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Corn Cob Compost An Environmentally Friendly Base Fertilizer Solution PT Nuansa Cipta Indowarna Mandiri

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ABSTRACT

This demonstration plot study of the use of corn cake compost as a base fertilizer for corn farming on rain-fed land owned by PT. Nuansa Cipta Indowana Mandiri on Jl. Lumbang km. 07, Sumberkramat Village, Tongas District, Probolinggo Regency aims to analyze the socio-economic impacts of utilizing the company's abandoned/idle rain-fed land. This idle land utilization is intended to increase farm income and contribute to national harvest yields as a basis for food security. It also aims to determine the economic value of corn cake industrial waste as compost that can improve soil fertility. The data used are secondary data in the form of Corn Cake Flour Analysis results and primary data sourced from the demonstration plot data on the use of Corn Cake Flour compost as a base fertilizer for corn planting in rain-fed rice fields owned by PT. Nuansa Cipta Indowarna Mandiri in Sumber Kramat Village, Tongas District, Probolinggo Regency.The method used in this study was purposive sampling with observation, interviews, and documentation. Data were collected/processed and then analyzed using quantitative descriptive methods. The results of the study indicate that the abandoned/idle land of PT Nuansa Cipta Indowarna Mandiri is rain-fed land that has been planted with rice twice since 2009, namely in 2014 and in 2025 in a demonstration plot using corn filter cake compost, the land was planted with corn. Planting corn on a 3,000 m² plot produced 1,400 kg of dry corn kernels, with a total cost of IDR 6,713,000, - generating income of IDR 1,267,000, - the harvest yield decreased because 20% of the corn seedlings died due to heavy rain for 4 days. The R/C ratio of 1.19 is greater than 1, which means it is economically feasible. Socially, corn farming on the idle/abandoned land can absorb labor, provide cattle feed in the form of corn stalks for farm laborers harvesting, and contribute to corn harvest yields that can increase the number of corn harvests nationally. Corn Flour which is sugar waste from corn as the basic ingredient can be used as organic fertilizer because it has an organic C content of 25.56% (SNI Solid Organic Fertilizer Organic C content >15%) and a very low Fe content, namely available Fe 83.3 and total Fe 366 (SNI maximum available Fe 500 and maximum total Fe 15,000).Key words: Rainfed lowland farmers, income contribution, side job.

Keywords: Abandoned Land/Idle Land, Rainfed Rice Fields, Compost, Corn, Socio-Economic Impact.

1. INTRODUCTION

In 2025, the Indonesian government designated corn as a strategic food commodity, a key pillar of national food security. This is driven by corn's crucial role, not only as a staple food in some regions but also as a primary raw material for animal feed, the food industry, and energy.

Food security in this commodity aims to ensure sufficient, stable availability of corn. Safe and affordable for all levels of society, while simultaneously increasing farmers' incomes. The key

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principles are reducing dependence on imports, maintaining competitive prices, and building strong national reserves. Furthermore, this strategy is projected to have broad socioeconomic impacts, ranging from increasing farmers' incomes, creating new jobs in rural areas, to strengthening food security, the foundation of national independence.

Corn (*Zea mays L.*) is an important food crop worldwide, known for its ability to adapt to various environmental conditions and its role as a major source of carbohydrates for humans and animal feed (Bantacut, Akbar, & Firdaus, 2015). Theoretically, corn growth is influenced by various factors including soil conditions, water availability, and proper fertilization. Corn plants require fertile soil conditions with a neutral pH and good nutrient management to achieve optimal results (Soekartawi, 2006). This process can be influenced by various environmental factors such as light intensity, temperature, and air humidity. Proper fertilization, especially the use of NPK fertilizers (Nitrogen, Phosphorus, and Potassium), also plays an important role in increasing the efficiency of photosynthesis and productivity of corn plants (Wachid & Alamsyah, 2018).

Corn (Zea mays L.) is a major food crop that plays a vital role in supporting food security and animal feed, not only in Indonesia but also globally. As a crop with a high carbohydrate content, corn is a primary source of energy in animal feed. Furthermore, corn boasts excellent adaptability to various environmental conditions, making it a primary choice for farmers in various regions (Nasution et al., 2024).

Besides being used as a feed ingredient, corn has significant industrial added value. Its derivative products include corn flour (maizena), corn oil, green fodder, and even raw materials for the biochemical industry. Corn flour is rich in pentoses, which can be processed into furfural, an important chemical raw material in the resin, pharmaceutical, and plastics industries (Ranum et al., 2014).

In terms of national production, Statistics Indonesia (BPS) recorded that in 2024, Indonesian corn production reached 20.48 million tons of dry corn kernels, with a harvested area of 4.15 million hectares and a productivity of 4.9 tons/ha. However, this production is insufficient to meet domestic demand, so Indonesia remains dependent on imports, particularly to meet the needs of the feed industry (BPS, 2024). Currently, corn as a raw material for animal feed is met through national production and corn imports. National corn demand has not been fully met by national corn production because the corn harvest peaks only in February, March, and April, while other months tend to remain constant.

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During the corn production process, corn undergoes changes in form from harvest to marketing. It is harvested in the form of husked cobs, but some also produce dry cobs, which are harvested and dried on the tree by removing the husk. The next step is to shell corn, then dry it, and store it. Each stage can experience changes in physical form, size, and weight. Therefore, in 2021, a Corn Conversion Survey was conducted in collaboration with the Central Statistics Agency (BPS) and the Ministry of Agriculture. The results of the conversion rate at the farmer level 1 were in the form of Corn Hull (JP) before drying with a water content of 27.81% and after drying to Dry Corn Hull (JPK) with a maximum water content of 14% (Center for Agricultural Data and Information Systems, 2024). This decline can be influenced by several factors, such as climate change affecting planting schedules and harvest times, conversion of agricultural land to non-agricultural sectors, pest and disease attacks on corn plants, and changes in farmer planting patterns that may shift to other commodities due to price or market demand.

To encourage food self-sufficiency, the government also increased the price of corn kernels starting February 1, 2025, namely the Government Purchase Price.(HPP)for feed corn to Rp. 5,500 per kilogram, from the original Rp. 5,000 per kilogram. Based on the Decree of the Head of the National Food Agency (NFA) Number 18 of 2025, the Government Purchase Price (HPP) for corn at the farmer level is IDR 5,500 per kilogram, the price is set to provide a minimum price guarantee to farmers so that they do not suffer losses when overproduction, increase the attractiveness of corn cultivation so that farmers are encouraged to maintain or increase the area of corn planting, this can prevent the scarcity of corn raw materials that can disrupt the production of the animal feed industry, processed foods, household consumption and other sectors.

