Journal of Smart Agriculture and Environmental Technology
e-ISSN:3021-8802
Vol. 3, No. 2, August 2025
https://josaet.com | https://doi.org/10.60105/josaet.2025.3.2.65-71

Research Paper

Application of KoHeA^{+}MF Compost at Various Dose of Inorganic Fertilizer to Increase Soil Fertility and Production of Hybrid Corn Seeds JH-37

Trisia Wulantika[1], Yun Sondang[1]*, Ngakumalem Sembiring[1], Wiwik Hardaningsih[1], Sentot Wahono[1], Febria Fitri[1], Azzukhruf Ariliusra[1], Hafid Harnas[2]

[1] *Seed Technology Study Program, Department of Food Crops Cultivation, Payakumbuh State Agricultural Polytechnic, Indonesia*
[2] *Head of West Sumatra Branch PT. Agro Zuriat Mandiri, Indonesia*
***Corresponding author**: silitongayun27@gmail.com

Article History: Received: December 5, 2024, Accepted: January 28, 2025

Abstract
Corn is one of the important food commodities after rice and wheat. Corn acts as a food, feed, and industrial ingredient. The need for corn in Limapuluh Kota Regency is very high along with the development of chicken farming businesses that require corn as the largest feed mixture. However, the need for corn has not been met by corn production in this Regency. The low corn production is more due to the low supply and use of superior corn seeds, as well as low soil fertility. One effort to increase soil fertility is the use of KoHeA^{+}MF compost. The purpose of this study is to ascertain how the production of KoHeA^{+}MF hybrid seeds is impacted by the dosage of KoHeA^{+}MF compost and the quantity of inorganic fertilizer that can be substituted. The study was conducted from May to September 2024 at the seed production land of PT. AZUMA Situjuah, Limapuluh Kota Regency, West Sumatra. The study used a Randomized Block Design (RBD) with 5 treatments, including: 100% inorganic fertilizer (Control), 75% inorganic fertilizer + 10 tons/ha KoHeA^{+}MF, 50% inorganic fertilizer + 10 tons/ha KoHeA^{+}MF, 25% inorganic fertilizer + 10 tons/ha KoHeA^{+}MF, and 0% inorganic fertilizer + 10 tons/ha KoHeA^{+}MF. The application of various doses of inorganic fertilizer combined with 10 tons/ha KoHeA^{+}MF affected soil fertility, especially the increase in soil pH (H_2O), organic C, total N, P_2O_5, K_2O, and soil Ca. The application of inorganic fertilizer + 10 tons/ha KoHeA^{+}MF significantly affected vegetative growth, yield components and corn kernel production of JH37 corn. The optimal dosage for dry corn kernel production is 10 tons/ha of KoHeA^{+}MF and 75% inorganic fertilizer.

Keywords
Compost, Corn, KoHeA^{+}MF, Seed, Soil

1. INTRODUCTION

The most vital food is maize (*Zea mays* L.) commodity besides rice and wheat. Maize commodities have various benefits, including as feed, food, and industrial raw materials (Yuwariah et al., 2022). The demand for maize in Indonesia is increasing in line as the population grows and livestock and industrial enterprises that rely on maize as a raw material expand, according to BPS (2023), maize productivity is still low, reaching only 6 tons/ha, below the yield potential of hybrid varieties that can reach yields of more than 10 tons/ha. The low productivity of maize is due to the limited supply and use of quality seeds and low soil fertility due to unbalanced crop management and fertilisation. The utilisation of improved varieties supported by improved seed quality is an efficient strategy to increase maize productivity. Efforts to increase maize productivity can be made through the provision and use of superior varieties, one of which is the provision of seeds of superior varieties of hybrid maize (Yuwariah et al., 2022). In addition, proper fertilisation, such as the use of organic fertilizers, is needed to increase soil productivity and ensure continuity of crop production.

KoHeA^{+}MF compost is one of the organic fertilizers processed from chicken manure with local microorganism solutions from banana weevil as bioaktivator. Local microorganism solutions from banana weevil is a local microorganism of banana weevil defined as a fermentation solution derived from banana weevil containing certain microorganisms. These microorganisms act as bioactivators in composting etc. The nutrients contained in KoHeA^{+}MF compost are total N 1.62%, P_2O_5 3.78%, K_2O 3.03%, Mg 0.80%; Ca 10.1%, and pH 8.94 higher than chicken manure compost without bioactivators which contains nutrients only reaching total N 1.22%, P_2O_5 2.88%, K_2O 1.89%, Mg 0.80%; Ca 10.1%, and pH 8.94 (Laboratorium Central Plantation Services, 2022). Local microorganism solutions from banana weevil as a bioactivator, besides containing nutrients, contains a variety of microorganisms, including *Tricho-*

derma asperellium, *Pseudomonas fluorescens*, *Bacillus subtilis*, *Aspergillus niger*, and *Enterobacter cloacae*. The two genera that can dissolve phosphate the best to enhance the amount of P available to plants are *Bacillus* and *Pseudomonas* (Sondang et al., 2015).

