plants, especially during the vegetative period and be able to improve land quality.

d. Pests

Pests that are often found in sugarcane planting are rats. Symptoms of damage caused by rats based on the growth stadia of sugarcane plants are: a)

In the seedling stadia, sugarcane seedlings damaged by rats are cuttings that have not sprouted (mules or shoot cuttings) and cuttings that have sprouted (rayungan). The segments of mule seedlings are gnawed by rats, while in the case of rayungan, the damage to the stem is slightly above the soil surface so that the leaves above it wither, dry and die. b) Young plants aged 2-3 months, damage to young plants is similar to damage to rayungan seedlings, namely the stem is damaged so that the leaves above it die. Damage to young plants is clearly visible, namely leaves like trimmed with a blunt knife. c) Old plants aged more than 3 months, sugarcane plants that have reached a height of 2 m or more, damage occurs to the stems in the soil, aboveground stems and shoots. The damage is usually accompanied by root damage, so that the leaves become withered, yellow, dry and the plant is easily pulled out.

The damage caused by rats to sugarcane crops is often severe, even though rats cannot live and reproduce by eating sugarcane plants alone. The factor that causes rats to attack sugarcane plantations, especially on the island of Java, is the unavailability of other food that rats like in that place besides sugarcane plants. In contrast to damage to sugarcane plantations that are far from other crops such as rice and secondary crops, the presence of rats in the area is absolutely only to get sugarcane plants, in addition to other food available around the sugarcane plantation.

e. Klentek

Klentek is an activity to clean and remove dry sugarcane leaves that are still attached to the stems by peeling them off. Klentek is done using a sickle or just by hand. The klentek activity is carried out three times. First, klentek is carried out when the sugarcane plant already has 3 - 5 internodes, which aims to facilitate gulud activities, stimulating plant height growth.

Klentek is an activity of removing old leaves from the sugar cane stem which aims to reduce pest and disease attacks, lighten the burden of plants so that sugar cane does not collapse easily, prevent fires, create good air circulation, accelerate the formation of sucrose from monosaccharides and facilitate logging activities. Klentek is carried out twice during the planting period, namely when the sugarcane is ± 5 months and ± 8 months old to increase sugarcane yield.

f. Water supply

To obtain sugarcane productivity, water supply must be maintained properly in each growth phase. But the reality in the field due to limited water sources is difficult to get maximum conditions in each phase of growth. If the water supply is lacking, farmers use an irrigation system because the production of sugarcane plants is determined by the number and weight of stems so that efforts to ensure water availability are needed.

g. Land fire

Most of the fires that occur are caused by people who dispose of cigarette ends carelessly. So this fire is a risk that is very difficult to predict. If a fire does occur, the burnt sugar cane must be cut down immediately and sent to the sugar factory. Because if it is not immediately cut, the sugar cane will dry out and cannot be accepted at the sugar factory.

Ex-Post Strategy

h. Capital

Capital for sugarcane processing usually uses KUR loans. KUR funds are applied for at the beginning of the planting process and will be paid after the milling process.

Risk Mitigation

The action to follow up on the risks that occur is to mitigate the risks.

Table 1. Risk Mitigation

Table 1. Descriptive Statistics Results

No.	Process	Risk	Risk Mitigation
1	Water Supply	Poor drainage system	Create a good irrigation system
2	Pest Control	Pest attack	Application of pest control drugs according to the rules
3	Klentek	Leaves are not peeled/clipped	Pay attention to the timing of the clap and carry out the clap well
4	Land fire	Sugarcane on fire	Always keep an eye on the surroundings of the land
5	Fertilization	Improper fertilizer dosage	Followed the fertilizer team briefing for sugarcane
6	Nursery	Embroidery die result	Always check the land and re-seed
7	Fertilization	Sugarcane does not get the right nutrients	Ensure irrigation system is good and smooth
8	Soil structure	Mismatch of soil structure with sugarcane	Adjusting seedlings to the land to be used
9	Fertilization	Sugarcane does not grow accordingly	Perform intensive care
10	Pest Control	No fertilization	Fertilization and weeding

11	Nursery	Seedlings are not placed according to type	Adjusting seedlings to the land

Conclusions and Suggestions

The first risk is to establish a good irrigation system, the second is to apply pest control drugs in accordance with the regulations and the third is to pay attention to the timing of kletek and carry out klentek properly.

Suggestions for improvement to increase productivity in the sugarcane planting process are to make good irrigation and carry out the planting process according to the schedule / applicable regulations....

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