Concrete government programs, such as mass planting, price fixing, procurement from farmers, infrastructure development, and technology utilization, are all designed to achieve corn self-sufficiency. If domestic demand can be met, the resulting surplus can also open up opportunities for strengthening food reserves and exports.

PT Nuansa Cipta Indowarna Mandiri is a company engaged in the production of organic fertilizer in the Tongas area of Probolinggo. The company owns approximately 6,000 m2 of unmanaged rain-fed land.[2]. Since the company's establishment in 2009 until 2024, it has only been planted once in 2014 with rice. Therefore, if referring to Government Regulation Number 20 of 2021 concerning the Regulation of Abandoned Areas and Land, then if the land is not used, cultivated, utilized, and/or maintained properly for 3 consecutive years since the issuance of land

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rights, then the land can be designated as abandoned land/area which is then directly controlled by the state through the Minister of ATR/BPN.

To support the government's food security program, research on demonstration plots to utilize abandoned/idle land of PT Nuansa Cipta Indowarna Mandiri is crucial, considering the potential of abandoned/idle land nationally if empowered, it can provide harvest results, increase income, absorption of farm laborers, and strengthen food security significantly. Idle or abandoned land has a low fertility rate compared to agricultural land that is consistently empowered due to the addition of fertilizer materials such as compost and the provision of synthetic fertilizers such as UREA, Phonska given periodically, so to increase the fertility of the land of abandoned/idle land PT Nuansa Cipta Indowarna Mandiri needs to be given compost in sufficient quantities as a base fertilizer to increase the level of C Organic soil. President Director of Petrokimia Gresik, Dwi Satriyo Annurogo explained the recommendation for balanced fertilization, because according to data from the Center for Agricultural Land Resources (BBSDLP) 2018, at least 70% of the 8 million hectares of rice fields in Indonesia are unhealthy. This means that around 5 million hectares of rice fields have low organic matter content.

Farming

Farming is a series of human activities in managing natural resources and the environment to produce agricultural products with the aim of meeting food needs, improving farmer welfare, and to obtain economic benefits. According to Suratiyah (2015), Farming is the science that studies how a farmer coordinates production factors to be as efficient as possible so that it can provide benefits for farmers. Farming (agriculture) is an activity that involves land cultivation, planting, caring for, and harvesting crops as well as managing animals for the purpose of producing food, feed, fiber, industrial raw materials, and sources of income. Farming is an important sector in the economy of many countries, because it provides food for the population and raw materials for industry. The history of the development of agricultural science in Indonesia has a long history and is influenced by geographical, cultural and socio-economic factors in each region in Indonesia.

Sleeping Land or Abandoned Land

Abandoned land is land that has been granted rights or management to a party, either an individual or a legal entity, but has not been used or utilized according to its intended use for a certain period of time. Abandoned land can be in the form of:

1. Freehold land that is left unused or not in accordance with the specified land use plan.

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2. Land with Cultivation Rights (HGU), Building Rights (HGB), and Usage Rights that are not managed in accordance with the permits and utilization plans granted.
3. Land Management Rights (HPL) that is not used properly by the party to whom the rights are granted.
4. Land with a Land Control Basis, such as land obtained through permits or agreements with the government, but not utilized optimally.

Abandoned land is a plot of land, whether it is a freehold, a right to cultivate, a building, a right to use, or a right to manage, that is not cultivated, not used, or not utilized in accordance with the conditions, nature, and purpose for which the rights were granted. The status of "abandoned" can also refer to land that is not maintained and is deliberately left to fall into disrepair after a certain period of time since the rights were issued.

Based on Law Number 5 of 1960 concerning Basic Agrarian Regulationsand Government Regulation Number 20 of 2021 concerning the regulation of abandoned areas and land requires rights holders to cultivate their land; if it is not used within the specified period, the land can be regulated with the consequence of being transferred to another party for productive use.

Based on Government Regulation Number 20 of 2021 concerning the Regulation of Abandoned Areas and Land, the period granted for land cultivation is three years from the issuance of land rights. If, within three consecutive years, the land:

1. Not worked on
2. Not used, or
3. No utilized in accordance with the purpose of granting rights

Idle land or abandoned land generally experiences degradation in the physical, chemical and biological quality of the soil, this is because :

1. There is no continuous input of organic materials,
2. Exposed to erosion or rainwater runoff,
3. Accumulated weeds, low soil pH, and low in essential nutrients (N, P, K),
4. Soil microorganism activity is very low,
5. Soil compaction and loose soil structure.

Idle or abandoned land is part of land degradation caused by a combination of biophysical factors (low fertility, drainage problems, drought) and socioeconomic factors (lack of capital, limited market access, and labor conversion). This land can actually be reclaimed with soil

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conservation technologies and restoration inputs, such as the addition of compost, green manure, and biochar.

According to Ministry of ATR/BPN (2021), in Indonesia there are more than12.4 million hectares of idle/abandoned land, most of which are in Java, Sumatra, and Kalimantan. Based on dataMinistry of Environment and Forestry (KLHK, 2022), the area of critical land in Indonesia reaches13.4 million hectares, including in forest areas and APL (Other Use Areas).

Study Suryani et al. (2020, Journal of Soil and Climate)found that idle land in East Java has a high contentC-organic <1.5%and low cation exchange capacity (CEC) (<15 cmol/kg), which indicates low fertility levels. However, with the addition ofcompost 10 tons/ha, corn productivity on fallow land can increase from2.1 tons/ha to 4.8 tons/ha.

Degraded Land

Regarding Land Degradation in Indonesia, Wahyunto and Ai Dariah A. 2014 define degraded land as follows:

1. Degraded land is agricultural land whose productivity has decreased due to the condition of the land, especially the surface soil (topsoil), which has deteriorated.
2. One form of degraded land is known as idle/abandoned land, namely agricultural land that was once used, but because the land is less suitable for agriculture, the land is unproductive and is no longer used or becomes abandoned.
3. A further consequence of the land degradation process is the emergence of unproductive areas called critical land.

Land degradation is the reduction in the capacity of land to produce products and ecosystem services due to physical, chemical, and biological factors. The topsoil (*topsoil*) is very important because it contains organic matter, nutrients, and soil biota that support fertility. If this layer is lost or its quality decreases (for example, due to erosion, nutrient leaching, compaction, or pollution), agricultural productivity automatically decreases.