In addition to contributing macro and micro nutrients, organic fertilizer also plays a role in increasing microbial activity and improving soil structure, chemistry and biology so as to increase the quantity and quality of crop yields and is an alternative fertilizer to reduce production costs and good crop management (Mawarti and Musnamar, 2009).

Previous research by Sondang et al. (2023) application of chicken manure + Local microorganism banana weevil provides the best results in pak choy plant production. The study aimed to determine the effect of KoHeA^{+}MF compost and the appropriate dosage level of inorganic fertilizer in an attempt to lessen the usage of inorganic fertilizer and increase the production of JH-37 hybrid maize seeds.

2. EXPERIMENTAL SECTION

2.1 Research Location, Biomaterial Use, and Cultivation Procedures

The experiment was conducted at the PT. Agro Zuriat Mandiri (AZUMA), Situjuh, Limapuluh Kota Regency, located 600 meters above sea level in West Sumatra. The experiment lasted five months from May-September 2024. The materials pure male and female maize seeds are among the resources utilized (CLY231/MAL03), KoHeA^{+}MF compost, inorganik fertilizer (Urea and NPKS), and sample marker stakes. Cultivation procedures : Initial land preparation by clearing the land of weeds. Followed by tillage: (a) The soil is processed until loose and left for at least 1 week, (b) Made Plots with a size of 120 m^2 with a distance of 40 cm between plots, and (c) Application of KoHeA^{+}MF organic fertilizer by spreading it in the path of the plant rows and then mixing it well with the soil. Application time is 1 week before planting with a dose of 10 tons/ha. The seeds used are pure strains, namely CLY231 (female elders) and MAL03 (male elders). Planting distance is 70 cm x 25 cm. The ratio of male and female plants (1:4) is in accordance with PT AZUMA standards. At the age of 2 weeks after planting, an inspection is carried out to remove wild plants that grow from the remaining seeds of the previous planting.

Fertilisation is based on the recommended doses of: 350 kg/ha Urea, 300 kg/ha NPKS. Basic fertilizer applications on a 2500 m^2 land area are: 87.5 kg Urea and 75 kg NPKS. Fertilizer application when the plants are 7 days after planting with a dose of 100 kg/ha Urea, which is as much as 25 kg/2500 m^2) and NPKS fertilizer at a dose of 300 kg/ha or 75 kg/2500 m2. The second Urea fertilizer was applied when the plants were 28-30 hst with a dose of 250 kg/ha (62.5 kg/2500 m^2).

Replanting is done if there are seeds that do not grow or are attacked by pests and diseases. This activity is carried out 1 week after planting. Replanting needs to be done to maintain an optimal population. Watering of maize plants is necessary during planting, flowering 45-56 days after planting and seed filling 60-80 days after planting Roguing is done twice: the first roguing is done when the plants are 32-35 days after planting and the second roguing is done when the plants are 45-52 days after planting. Panicle cutting is done every day during the flowering period age 45-56 days after planting depending on the variety and weather conditions in the field.

Harvesting of JH-37 hybrid maize seeds was done at 108 days after planting, with the following harvest criteria: (a) black layer was formed on the kernels or some parts of the plant had dried up and were brown in colour, (b) the cobs examined for black layer were taken from the female row randomly and represented the other cobs, and (c) black layer observations were made on the kernels at the base, middle and end of the cobs.

2.2 Data Collection

Plants that were randomly selected for observation were examined. Number of leaves, leaf count, leaf length, and leaf width were the vegetative variables that were observed. Length of cob, diameter of cob, number of rows/cob, number of seeds/row, number of seeds/cob, weight 100 grains, wet kernel weight/cob, production/ha and all generative factors that were noted.

