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Response of Sweet Corn (*Zea mays* saccharata Sturt) to Different Decomposers and Rice Straw Compost Dosages

Jamilah *, Fauzi Novia Okta Vino, Milda Ernita, Afri Rona Diyanti, Ermawati, Aslan Sari Thesiwati

[1-6] Universitas Tamansiswa Padang

* Correspondence: jamilah@unitas-pdg.ac.id

ABSTRACT

This study was conducted in Kalumbuk Subdistrict, Kuranji District, Padang City, to evaluate the effects of decomposer type and rice straw compost dosage on the growth and yield of sweet corn. The objective of the study was to determine the effect of decomposer origin and rice straw compost dosage on the growth and yield of sweet corn. The experiment used a factorial randomized complete block design (RCBD) with two factors. The first factor was the type of decomposer consisting of three sources: natural (no added decomposer), EM4, and Crocober Plus LOF (CP LOF). The second factor was the rice straw compost dosage consisting of three levels: 10, 15, and 20 tons per hectare. The results showed no significant interaction between decomposer type and compost dosage on plant height and Leaf Area Index (LAI). However, both decomposer type and compost dosage had significant main effects. Crocober Plus (CP LOF) and EM4 liquid significantly improved plant growth and yield compared to natural decomposer, with CP LOF producing the best results. The optimal compost dosage was 15 t ha^{-1}, which resulted in a maximum yield of 27.46 t ha^{-1} of fresh ear weight.

Keywords: sweet corn; decomposer; EM4; crocober plus; rice straw compost; plant growth; yield

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1. Introduction

Sweet corn (*Zea mays saccharata*) is a variety of maize with a naturally higher sugar content compared to regular corn. It is classified as a functional food due to its bioactive compounds that offer health benefits beyond basic nutritional needs. Sweet corn is widely cultivated in countries such as the United States, Japan, Canada, France, and Taiwan, with the U.S. being the largest producer [17]. Sweet corn contains lutein and zeaxanthin, which are important for eye health; dietary fiber, which supports digestive health and helps regulate cholesterol levels; and a range of vitamins and minerals, including B vitamins, folate, magnesium, and potassium. Its low glycemic index also makes it suitable for diabetic individuals when consumed in moderation. The market potential for sweet corn is growing across Asia and other regions, driven by its use in various culinary applications, such as soups and snacks [1].

Sweet corn is rich in carbohydrates, proteins, vitamins, and minerals, making it a nutritionally valuable crop that can help combat global malnutrition [7]. It has gained popularity in the snack food industry due to its natural sweetness and crunchy texture, making it ideal for a range of products, including frozen corn, sweet corn chips, dried sweet corn toppings, and even sweet popcorn (traditionally not made from sweet corn but increasingly being explored). Its high sugar and low starch content further enhance its appeal as a healthy food option [13].

The trend toward healthy and natural foods is pushing manufacturers to use ingredients like sweet corn to attract nutrition-conscious consumers. Instant and ready-to-eat products such as sweet corn soup, corn pudding, and corn-in-a-cup are becoming increasingly popular. Sweet corn thrives under various environmental conditions, with factors such as temperature, soil fertility, and planting dates significantly influencing yield [15]. Advances in breeding techniques, including genetic innovation, have enhanced the crop's resilience and nutritional profile, supporting its adaptation to different agroecosystems [7]. However, challenges such as climate change and soil degradation may affect future cultivation. Addressing these through sustainable practices and genetic improvements will be key to maintaining its global relevance.

Successful cultivation of sweet corn requires proper fertilization. The use of organic fertilizers is one of the most effective ways to reduce dependency on synthetic fertilizers. The rising cost of chemical fertilizers poses a significant challenge for farmers aiming to increase sweet corn productivity. Among various agricultural wastes, rice straw holds great potential as a compost material for sweet corn cultivation [16]. However, improving the quality of rice straw compost is essential. This can be achieved by adding suitable bioactivators to enhance its positive impact on sweet corn growth.