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According to researchUtomo & Agus (2016, Soil Research Center), loss of 1 cm of topsoil due to erosion can cause the loss of around100 tons of soil per hectare per yearwhich is equivalent

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to the loss of 2–3% of soil organic matter. The impact is a decrease in rice and corn yields of up to15–30%.

Rainfed Land

Rainfed land is agricultural land that does not receive irrigation water, so the plants' water needs are met solely by rainfall. This situation often causes crop failures or suboptimal yields due to water shortages (Jonizar & Martini, 2016). Rainfed land is land whose irrigation system relies heavily on rainfall. Farmers generally cultivate their land when water is insufficient during the rainy season. During the dry season, this land is left uncultivated because water is scarce or nonexistent.

Based on BPS data, 2018, rice fields in Indonesia in 2015 reached 8,087,393.00 ha spread across 38 provinces and can be seen as follows:

1. Java Island 3,223,503 ha
2. Sumatra 2,200,950 ha
3. Kalimantan 1,055,877 ha
4. Sulawesi 1,009,453 ha
5. Papua 54,588 ha
6. Maluku 25,196 ha

The highest area of rice fields on the island of Java is East Java which reaches 1,092,752 ha, second is Central Java with a rice field area of 965,262 ha, while West Java has 912,794 ha, Banten 199,492 ha and DI Yogyakarta 53,553 ha. Rainfed rice fields can be optimized for their potential use to ensure the fulfillment of national food needs. Rainfed rice fields in Indonesia cover 3.71 million hectares (45.7% of the total rice fields), spread across Java, Nusa Tenggara, Sumatra, Kalimantan, and Sulawesi (Kasno et al. 2016 in Wihardjaka et al., 2020). Meanwhile, the area of rain-fed rice fields in East Java is approximately 240,273 hectares, concentrated primarily in Gresik Regency, where 29,609 hectares are located. Rain-fed rice fields are a crucial type of rice field that relies on rainfall for irrigation and constitute the second-largest food-producing region in Indonesia after irrigated land.

Indonesia's national standard rice field area as of 2019 was recorded at 7.46 million hectares. This figure is the latest data used by all government and regional institutions in Indonesia. This data was determined based on Decree of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency (BPN) No. 686/SK-PG.03.03/XII/2019 (BPS Kendal Regency, 2019).

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The following are the characteristics of rain-fed land (Diperpa Bandung Regency, 2018):

1. Dependence on Rainfall
   a. Production is highly dependent on the amount, distribution and intensity of rainfall.
   b. If rain comes late or stops in the middle of the planting season, crops can fail.
2. Limited Planting Season
   a. Generally, it can only be planted 1-2 times a year (rainy season only).
   b. In the dry season, land is often left fallow (uncultivated) due to lack of water.
3. High Risk of Drought

During long dry periods or the El Niño phenomenon, the potential for crop failure increases.

4. Low and Fluctuating Productivity
   a. Due to the lack of a stable water supply, plants do not receive optimal water supply throughout the growth cycle.
   b. Harvest yields are often inconsistent from year to year.
5. Soil Fertility is Rapidly Declining
   a. High rainfall at the start of the season can cause erosion and leaching of nutrients (*nutrient leaching*).
   b. It is difficult to carry out efficient fertilization if water is not evenly available.
6. Difficult for High Value Crops

Horticultural crops or commodities with high economic value are difficult to develop because they require a controlled water supply.

Applying Compost to Agricultural Land

Compost is the final product of the biodegradation process of organic materials which takes place in a controlled manner through the activity of saprophytic microorganisms, such as bacteria, fungi, and actinomycetes, as well as soil fauna such as worms (*Lumbricus sp*.). Commonly used organic materials include food scraps, fallen leaves, grass clippings, kitchen waste, and other agricultural waste. The composting process is a form of aerobic decomposition that utilizes oxygen to break down complex organic compounds (such as cellulose, hemicellulose, and lignin) into simpler, more stable compounds in the form of humus. During this process, microorganisms use organic matter as a source of energy and nutrients, producing heat (up to 55–70 °C in the thermophilic phase), water, and carbon dioxide, and increasing the availability of nutrients such as nitrogen (N), phosphorus (P), and potassium (K) (Bernal et al., 2009).

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Based on this, compost functions as an organic fertilizer that not only improves the physical properties of the soil (structure, porosity, water holding capacity), but also increases chemical fertility (provision of macro and micro nutrients) and biological fertility (soil microbial activity).

Corn (*Zea mays L.*)

Corn (*Zea mays L.*) is an annual cereal plant belonging to the Poaceae family and is one of the world's main food crops besides rice and wheat. This plant originates from Central and South America, then spread widely to various parts of the world, including Indonesia. Corn has an upright, unbranched stem, ribbon-shaped leaves, and separate male flowers (panicles) and female flowers (cobs) on the same plant (*monoecious*). Corn (*Zea mays L.*) is a secondary crop commodity, including the food crop sub-sector and corn is one of the potential commodities that can be used as food and raw material for animal feed. As a food ingredient, corn contains; 70% starch, 10% protein, and 5% fat, as a raw material for animal feed, the composition of the feed consists of 46% corn (Sarasutha. 2002).

Corn can grow at altitudes of 0–3,000 m above sea level, but optimal production is achieved at altitudes of 0–1,500 m above sea level with temperatures of 21–27 °C and rainfall of 600–1,200 mm/year. This plant is tolerant of various soil types, but best growth is achieved in loose, fertile, and well-drained soil (Sutoro & Sumarno, 2018).

Socio-Economic Impact

Corn farming is the management of production resources (land, labor, capital, and technology) to produce corn, an economically valuable agricultural commodity. This activity encompasses all stages, from land preparation and planting, maintenance, harvesting, and marketing. Corn, as a strategic food crop, plays a vital role in national food security, providing raw materials for the animal feed industry, and providing income for farmers (Sutoro & Sumarno, 2018).

On the social side**,**Corn farming provides employment for rural communities, at all stages of production, processing, and distribution. Corn farming also strengthens social networks among farmers through farmer groups, cooperatives, and agribusiness partnerships. Furthermore, corn is a commodity that can increase the participation of women and young people in the agricultural sector, particularly in post-harvest processing and marketing (Rachman et al., 2018).

Economically, corn farming contributes to increased household income through the sale of harvested corn in the form of fresh corn, shelled corn, or value-added processed products. Large-

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scale production also plays a role in strengthening the food and feed industry supply chain. At the regional and national levels, corn is a commodity that drives economic growth in producing regions, reduces dependence on imports, and strengthens the agricultural commodity trade balance (Shiferaw et al., 2011).