2.3 Data Analysis

The experiment was arranged using a Randomized Block Design (RBD) with five treatments, including 100% Inorganik fertilizer (control), 75% Inorganik fertilizer + 10 tons/ha KoHeA^{+}MF, 50% Inorganik fertilizer + 10 tons/ha KoHeA^{+}MF, 25% Inorganik fertilizer + 10 tons/ha KoHeA^{+} MF, and 0% Inorganik fertilizer + 10 tons/ha KoHeA^{+}MF. The treatment was repeated 5 times to obtain 25 treatment units. To test the effect of treatment on the observed variables, a variance analysis of the SPSS program was carried out. If the effect of the treatments is significantly different, the Duncan New Multiple Range Test is then carried out to see the treatment at the 5% level. Fertilisation is based on the recommended doses of: 350 kg/ha Urea, 300 kg/ha NPKS. Basic fertilizer applications on a 2500 m^2 land area are: 87.5 kg Urea and 75 kg NPKS.

3. RESULTS AND DISCUSSION

3.1 Soil Analysis

Findings from the Research Site's Soil Analysis. Table 1 below displays the findings of the preliminary soil nutrient analysis conducted prior to treatment.

Table 1 shows that the pH of the soil at the study site, which is 4.60, falls within the low criterion or acidic soil reaction. According to Hardjowigeno (2003), The primary indicator of the soil's nutrient availability is its pH. Since

Table 1. Results of initial soil analysis at the research site

Parameter	Unit	Value	Criteria*
pH (H_2O)	-	4,60	*low*
C-organic	%	2,50	*medium*
N total	%	0,32	*medium*
C/N	-	7,81	*low*
P_2O_5 (Extr P Bray 2)	ppm	62,2	*very high*
K available	me 100 g^{-1}	1,01	*high*
Mg available	me 100 g^{-1}	2,05	*high*
Ca available	me 100 g^{-1}	4,70	*low*

Source: (Laboratorium Central Plantation Services, 2024).
*Referring to (Balai Penelitian Tanah, 2009)

most nutrients are readily soluble in water at a pH around neutral, nutrient availability in the soil typically occurs at that pH. At low pH, many nutrients are not available to plants. At the study site, the C-organic value is at a medium level, specifically 2.50%. Since the amount of organic matter added to the soil is directly correlated with the amount of soil organic carbon, adding organic matter can both raise the amount of organic carbon and enhance the soil's physical, chemical, and biological qualities. Since carbon serves as a food supply for soil microorganisms, the presence of organic carbon in the soil would increase soil microbe activity as well as activities that call for microorganisms, such as the dissolution of P.

At 7.81, the C/N ratio in the study area fell into the low range. The capacity of soil for microorganisms to break down organic materials into plant nutrients is known as soil C/N. Kusumastuti (2021) asserts that organic matter has a critical role in shaping the chemical, physical, and biological characteristics of soil as well as its fertility. Furthermore, the primary source of several nutrients, like N, is organic matter. As a result, it is necessary to maintain the soil's organic matter level at 2% or above (Mustofa, 2007).

Prior to treatment, the soil's total N concentration was found at 0.32%, according to the results of the analysis, N is a macronutrient that plants need in high amounts. They absorb it as ammonium ($NH4^+$) and nitrate ($NO3^-$). N nutrients in the soil only come from the decomposition of organic matter so that the amount of N is strongly influenced by the amount of organic matter in the soil and the speed of its decomposition (Kusumastuti, 2021). Furthermore, it is explained that the presence of N in the soil through the process: (1) mineralisation of N and its immobilisation; (2) fixation of N from the air by microorganisms (3) through rain and precipitation forms and (4) fertilisation. Conversely, soil N loss can be caused by volatilisation, leaching, denitrification, erosion or plant uptake.

The soil K value is at a high status, namely 1.01 me/100g. The source of K in the soil can come from crop residues, animals, manure and weathering of mineral K. The amount of mineral K in the soil and the degree of weathering of organic matter will have an impact on this (Barber, 1984). Most of the soil K is in soil minerals. Potassium in soil from minerals can be liberated by the effect of carbonic acid. Potassium released through the reaction will be absorbed by plants, lost with drainage water or absorbed by clay colloids.

Magnesium (Mg) and Calcium (Ca) are secondary essential macro-nutrients, required in large quantities but less than the needs of N and K. In Table 1, it can be seen that the Mg nutrient measured 2.05 is included in the high category, while Ca measured 4.70, is in the low criteria. Mg elements in the soil come from the decomposition of rocks containing Mg, absorbed by plants in the form of Mg^{2+} ions. The nutrient Ca in the soil comes from mineral weathering, especially the sand and dust fractions. In addition, Ca also comes from organic matter but in relatively small amounts. Ca nutrients are absorbed by plants in the form of C^{2+} ions (Kusumastuti, 2021). Table 2 below displays the findings of the post-treatment soil nutrient analysis.