Thus, corn farming not only plays a role as a source of food and feed production, but also as a driver of the local economy that can improve the welfare of farmers and strengthen food security and the regional economy.

Economic Value of Industrial Waste

Indonesia faces serious challenges related to waste management and environmental degradation. Rapid economic growth and urbanization have led to increased waste production, while a lack of infrastructure and awareness of the importance of sustainable waste management further complicate environmental issues. Therefore, effective waste management measures are needed to protect the environment and public health.

Industrial waste is the residue or waste produced during industrial production processes. Different types of waste are generated depending on the industrial product being produced. Industrial waste is divided into four groups: liquid waste, solid waste, gaseous waste, and hazardous and toxic waste (B3) (Faza Nanda et al., 2024). Some industrial waste, particularly organic waste such as bagasse from sugar factories, organic sludge from food processing industries, coffee husks, rice husks, and vegetable waste from agricultural processing industries, contains high levels of organic matter and nutrients.

This organic waste has economic value if used as compost, because it can go through a composting process to become a soil conditioner that is rich in nutrients such as nitrogen (N), phosphorus (P), potassium (K), and humic compounds. Utilizing industrial waste as compost not only reduces the cost of purchasing inorganic fertilizers for farmers but also opens up new business opportunities in the organic fertilizer processing sector. Furthermore, this utilization provides the dual benefit of reducing environmental pollution and increasing agricultural productivity (Haug, 2018).

Thus, organic industrial waste previously considered useless can become an economically valuable resource through innovative composting technology, which contributes to sustainable agriculture and a circular economy.

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2. RESEARCH METHODS

Place and Time of Research Implementation

The research was conducted on rain-fed land owned by PT Nuansa Cipta Indowarna Mandiri on Jl. Lumbang KM. 07, Sumber Kramat Village, Tongas District, Probolinggo Regency, East Java Province. The research was conducted for approximately four months, from April to July 2025. The condition of the abandoned land, which had not been utilized for years, was a consideration for conducting the research.

Sampling Determination Techniques

Determination of samples using the method*Simple Random Sampling*(SRS) is a sampling method widely used in quantitative studies. Simple random sampling is considered advantageous in homogeneous and uniformly selected populations. In this selection method, every unit in the population has an equal chance of being selected as a sample, as the selection process is entirely based on luck (Noor et al. 2022). This method was chosen because land conditions are relatively uniform, and sample plots are randomly selected from across the company's land.

During the demonstration plot, the land is planted in areas that can be planted. The areas not planted include the raw material storage area and areas filled with trees and shrubs, resulting in a land area of approximately 3,000 m2.^{2}. The method used was descriptive through surveys, field observations, and laboratory analysis. Sample points were determined in the field using purposive sampling based on land use and slope gradient.

Determination of Research Respondents

To determine the land sample point that will be used as a compost demonstration plot location, the technique used is:*Purposive Sampling*, namely abandoned land/idle land belonging to PT Nuansa Cipta Indowarna Mandiri which is not used for productive activities, while respondents who will be used as sources of information include: the person in charge or management of PT Nuansa Cipta Indowarna Mandiri and farm laborers who work on the corn planting demonstration plot.

Data source

Data sources used in conducting the research analysis process include:

1. Primary data is the primary source of information collected directly by researchers during the research process. This data is obtained from original sources, namely respondents or informants related to the research variables. Primary data can be in the form of observations, interviews, or data collection through questionnaires (Laia et al.,

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2022). The primary data in this study were obtained directly through interviews with questionnaires and documentation from respondents from the management of PT Nuansa Cipta Indowarna Mandiri and those working on the corn planting demonstration plots.

2. Secondary data is a source of research data obtained indirectly through intermediary media. This means that this data is not collected directly by the researcher but rather from pre-existing sources, such as documents, literature, or data collected by other parties. Secondary data can be obtained from various sources, including documents, government publications, industry analysis by the media, websites, and the internet. Researchers use documentation methods to collect secondary data, such as searching for and analyzing documents relevant to the research topic. In addition, researchers can also use books, journals, and internet references to obtain the necessary secondary data (Ariyaningsih et al., 2023).

Data Analysis Methods

The data analysis method used is a quantitative descriptive analysis method, namely to analyze the socio-economic impact of the utilization of abandoned/idle land of PT Nuansa Cipta Indowarna Mandiri, as well as to analyze the economic value of corn cob industrial waste after being composted. The analysis method is carried out through two main approaches, namely:

1. Social Analysis

Assessing the social impact of the use of idle or abandoned land, using several analysis tools, namely:

a. Qualitative Descriptive Analysis

Describes changes in social conditions in the community, including employment opportunities, participation, social conflict, and farmer group involvement. Data were obtained through interviews, focus group discussions (FGDs), and observations.

b. Analysis of labor absorption description

Looking at macroeconomic impacts, such as employment absorption and income distribution between sectors.

c. For example, by measuring increased access to education, health, group participation, and community perception of the program.

2. Economic Analysis

Assessing the economic impact of idle land utilization, through:

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a. Farm Budgeting Analysis

In general, farm business analysis can be calculated through the following points:

1. Fixed costs are costs that are not affected by production results or any level of output. Total fixed costs (TFC) are the sum of all fixed costs incurred.
2. Variable costs are costs whose size is influenced by the size of production. This means that when production is low, production expenses increase, and when production is high, costs also increase. Meanwhile, total variable costs (TVC) are the sum of all variable costs.
3. Total Cost (TC)

The total cost is formulated as follows

$$TC = TFC + TVC$$

Where Total Cost (TC) is the sum of Total Fixed Cost (TFC) and Total Variable Cost (TVC).

4. Total Revenue (TR)

Total revenue is the total amount of revenue from production (Quantity=Q) multiplied by the selling price (Price=P). Total revenue can be obtained using the formula:

$$TR = P \times Q$$

Where:

TR (Total Revenue) : Total Income from Corn Farming (Rp)
P (Price) : Corn price (Rp)
Q (Quantity) : Amount of corn harvest (Kg)

5. Income (PD)

Revenue is generated from total revenue (TR) minus total costs incurred (Total Cost=TC) which is formulated as follows (Rusmiati, 2021):

$$PD = TR - TC$$

Where:

PD : Corn Farming Income
TR : *Total Revenue* (Total revenue)
TC : *Total Cost* (Total cost)

Income Analysis is also used to compare income before and after utilization of idle land.

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6. Analysis R/C Ratio (Revenue Cost Ratio)

R/C = TR/TC

Information:

R/C Ratio = Revenue Cost Ratio

TR = Total Revenue

TC = Total Cost

(Mirayanti et al., 2021)

Criteria:

a) If R/C > 1, then corn farming is profitable or worth developing.

b) If the R/C Ratio < 1, then the corn farming business is experiencing losses or is not feasible to develop.

c) If the R/C Ratio = 1, then the corn farming business is at the break-even point (Break Event Point), neither making a profit nor a financial loss.

b. *Cost–Benefit Analysis* (CBA)

Assess the social economic feasibility, to determine whether the benefits outweigh the costs.

Cost-benefit analysis (CBA) is a systematic evaluation method for comparing the total costs and benefits of a project, decision, or policy to determine its feasibility and effectiveness. CBA aims to ensure that the expected benefits outweigh the costs, thus facilitating rational, data-driven decision-making and identifying the best options for achieving objectives.

3. RESEARCH RESULT

General Condition of the Research Location

Tongas District is located in the Probolinggo Regency area, which is in the western part of the capital of Probolinggo Regency with the following boundaries:

North : Madura Strait Sea

East : Sumberasih District

South : Lumbang District

West : Pasuruan Regency

Tongas District consists of 14 villages, namely:

1. Desa Pamatan

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2. **Sumber Kramat Village**
3. Sumberejo Village
4. Semendi Village
5. Bayeman village
6. Dungun village
7. Curah Dringu Village
8. Wringinanom Village
9. Tongas Wetan Village
10. Tongas Kulon Village
11. Curah Tulis Village
12. Klampok Village
13. Tanjungrejo Village
14. Tambakrejo Village

Source: (BPS 2020)

Tongas District is home to 14 villages, most of which are agricultural areas. One of the villages in Tongas District is Sumber Kramat Village. Sumber Kramat Village is located at an altitude of 0–250 m above sea level, with flat to sloping topography in several hamlets. This area has a dry and hot climate, with an average daily temperature of 36–39 °C. Sumber Kramat Village is included in the dry fields/fields and yards managed by local farmers, used for crops such as rice, corn and komak beans.

The climate in Tongas District is similar to other districts in Probolinggo Regency. Tongas District has a tropical climate with two seasons: the rainy season and the dry season. The rainy season occurs from October to April, and the dry season from April to October. The air temperature in Tongas District, like other districts at an altitude of 0 to 250 meters above sea level, is relatively hot, as is typical in lowland areas, ranging from 36 to 39°C. (Tongas District in 2020 figures)

Based on 2020 BPS data, it is known that the area of rice fields in Tongas District is as follows:

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Table 1. Area of Paddy Fields in Sumber Kramat Village (Ha)

No	VILLAGE	Goes on		Simple	Rainfall	Amount (Ha)
		Technical	1/2 Technical			
1	young		78,00	25,00	147,00	250,00
2	Kramat Spring				122,00	122,00
3	Sumberejo		9,00		36,00	45,00
4	Cement	181,00	18,00		38,00	237,00
5	Bayman	133,00	11,00		9,00	153,00
6	Dungun	38,67			4,00	42,67
7	Dringu Waterfall	49,00			6,00	55,00
8	Wringinanom	135,00	3,00		56,00	194,00
9	East Tongas	81,00	20,00		84,00	185,00
10	Tongas Barat	49,00	5,00		2,00	56,00
11	Curahtulis	34,00	47,00		59,75	140,75
12	Klampok		93,00		153,00	246,00
13	Tanjungrejo		174,00		32,00	206,00
14	Tambakrejo		140,00		11,00	151,00
	Total 2019	700,67	598,00	25,00	759,75	2.083,42
	2018 Total	700,67	598,00	25,00	759,75	2.083,42
	Total 2017	700,67	598,00	25,00	759,75	2.083,42

BPS Probolinggo Regency, 2020 in Aditya, 2025

The rain-fed land area of Sumber Kramat Village is 122 ha, second only to Pamatan. In 2020, there was no technical or half-technical irrigation, where farmers only planted rice or corn during the rainy season, depending on nature. Based on observations in 2025, there was a farmer who built a drilled well right in front of the PT Nuansa Cipta Indowarna Mandiri factory to water his own rice fields and several neighbors, which were limited to the reach of his pump machine. PT Nuansa Cipta Indowarna Mandiri has a drilled well, but its purpose is for the production of solid organic fertilizer and daily needs of the factory such as employee toilets. The absence of technical or half-technical irrigation causes agricultural land in Sumber Kramat Village to be generally unproductive during one season or during the dry season.

1) Corn Cultivation

The following is an explanation of the corn farming process at the research location:

1. Corn cob compost as basic fertilizer.

Compost collection or stockpiling was carried out from January 2025 to February 2025 in a fairly large amount of approximately 100 tons, this was done as an initial investment to

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significantly increase the organic content in the soil because it had never been planted for more than 5 years. The compost that was spread had an Organic C content of 25.56% (SNI Solid Organic Fertilizer Organic C content >15%).

Corn Compost is calculated as a fixed cost, this is done because the addition of large amounts of compost is calculated at the beginning, so that for the next planting no more compost is added. This is done because the planted rice fields are idle land where from 2009-present only 2 times planted, the first in 2014 for rice plants. If each land cultivation is given compost, then for example referring to the balanced fertilization of PT Petrokimia Gresik for Basic Fertilizer using Petroganik Fertilizer, namely granular organic fertilizer as much as 500 kg per ha (1 ton of Petroganik with a weight of 40 kg / sack = 25 sacks) for food crops, then if the land area is only 2,500-3,000 m2 = 500 kg / 4 = 125 kg or the equivalent of 3 sacks of Petroganik fertilizer, but if the solid organic fertilizer is as much as 3 sacks for an area of 2,500-3,000 m^2Therefore, it is very insignificant. The use of organic crumb fertilizer is due to its lower price, at Rp. 200/kg compared to Rp. 800/kg of petroganic fertilizer. Therefore, when converted to balanced fertilization, the following calculation is obtained:

125 kg x Rp. 300 = Rp. Rp. 37,500.-

This means that for each land cultivation, the requirement for solid organic fertilizer is 125 kg per 2,500 m^2or 500 kg per hectare at a cost of Rp. 150,000 per hectare/planting.

2. Land Cultivation

Land processing was carried out on February 22, 2025 after the addition of compost, then the dictator land so that the topsoil is broken and mixed with compost and left fallow which will be planted with corn in April, so that the compost will ferment in the land for approximately 3-4 months, the glucose content of corn cake also seeps into the soil due to the splash and infiltration of puddles of rainwater into the soil. Glucose also seeps into the soil and because microorganisms also need sugar in addition to increasing soil porosity as an ideal environment for the growth and development of soil microorganisms, it is hoped that the population of soil microorganisms will increase.