According to the findings of the soil analysis, the pH of the soil increased both before and after treatment, although not significantly. In Table 2, it can be seen that the application of organic fertilizer can increase soil pH (pH 4.84-4.96) when compared to the treatment of 100% inorganic fertilizer, without organic fertilizer (pH 4.63). Compost can increase soil pH because it can release base cations. It can be seen that the increase in soil nutrients is directly proportional to the high nutrient content of $KoHeA^+MF$ compost based on Laboratorium Central Plantation Services (2024) data.

The data in Table 2, shows that total soil N increased for all compost application treatments with various dosage levels of inorganic fertilizer. The 75% inorganic fertilizer + 10 tons/ha $KoHeA^+MF$ compost treatment and 50% inorganic + 10 tons/ha $KoHeA^+MF$ compost treatment showed higher soil total N than the 100% inorganic without organic fertilizer treatment. This happened because of the good impact of $KoHeA^+MF$ compost as a fully decomposed organic fertilizer. The breakdown and mineralization of organic materials in the soil is what causes the increase in soil total nitrogen. The process of decomposition of organic matter is carried out by microorganisms which are needed as a source of energy which will then undergo a mineralisation process so as to release N into the soil.

Darnawati (2015) explained that N contained in the soil then undergoes a mineralisation process so that it can release N into the soil to be absorbed by plant roots. Based on Balai Penelitian Tanah (2009), the total N content of the initial soil and after treatment is in the medium criteria of 0.4-0.5%, meaning that the N nutrient state in the soil is sufficient, but still responsive if N fertilisation is carried out. Firmansyah and Sumarni (2013) explained that the absorption of N in the form of NO_3^- and NH^+ by plants

Table 2. Nutrient levels in the soil following treatment with KoHeA+MF compost fertilizer

Treatment	pH (H_2O)	C Organik (%)	N total (%)	C/N	P_2O_5 (ppm)	K (cmol/kg)	Mg (cmol/kg)	Ca (cmol/kg)
100% Inorganik fertilizer (Kontrol)	4,63	3,24	0,33	9,82	103,0	2,38	2,02	4,73
75% Inorganik fertilizer + KoHeA+MF	4,84	2,92	0,38	7,68	70,6	1,44	1,68	4,18
50% Inorganik fertilizer + KoHeA+MF	4,96	3,60	0,43	8,37	69,3	1,76	2,28	5,60
25% Inorganik fertilizer + KoHeA+MF	4,84	2,73	0,33	8,27	60,3	1,42	2,03	5,01

Source: Laboratorium Central Plantation Services (2024)

whose availability depends on the total N of the soil.

Table 2 shows that the lowest C/N value of 7.68 was found in the treatment of 75% inorganic fertilizer + 10 tons/ha of KoHeA+MF compost, indicating that the organic matter in the soil was fully decomposed and provided nutrients faster. Whereas in the 100% inorganic treatment, without organic fertilizer, the C/N ratio is still relatively high, indicating that the inorganic fertilizer given has not decomposed properly due to the lack of microorganism activity in the soil so that the total soil N becomes lower. The P_2O_5 content of the soil before and after treatment is in the very high category. Table 2 shows that the course of treatment of 75% inorganic fertilizer + 10 tons/ha of KoHeA+MF compost and the treatment of 50% inorganic fertilizer + 10 tons/ha of KoHeA+MF compost showed a higher P_2O_5 content compared to the 25% inorganic fertilizer + 10 tons/ha of KoHeA+MF compost. The higher the dose of inorganic fertilizer used, the higher the P_2O_5 content. This happens because of the balance of nutrients in the soil so that it can increase the P_2O_5 content in the soil. According to Kusumastuti (2021), besides organic fertilizer, inorganic fertilizer is a source of P.