3. Grass Weed Eradication

Before planting corn, weed control was carried out using the systemic herbicide Matteo 480 SL brand with the active ingredient Isopropyl Amine Glyphosate 480g/l, liquid volume 1 liter. The method of application is by measuring 1 sprayer tank 17 liters using a measurement of 2 Matteo bottle caps or 1 bottle for 3 sprayer tank fills, for the entire field using 2 Matteo bottles

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or 6 tank fills for spraying grass. Application is done in the morning. The previously green grass turns yellow and dries in 1-2 days.

4. Planting Corn Seeds

After the land preparation stage is complete, the next step is planting corn seeds. The seeds used in this demonstration plot are Syngenta's NK 212 hybrid corn, a superior variety favored by local farmers, as they have demonstrated greater resilience to both the rainy and dry seasons.

The planting process is carried out using a simple tool in the form of a wooden Gejig with a boomerang shape to make holes in the ground 3-5 cm deep as holes where the corn seeds are inserted, while the planting distance used is 60 cm x 20 cm in rows measured using raffia rope with 20 cm knots, this distance is suitable in the surrounding area because of the condition of the rain-fed land, if the arrangement is too close it will be problematic if the rain does not fall for a long time because the more plants the water absorption is also more and faster so that the soil dries faster. In this spacing arrangement, each hectare of land can accommodate around 83,000 plants, so that for a demonstration plot area of 3,000 m² (0.3 ha) it is estimated that there are around 25,000 corn plants. This population was chosen because it is considered ideal to maintain a balance between plant density and the availability of nutrients and water in the soil.

In addition to spacing, the NK 212 seeds are also given special treatment before planting. This treatment involves mixing the seeds with the systemic insecticide Cruiser 35 FS, two bottles per 6 kg of seeds. The goal is to protect the seeds from early attacks by soil pests and insects that eat seedlings, such as caterpillars, ants, and young stem borers. This treatment increases seed germination because damage in the early stages can be minimized. This is especially important for land that has not been planted for a long time, as soil pest populations are usually relatively high due to the lack of routine cultivation activities.

Planting was carried out at the beginning of the rainy season so that water requirements for germination and the early vegetative phase could be met by natural rainfall. This strategy was chosen to reduce reliance on expensive diesel-powered irrigation. Therefore, the combination of hybrid seeds was used.NK212which has the potential for high yields, proper planting distance, seed treatment with systemic insecticides, and adjustment of planting time to the rainy season are important factors in supporting the success of early corn growth.

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5. Fertilization

The first fertilization was carried out on May 14, 2025, after rain, using 1.5 sacks (@50kg) or 25 kg of Urea fertilizer mixed with 0.5 sacks (@50kg) or 25 kg of Phonska fertilizer. After mixing evenly, the Urea and Phonska fertilizers were sprinkled around the corn plants.

The second fertilizing, done on June 23, 2025 with the same method and dose and done after 1 month of the first fertilizing, fertilizing is done after it rains, or after irrigation if it doesn't rain, this is done because if it doesn't rain or there is irrigation then the soil is in a dry condition and the fertilizer will not be able to seep into the soil because it is not dissolved by the moisture of the water.

6. Irrigation

Irrigation is carried out if there is no rain for more than two weeks, so technical irrigation is required, namely irrigation with the help of a diesel engine. At the demonstration plot location when it does not rain for 2 weeks, the soil is still moist because the fairly thick compost also acts as topsoil mulch in retaining moisture. Observations were found when the dry topsoil was dug up, it turned out that the soil underneath was still moist. The demonstration plot location is adjacent to a river, the river will always have water during the rainy season, but during the dry season the river water is very low and cannot be used to irrigate the rice fields. The river next to the corn planting location is a river with a steep path downwards, because the location is at the foot of Mount Bromo. The flowing river water sometimes also gets smaller if farmers in the upper areas are all taking water from the river. Therefore, to take water from the river, permission is required from the irrigation authorities at the village level. This is done to regulate rotations, so that when farmers pay and use irrigation services to the party that owns the pump machine, there is enough water to irrigate their land. Even though it doesn't rain in Sumber Kramat Village during the rainy season, the river still has enough water to irrigate the rice fields, because this river comes from the top of Mount Bromo, where the rain is more intense in the upper areas.

7. Plant Damage Due to Rain

January-April is the rainy season, and in the second week of May 2025, heavy rain fell for four days, causing approximately 15% of corn plants, between 20-25 cm in height, to die due to the inundation and standing water. Some plants did not grow well after the heavy rain, but after the floodwaters receded and the topsoil dried, the corn plants began to grow well.

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8. Corn Growth

The growth of corn plants is quite good, locations where the compost is spread thicker have a much better growth rate of corn plants, namely 2 times greater than corn plants that grow in areas with less compost. The compost heap is located on the north side of the plot, and the corn growth on the north and south sides is very different. On July 9, 2025, observations and measurements of the height of the corn plants were conducted. It was found that the height of the corn plants on the north side, measured from the ground to the top of the stem or the base of the male flower (tassel), reached a height of up to 269 cm. Meanwhile, the height of the corn plants on the north side ranged from 170-200 cm.

9. Plant Pest and Disease Control

In the process of controlling plant pests and diseases using:

a) Cruiser 350 FS insecticide, this liquid type insecticide is applied when planting corn seeds, by adding 10-20 ml of water to the liquid Cruiser 350 FS insecticide, the corn seeds and the water solution are stirred evenly, the corn is drained and ready to be planted, the function of this insecticide is to protect corn seeds from pest attacks at the beginning of the growing period.

b) Cyclone 5.7 WG. This insecticide contains 5.7% emamectin, an active ingredient that is translaminar, meaning it can be absorbed and moved within leaf tissue, reaching corn caterpillar pests (*Spodoptera frugiperda*) which is behind the leaves. On May 21, several corn plants were found to be attacked by caterpillar pests which caused some of the plant's leaves to be damaged. Then, caterpillar pest control was carried out using Siklon 5.7 WG pesticide, the dose used was 1 sachet of 25 grams for a 17 liter sprayer tank and for spraying all the land, 5 sachets of Siklon 5.7 WG were used (5 times filling the tank). Plants were sprayed from top to bottom, especially on the leaves, cobs and stems, on plants that were more severely attacked, spraying was more intense.

10. Corn Harvest

Harvesting is done when the corn has reached physiological maturity, marked by yellowing of the cob skin and decreasing water content. Corn harvesting was carried out on July 30, 2025 or 98 days after planting (dap). Some common corn harvesting methods in Sumber Kramat Village are 1) the stalks from the cob area up are cut, the corn is left to dry in the field until the entire stalk and husk are bright yellow which takes 2-8 days, 2) corn is harvested when the corn husk has

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turned yellow, but the stalks and leaves are still green. The second method used in corn harvesting at the research location, this is done so that the entire stalk and leaf can still be used for cattle feed, Farm laborers harvest in bulk by bringing their own equipment such as sickles to cut the base of the plant, corn is collected at several points then removed from the husk and collected into sacks, one corn cob farm laborers get the stalks and leaves in exchange for wages, farm laborers need the stalks and leaves of corn plants for cattle feed. Farmers usually buy corn stalks 1 pick up ranging from Rp. 700-800 thousand for feed for 2 cows for 2 months with grass as an interlude.

The harvest from the 3,000 m² demonstration plot yielded 1.4 tons of dry corn kernels with a 98-day planting period. This production serves as the basis for calculating corn farming revenue. At harvest time, the price of corn was quite good at Rp. 5,700 per dry corn kernel (corn price information in the Pungging Mojokerto area reached Rp. 6,150/kg of dry corn kernels on the same day). Based on this price, corn farming revenue can be calculated as follows:

Interestingly, this harvesting activity has a unique socio-economic value at the farmer level. Farm laborers who assist in the corn harvesting process are not paid in cash but are instead compensated in the form of corn stalks and leaves, which are used as cattle feed, given that corn stalks are quite expensive during the dry season. With this system, farmers do not need to incur additional costs for harvesting labor, while farm laborers still receive tangible benefits in the form of economically valuable animal feed. The only costs incurred are for labor responsible for transporting and moving the harvest from the field to the drying location.

In addition to reducing production costs, this mechanism also demonstrates the socio-economic interaction between landowners and farm laborers. The wage system, which provides by-products (animal feed), offers a dual benefit: farmers can reduce costs, while farm laborers gain access to feed, which is often difficult to obtain, especially during the dry season. Furthermore, harvesting activities also create seasonal employment opportunities, as local labor is absorbed in the harvesting, transporting, and drying of corn. Thus, in addition to boosting agricultural productivity, corn cultivation also provides socio-economic benefits to the surrounding community.

Economic Analysis

A. Total Fixed Cost (TFC)

Fixed costs incurred in corn farming on idle/abandoned land of PT Nuansa Cipta Indowarna Mandiri in Sumber Kramat Village, Tongas District, Probolinggo Regency are converted as leased land, this is done so that all costs are recorded so that if cultivation is carried

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out in other locations whose land is not owned, the costs are covered. Meanwhile, for other fixed costs such as equipment and machinery there are no, because the costs related to this are already one package with the use of services such as land processing services using tractors are already one package with operators and machines, farm labor services for example for planting using gejik or sickle tools for harvesting are tools owned by farm laborers, so labor costs are one package with the equipment.

Fixed costs in the corn demonstration plot can be seen in the following table:

Table 2. of Corn Farming on Rainfed Land with an Area of 3,000 m2

No	Information	Cost (Rp)	Total Fixed Costs
1	Land Rent 3,000 m2 per year	IDR. 1,500,000	IDR 500,000
			IDR 700,000

Source: Processed Primary Data, 2025

Land rent per hectare is Rp. 1,500,000 million per year, while for a land area of 3,000 m^2Rp. 700,000 for two planting seasons. If the dry season can be utilized for cultivation, the fixed rental cost per planting is Rp. 500,000 for an area of 3,000 m², so the total Fixed Cost (TFC) is Rp. 500,000.

Total Variable Cost (TVC)

The following are details of the variable costs incurred by corn farmers on rain-fed land in Sumber Kramat Village, Tongas District, Probolinggo Regency.

Table 3. Total Variable Costs of Corn Farming on Rainfed Land with an Area of 3,000 m^2

No	Description	Unit	Price (IDR)	Total Cost (IDR)
1	Matteo 480 SL Grass Medicine	2 bottles	57.600	115.200
1	Hybrid corn seedsNK212	6 kg	93.500	561.000
2	Land cultivation (Hand Tractor)	1 time	1.350.000	1.350.000
3	Fertilization			
	a. Compost	125 kg	300	37.500
	b. Urea Fertilizer	3 sack (@50 kg)	150.000	450.000
	c. Phonska Fertilizer	3 sack (@50 kg)	150.000	450.000

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4	Pest Control			
	a. Insect side Cruiser 350 FS	1 bottle 5 Sachets	30.000 44.000	30.000 220.000
6	b. Cyclone 5.7WG 25 Gram	2 times	1.000.000	2.000.000
7	Irrigation (diesel)	Wholesale	200.000	200.000
	Workforce	Wholesale	75.000	150.000
	1. Planting	3 people	75.000	150.000
	2. 1st fertilization, 0.5 hr	1 person	50.000	50.000
		wholesale	100.000	100.000
	3. 2nd fertilization, 0.5 hr		150.000 100.000	150.000 200.000
	4. Treatment			
	5. Corn transport power			
	6. Harvest consumption			
	7. Drying Corn for 2 days			
	Amount			**6.213.700**

Source: Processed Primary Data, 2025

Urea and Phonska fertilizers for the demonstration plot in this study used subsidized fertilizers and not premium fertilizers, this is intended so that the growth of corn plants until harvest is closer to the habits of farmers' capital so far, only the emphasis is on the addition of compost in more significant amounts, with the hope that if the addition of this compost can significantly increase the fertility of idle land then it can be applied to idle land in other areas. Subsidized and non-subsidized synthetic fertilizers have different qualities, synthetic fertilizers such as Urea and non-subsidized Phonska are of higher quality because their content is purer and can be absorbed more quickly by plants, this is what causes the price of non-subsidized (premium) fertilizers to be more expensive. The use of fertilizers and methods that are close to farmers' methods is due to financial or capital conditions as well as all the limitations of farmers that cause the low level of intensification of one farmer to another farmer is different. Generally, demonstration plots are conditioned in ideal conditions, with premium seeds, fertilizers, and medicines, which will certainly produce abundant harvests. However, when farmers are encouraged to follow this formula, they are unable to afford the capital and if there is a crop failure, for example due to excessive rain, or long droughts, attacks by pests and diseases that are resistant or immune despite systemic control, or when prices fall due to abundant harvests, this will

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destroy the farmers' capital. Therefore, with these considerations in mind, this study uses farmers' capital habits, but emphasizes the addition of compost to improve soil fertility.