Potassium is also an essential nutrient for plants. The content of available K nutrients in the soil is classified as very high criteria with a value > 1 based on data from the Balai Penelitian Tanah (2009). This shows that the level of available K in the soil has exceeded the tolerance limit so that it is not good for plant growth. The treatment of 75% inorganic fertilizer + 10 tons/ha KoHeA+MF compost showed that the lowest available K content was 1.44 me/100 g so that it was more optimum to support plant growth and development. Magnesium element was in the medium and high range. In the 100% inorganic treatment, the Mg content showed the highest value of 4.22 me/100 g and the lowest was in the 75% inorganic + 10 tons/ha KoHeA+MF compost treatment, which was 1.68 me/100 g. This may be due to the effective absorption of Mg nutrients by the plants. This is thought to occur in connection with the effective absorption of Mg nutrients by plants. Hardjowigeno (2003) explained that the process of nutrient loss in the soil is due to several things, namely absorbed by plants, used by microorganisms and washed or eroded. While the element Ca, in all treatments is in the low category. This is in line with the low Ca content at the research location. The addition of KoHeA+MF organic Fertilizer was not able to increase the availability of Ca in the soil. This is in line with the opinion of Kusumastuti (2021), that Ca in the soil generally comes from mineral weathering but only a little comes from organic matter. Soil quality, a crucial indicator of soil's ability to provide essential ecosystem services, is vital for environmental preservation and sustainable agricultural productivity(Li et al., 2023).

3.2 Vegetatif Growth

The results of observations on vegetative growth, yield components and production of JH37 hybrid corn can be seen in Table 3 below.

The best plant height growth was in the 50% inorganic fertilizer + KoHeA+MF treatment. The best number of leaves was in the 100% inorganic fertilizer treatment (Control). The longest leaf length was in the 50% inorganic fertilizer + KoHeA+MF treatment, and the widest leaf width was in the 100% inorganic fertilizer (Control). Overall, a comparison of 50% inorganic fertilizer and 50% KoHeA+MF fertilizer, as well as 100% inorganic fertilizer tends to provide the best growth. Providing 100% inorganic fertilizer provides a faster growth response compared to other treatments. On the other hand, KoHeA+MF fertilizer provides a rather long response because it has to be adjusted to soil conditions first.

The fertilizer treatments given were KoHeA+MF organic fertilizer and inorganic fertilizer. Inorganic fertilizer contain NPK which affects plant height, number of leaves, leaf length and leaf width. This is in accordance with the opinion of Rohmaniya et al. (2023) which states that plants with sufficient N, P, K nutrients have access to nutrients,

Table 3. Vegetative growth of female elders of JH37 broodstock

Treatment	Plant height (cm)	Number of leaves (sheet)	Leaf length (cm)	Leaf width (cm)
100% Inorganik fertilizer (Kontrol)	123,40 a	9,75 b	69,05 a	8,85 c
75% Inorganik fertilizer + KoHeA$^+$MF	153,87 b	9,12 b	75.07 ab	7,87 ab
50% Inorganik fertilizer + KoHeA$^+$MF	157,55 b	8,13 a	77,20 b	8,55 bc
25% Inorganik fertilizer + KoHeA$^+$MF	129,33 a	8,13 a	74,03 ab	7,55 a
0% Inorganik fertilizer + KoHeA$^+$MF	139,60 ab	9,10 b	70,63 ab	7,60 a

*The DMRT test indicates that there is no significant difference between the numbers in the column that are followed by the same lowercase letter at the 5% level of significance.

while the vegetative phase requires the N component for the development of roots, stems, and leaves. This is also in accordance with the opinion of Kochhar and Gujral (2020) which explains that nitrogen nutrients spur the overall vegetative growth of plants, both root, stem and leaf growth, contributing significantly to the production of chlorophyll, which is essential for photosynthetic activity. In addition, nitrogen nutrients also play an important role in the synthesis of proteins and other organic compounds so that the availability of nitrogen nutrients can accelerate the formation of new cells and overall plant growth. Yusuff et al. (2007) claimed that the uptake of N and K in the stems of sweet corn plants cultivated in acidic soils was significantly impacted by nitrogen and K fertilization.

3.3 Result Components and Yield

The results of observations on the yield components and results of JH37 hybrid corn can be seen in Table 4 and Table 5 below.

It is evident from Table 4 that the 75% Inorganic fertilizer + KoHeA$^+$MF treatment has the best yield component data and is different from other treatments. The yield component data correlates with the results of soil analysis and vegetative parameters. Based on the results of soil nutrient analysis, the 75% Inorganic fertilizer + KoHeA$^+$MF treatment has a higher P element than other treatments where the P element functions to grow early roots, energy sources in metobalism, respiration, Kreb's cycle, protein in seeds, seed formation etc. This is in accordance with the results of the study Hatibie et al. (2022) stated that the cob diameter becomes larger if the P nutrient is sufficient, thus influencing the formation of seed cobs. This explanation is relevant to Meena and Bhelave (2023), the physical attributes of maize plants at harvest time include cob length and cob diameter.

The increase in vegetative growth correlates with the leaf area index. The leaf area index is also correlated with high photosynthesis. The higher the photosynthesis, the higher the photosynthate that can be used for the development of the plant's generative components. There are more seed rows per cob as indicated by the rise in cob diameter and length. The number of seeds each row increases as the cob's length increases.

The large weight of these production-related seeds indicates that photosynthate has a significant impact on the more efficient filling of seeds in addition to increasing the cob's length and width. The following yield components can be used to compute production: population, number of cobs per plant, number of rows per cob, number of seeds per row, and seed weight.

Table 5 shows that the treatment of 75% inorganic fertilizer + KoHeA$^+$MF gave the best weight of 100 seeds, dry shell/cob weight, dry shell production per hectare of JH37 corn. A combined dose of 75% inorganic fertilizer and 10 tons/ha of KoHeA+MF provides balance in nutrient uptake by plants, in accordance with the research results of Wulantika et al. (2023) that a combination of 75% - 100% and 10 tons/ha KoHeA$^+$MF provides the best growth and production. Likewise, the results of research by Murnita and Taher (2021) show that the combination of organic fertilizer and inorganic fertilizer provides a significant increase in the weight of 100 grains.

In order to support optimal output, the effectiveness of applying inorganic fertilizer can be increased by using organic fertilizer. A single application of inorganic fertilizer is no longer effective since the majority of the fertilizer will be leached by water or bound by soil colloids, making it unavailable to plants. This disrupts the soil's nutritional balance and results in suboptimal plant production. According to Chen (2006), the application of microbial inoculants can raise the amount of nutrients that can be absorbed from the soil, decrease the amount of inorganic fertilizer, boost plant productivity, and enhance land quality in a sustainable way.

Numerous earlier research have demonstrated that combining organic and inorganic fertilizer can improve crop productivity and soil quality like Chen et al. (2024) in the study Improving Soil Quality with Lower Fertilizer Use to Increase Maize Yield and Nutrient Utilization: The conclusion regarding the effectiveness of organic-inorganic com-

Table 4. Corn yield components JH37

Treatment	Length of cob (cm)	Diameter of cob (cm)	Number of rows/cob (row)	Number of seeds/cob (grains)
100% Inorganik fertilizer (Kontrol)	12,05 a	4,05 a	14,0 a	24,05
75% Inorganik fertilizer + $KoHeA^{+}MF$	13,28 b	4,42 c	18,8 b	25,65
50% Inorganik fertilizer + $KoHeA^{+}MF$	11,86 a	4,34 bc	18,0 b	25,35
25% Inorganik fertilizer + $KoHeA^{+}MF$	11,86 a	4,27 bc	18,0 b	24,05
0% Inorganik fertilizer + $KoHeA^{+}MF$	12,05 a	4,17 ab	17,6 b	24,05

*The DMRT test indicates that there is no significant difference between the numbers in the column that are followed by the same lowercase letter at the 5% level of significance.

Table 5. 100-grain weight, dry kernel weight/cob, and dry kernel production/hectare of Maize JH37

Treatment	Weight of 100 grains (g)	Weight of dried pipilan/cob (g)	Production of dry pipilan/ha (t)
100% Inorganik fertilizer (Kontrol)	214,0 ab	77,495 a	3,655 a
75% Inorganik fertilizer + $KoHeA^{+}MF$	246,8 b	105,082 ab	4,967 b
50% Inorganik fertilizer + $KoHeA^{+}MF$	218,8 ab	88,721 ab	4,185 ab
25% Inorganik fertilizer + $KoHeA^{+}MF$	224,0 ab	79,849 a	3,785 a
0% Inorganik fertilizer + $KoHeA^{+}MF$	202,0 a	87,447 ab	4,297 ab

*The DMRT test indicates that there is no significant difference between the numbers in the column that are followed by the same lowercase letter at the 5% level of significance.

pound fertilizer A useful and efficient strategy for lowering N, P, and K inputs, enhancing soil quality, and eventually raising maize and NUE yields is COIF. Gao et al. (2020) further demonstrated that combining 50% chemical fertilizer with biological organic fertilizer can be a successful substitute fertilizer to lower the use of chemical fertilizers in sustainable agriculture. Bekeko (2013) additionally discover how to boost the production of hybrid maize (BH-140) and maintain its productivity over many years. Sudding et al. (2021) found dosage recommendations for optimal maize production through improved plant growth and yield parameters. Egos and Banoc (2024) The application of 75% inorganic fertilizer and 25% Vermicompost based on their recommended rate obtained the highest marketable ear yield of 8.20 (tons ha^{-1}).