The compost fertilizer applied at the start of planting was 100 tons, but in the cost calculations it was considered a variable cost, referring to PT Petrokimia Gresik's balanced fertilization recommendations, which state that 500 kg of solid organic fertilizer is applied to 1 hectare of land for each tillage. Therefore, for

The highest cost is in technical irrigation, for a land area of 3,000 meters the cost incurred is Rp. 1,000,000 for one irrigation and during the corn farming process, this is done because it has not rained for 2 weeks, if technical irrigation is not carried out the plants will lack water and their growth will be disrupted. The harvest from the 3,000 m² demonstration plot yielded 1.4 tons of dry corn kernels after a 98-day planting period. This production serves as the basis for calculating corn farming revenue. At harvest time, the price of corn was quite good at Rp. 5,700 per dry corn kernel (corn price information in the Pungging Mojokerto area reached Rp. 6,150/kg of dry corn kernels on the same day). Based on this price, corn farming revenue can be calculated as follows:

1,400 kg x Rp. 5,700 = Rp. 7,980,000

The total revenue value is then reduced by the total production costs (TVC + TFC) to determine the income from corn farming.

Revenue Analysis

Revenue is a calculation of total revenue minus total costs and can be seen in the following table:

Table 4. Net Income of Rainfed Corn Farming in Sumber Kramat Village, Probolinggo Regency in 2025

No	Cost description		Total cost (Rp)
1	Total Revenue (R)		7.980.000
2	Total cost (TC)		6.713.000
	a) Fixed Costs	500.000	
	b) Variable Costs	6.213.000	
	Income per 3,000 m2		1.267.000
	R/C Ratio		1,19

Source: Processed Primary Data, 2025

Based on Table 4, it is known that the income from corn farming per 3,000 $m^2$is as large as:

1. For 3,000 m^2amounting to Rp. 1,116,300,- or Rp. 3,348,900,- per hectare

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2. R/C Ratio >1 which means that corn farming is still efficient, with a value of 1.19 which is positive.
3. Income can be increased if:

d) Investing in the purchase of a hand tractor machine, so that costs can be reduced in each land processing. And it is necessary to invest in the purchase of a pump machine itself, so that expenses are only to pay for fuel and 1 operator, considering that the highest variable cost is the cost of irrigation, which is 2 times irrigation Rp. 1,000,000 x 2 = Rp. 2,000,000, -, this irrigation cost will increase if the days do not rain increase. Meanwhile, the price of the pump machine can be calculated for depreciation to return on capital. It also includes the need to invest in a machine on a hand tractor for land cultivation, so that the costs incurred are only for

and) To anticipate plants being damaged when they are still small and when heavy rain falls intensely for several days, prepare backup plants, so that when the plants die, they can be replaced with new plants planted in separate beds, for example in polybags.

Social Analysis

Utilization of idle/abandoned land includes:

1. Labor absorption: The cultivation process requires farm laborers, from soil preparation and fertilization to pest and disease control, and finally harvesting. This provides additional income for farm laborers due to the additional work. In some cases, farmers even work part-time as farm laborers while completing their primary work on their own land. The significant benefits of working as a farm laborer can be seen in the variable cost table, specifically the wage. Although small, the work is not done for a full day.
2. Harvesting workers are paid in corn stalks, the stalks and leaves of corn used as feed for their cattle. This means that corn farming on idle/abandoned land contributes to the availability of supplemental feed for farmers' cattle farms.
3. On an area of 3,000 m2 of unused land, the yield of dry corn kernels is 1,400 kg or equivalent to 4,200 kg/ha. The yield can be increased in the next planting because it is the first planting, as well as the risk of damage due to rainwater that damages 20% of the plants when the seeds are not replanted, if replanting is done, the yield can be

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obtained in the range = (100%/80%) x 1,400 kg = 1,750 kg or 5,250 kg per ha if there is no damage due to dead plants as much as 20%.

If the area of idle/abandoned land of 13.4 million ha can be empowered for corn farming, at least 30% planted with corn with an average yield of 5,250 kg, then 9,765,000,000 kg of corn will be produced nationally. If idle/abandoned land can be empowered nationally, it is possible that corn self-sufficiency can be realized, accordingly. It is known that corn imports for food industry needs are still necessary because the quality of local corn does not meet the industry standards, with around 900,000 tons of industrial corn to be imported in 2025. We. Conclusion And Suggestions

4. CONCLUSION

Based on the objectives and results of the research as presented in the description above, the following conclusions can be drawn: PT Nuansa Cipta Indowarna Mandiri's utilization of unused/abandoned land through the use of corn cob compost has proven to provide economic and social benefits. Corn planting on 3,000 m² of unused/abandoned land has proven to provide economic and social benefits. producing 1,400 kg of dry corn kernels**,** With a total cost of Rp 6,713,000, it generated an income of Rp 1,267,000. This income can be increased if crop damage caused by heavy rain during seedling stage can be overcome. Socially, corn farming on idle/abandoned land can absorb labor, provide cattle feed in the form of corn stalks for farm laborers who work in the harvest, and contribute to corn harvest yields that can increase the national corn harvest. Corn Flour which is sugar waste from corn as the basic ingredient can be used as organic fertilizer because it has an organic C content of 25.56% (SNI Solid Organic Fertilizer Organic C content >15%) and a very low Fe content, namely available Fe 83.3 and total Fe 366 (SNI maximum available Fe 500 and maximum total Fe 15,000).

Suggestion

1. Regional and central governments should provide irrigation subsidies and support for production facilities, not only fertilizer but also simple irrigation technology, to reduce the risk of crop failure due to drought in rain-fed areas.
2. It is necessary to conduct training in cultivating dryland adaptive plants, for example legume plants for mining needs such as Pueraria Javanica, Calopogonium Mucunoides and so on for oil palm plantation needs for farmers so that rain-fed land remains productive even in the dry season.

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3. The use of compost needs to be increased on dry land to maintain soil moisture and needs to be developed more widely, both by companies and farmers, because it has been proven to have economic value and is able to improve soil quality.
4. Companies that own abandoned land together with the community can build mutually beneficial agribusiness partnerships, so that sustainable land management, employment absorption, and increased community income can be achieved.
5. The government and the private sector need to encourage the development of organic fertilizer processing businesses from livestock waste, an industry that can be used as organic raw materials that can provide added value and have a positive impact both economically and socially and also contribute to sustainable environmental management.

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