According to the research, the combination of inorganic fertilizer and $KoHeA^{+}MF$ organic fertilizer can enhance soil fertility and boost the yield of hybrid corn seeds variety JH 37. This technology can help PT Agro Zuriat Mandiri promote ecologically friendly farming.

4. CONCLUSION AND SUGGESTION

The application of various doses of inorganic fertilizers combined with 10 tons/ha of $KoHeA^{+}MF$ affected soil fertility, especially the increase in soil pH (H_2O), organic C, total N, P_2O_5, K, and soil Ca. The application of inorganic fertilizers + 10 tons/ha of $KoHeA^{+}MF$ significantly affected vegetative growth, yield components and production of JH37 corn kernels. The best combination for dry corn kernel production was at a dose of 75% inorganic fertilizer and 10 tons/ha of $KoHeA^{+}MF$. The authors suggest further research on the application of $KoHeA^{+}MF$ technology to maize crop production. So that not only seed breeders benefit from the technology but also maize farmers in general.

ACKNOWLEDGEMENT

We would like to thank our colleagues at Politeknik Pertanian Negeri Payakumbuh for their scientific contribution and PT. Agro Zuriat Mandiri as partners in this study. The research was funded by Directorate of Academic Vocational Higher Education, Ministry of Education, Culture, Research and Technology in the 2024 vocational matching fund grant programme.

REFERENCES

Balai Penelitian Tanah (2009). *Petunjuk Teknis Analisis Kimia Tanah, Tanaman, Air dan Pupuk*. Badan Penelitian dan Pengembangan Pertanian, Bogor

Barber, S. (1984). *Soil Nutrient Bioavailability "A Mechanistic Approach"*. John Wiley and Sons Inc., New York

Bekeko, Z. (2013). Improving and sustaining soil fertility by use of enriched farmyard manure and inorganic fertilizers for hybrid maize (BH-140) production at West Hararghe zone, Oromia Eastern Ethiopia. *African Journal of Agricultural Research*, **8**(14); 1218–1224

BPS (2023). *Sumatera Barat dalam Angka*. Badan Pusat Statistik Provinsi Sumatera Barat

Chen, J. H. (2006). The combined use of chemical and organic fertilizers and/or biofertilizer for crop growth and soil fertility. In *International workshop on sustained management of the soil-rhizosphere system for efficient crop production and fertilizer use (Vol. 16, No. 20, pp. 1-11)*. Land Development Department Bangkok Thailand

Chen, X., Z. Li, H. Zhao, Y. Li, J. Wei, L. Ma, F. Zheng, and D. Tan (2024). Enhancing Maize Yield and Nutrient Utilization through Improved Soil Quality under Reduced Fertilizer Use: The Efficacy of Organic–Inorganic Compound Fertilizer. *Agriculture*, **14**(9)

Darnawati, D. (2015). Efektivitas Berbagai Bioaktivator Terhadap Pembentukan Kompos dari Limbah Sayur dan Daun. *Dinamika Pertanian*, **30**(2); 93–100. https://doi.org/10.25299/dp.2015.vol30(2).801

Egos, A. and D. M. Banoc (2024). Growth and yield performance of sweet corn (*Zea mays* L.var. saccharata) applied with organic and inorganic fertilizers under different methods of crop establishment. *SVU-International Journal of Agricultural Sciences*, **6**(3); 90–106

Firmansyah, I. and N. Sumarni (2013). Pengaruh dosis pupuk N dan varietas terhadap pH tanah, N-total tanah, serapan N, dan hasil umbi bawang merah (*Allium ascalonicum* L.) pada tanah entisols-Brebes Jawa Tengah. *Jurnal Hortikultura*, **23**(4); 358–364. http://dx.doi.org/10.21082/jhort.v23n4.2013.p358-364

Gao, C., A. M. El-Sawah, D. F. I. Ali, Y. Alhaj Hamoud, H. Shaghaleh, and M. S. Sheteiwy (2020). The Integration of Bio and Organic Fertilizers Improve Plant Growth, Grain Yield, Quality and Metabolism of Hybrid Maize (*Zea mays* L.). *Agronomy*, **10**(3)

Hardjowigeno (2003). *Soil Fertility*. Balai Pustaka, Jakarta

Hatibie, S., Kaimuddin, and S. Garantjang (2022). The effect of manure combination and liquid organic fertilizer (LOF) on livestock-integrated maize farming production (*Zea mays* L). *Hasanuddin J. Anim. Sci*, **4**(1); 20–29. https://doi.org/10.20956/hajas.v4ij.20594

Kochhar, S. L. and S. K. Gujral (2020). *Plant physiology: Theory and applications*. Cambridge University Press

Kusumastuti (2021). *Buku Ajar Kesuburan Tanah dan Pemupukan*. Poltek Press, Yogyakarta

Laboratorium Central Plantation Services (2022). *Sertifikat hasil pengujian pupuk*. PT. Sentral Alam Receources Lestari, Pekan Baru, Riau

Laboratorium Central Plantation Services (2024). *Sertifikat hasil pengujian pupuk*. PT. Sentral Alam Receources Lestari, Pekan Baru, Riau

Li, G., W. Niu, L. Ma, Y. Du, Q. Zhang, J. Sun, and K. H. M. Siddique (2023). Legacy effects of wheat season organic fertilizer addition on microbial co-occurrence networks, soil function, and yield of the subsequent maize season in a wheat-maize rotation system. *J Environ Manage*, **347**; 119160

Mawarti, E. I. and Musnamar (2009). *Pupuk organik cair dan padat*. Penebar Swadaya, Jakarta

Meena, B. S. and A. K. S. K. Bhelave (2023). Physical Characteristics of Maize Plants for Development of Maize Cobs Picker. *Biological Forum – An International Journal*, **15**(2); 408

Murnita, M. and Y. A. Taher (2021). Dampak pupuk organik dan anorganik terhadap perubahan sifat kimia tanah dan produksi tanaman padi (*Oriza sativa* L.). *Menara Ilmu: Jurnal Penelitian dan Kajian Ilmiah*, **15**(2)

Mustofa, A. (2007). Perubahan Sifat Fisik, Kimia dan Biologi Tanah Pada Hutan Alam Yang diubah Menjadi Lahan Pertanian Di Kawasan Taman Nasional Gunung Leuser

Rohmaniya, F., R. Jumadi, and E. S. Redjeki (2023). Respon pertumbuhan dan hasil tanaman jagung manis (Zea mays saccharata Sturt) pada pemberian pupuk kandang kambing dan pupuk NPK. *Tropcrops (Indonesian Journal of Tropical Crops)*, **6**(1)

Sondang, Y., R. Alfina, and K. Anty (2015). *Caharacteristic of local microorganism from presenteThe National Seminar FoodScurity and Pertanian Berkelanjutan, Tantangan dan Peluang Implementasi Teknologi dalam Prespektif Nasional*

Sondang, Y., T. Wulantika, R. Alfina, N. Sembiring, W. Hardaningsih, and S. Wahono (2023). Effect of Several Types and Doses of Organic Fertilizer on The Growth and Production of Pakcoy Plant (*Brassica chinensis*). In *IOP Conference Series: Earth and Environmental Science (Vol. 1228, No. 1, p. 012024)*. IOP Publishing

Sudding, F., M. Asri, and A. W. Rauf (2021). Application of liquid organic and inorganic fertilizer on growth and production of hybrid maize. In *IOP Conference Series: Earth and Environmental Science (Vol. 648, No. 1, p. 012140)*. IOP Publishing

Wulantika, T., F. Fitri, Ngakumalem, Y. Sondang, W. Hardaningsih, S. Wahono, and K. Anty (2023). Pengaruh pemberian pupuk organik kohea+mf terhadap produksi benih padi Junjuang varietas unggul lokal. *SINTA Journal – Science, Technology and Agriculture Journal*

Yusuff, M. T. M., O. H. Ahmed, W. A. W. Yahaya, and N. M. A. Majid (2007). Effect of organic and inorganic fertilizers on nitrogen and potassium uptake and yield of sweet corn grown on an acid soil. *American Journal of Agricultural and Biological Science*, **2**(2); 118–122

Yuwariah, Y., D. N. Putri, D. Ruswandi, F. Y. Wicaksono, and D. Esperanza (2022). Karakter agronomi beberapa jagung hibrida Padjadjaran dan hubungannya dengan hasil di dataran medium. *Kultivasi*, **21**(2); 231–238