The liquid of EM4 contains beneficial microorganisms such as *Azotobacter sp.*, *Lactobacillus sp.*, yeast, photosynthetic bacteria, and cellulose-degrading fungi. EM4

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liquid application during composting reduced the C/N ratio of rice straw to 34.40 compared to 39.07 in the control, as microbial activity enhanced organic matter decomposition, decreasing organic carbon and the C/N ratio, while increasing nitrogen and other nutrients [8]. Crocober Plus liquid organic fertilizer (LOF), made from *Chromolaena odorata* and coconut coir, contains a variety of microorganisms including *Bacillus*, *Actinobacteria*, *Streptomyces*, and *Pseudomonas*, which are believed to accelerate the decomposition of organic materials during composting [5]. The objective of this study was to investigate the interaction between different decomposer resources and rice straw compost application rates on the growth and yield of sweet corn (*Zea mays saccharata* Sturt).

2. Materials and Method

The experiment was conducted on dry land classified as Ultisol, located in Kalumbuk Subdistrict, Kuranji District, Padang City, and in the laboratory of the Faculty of Agriculture, Tamansiswa University Padang. The materials used in the experiment included sweet corn seeds (Bonanza variety), rice straw, cattle manure, EM4 liquid, Crocober Plus (CP) liquid organic fertilizer (LOF), urea, KCl, and SP-36 fertilizers.

The experiment employed a factorial randomized block design with two factors. The first factor was the source of decomposer: Natural, EM4 liquid, and CP LOF. The second factor was the dosage of rice straw compost, consisting of three levels: 10 t ha^{-1}, 15 t ha^{-1}, and 20 t ha^{-1}. These two factors were combined into 9 treatment combinations, each replicated 3 times, resulting in a total of 27 experimental plots.

Data were analyzed using analysis of variance (ANOVA), with F-tests at the 5% and 1% significance levels. When significant differences were detected, Duncan's Multiple Range Test (DMRT) at the 5% level was used for mean separation.

The rice straw compost was prepared by chopping the straw into 3 cm pieces, mixing it with cattle manure in a 3:2 (v/v) ratio, and adding a decomposer (either EM4 liquid or CP LOF). The mixture was incubated for 4 weeks. Each decomposer was applied at a rate of 50 mL dissolved in 1 liter of water for every 10 kg of fresh compost material.

The experimental plots measured 300 cm × 200 cm, with a spacing of 30 cm between plots. The compost treatments were applied 7 days before planting. Planting

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was carried out using the dibble method at a depth of 3 cm, with two sweet corn seeds sown per hole. Fertilization followed the recommended rates: 200 kg ha^{-1} of urea, 150 kg ha^{-1} of SP-36, and 100 kg ha^{-1} of KCl. SP-36 and KCl were applied once at 7 days after planting (DAP), while urea was split—half (100 kg ha^{-1}) at 7 DAP and the remaining half at 30 DAP, applied by broadcasting along the plant rows within each plot. Harvesting was done by detaching the cobs from the stalks. Observations were made on the following parameters: plant height, leaf area index (LAI), days to tasseling, days to silking, cob length without husk, fresh kernel weight per plot, and husked cob weight per plot and per hectare

3. Result

There was no interaction between decomposer source and rice straw compost dosage on plant height and leaf area index (LAI) of sweet corn (Table 1). Decomposers from CP LOF and EM4 had a similar positive effect, both significantly better than the natural decomposer alone. Similarly, compost doses of 15 and 20 t ha^{-1} resulted in greater plant height compared to the 10 t ha^{-1} dose at 7 weeks after planting (WAP).

Table 1. Effect of Decomposer Source and Rice Straw Compost Dosage on Plant Height and Leaf Area Index (LAI) of Sweet Corn at 7 Weeks After Planting (WAP)

Nutrient Decomposer Sources	**Plant height cm**	**LAI**
Natural	229,04 b	3,00 b
EM4 Liquid	248,06 a	3,66 a
CP LOF	250,82 a	3,89 a
Compost dosage (t ha-$^{1)}$		
10	240,63	3.21 b
15	240,68	3.59 a
20	246,61	3.75 a
CV (%)	5.76	10.48

Numbers followed by the same lowercase letter in the same column are not significantly different according to DMRT at 5% level.

The use of decomposers such as EM4 liquid and CP LOF is attributed to their higher concentration of microorganisms compared to the natural decomposer (i.e., no added inoculant). However, there was no significant difference between EM4 liquid and CP LOF, indicating both are equally effective. These materials contain

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Bacillus and Pseudomonas species that function as organic matter decomposers, enhancing nutrient availability during the vegetative growth stage of sweet corn. This results in optimal plant growth due to adequate nutrient supply.

Microorganisms such as *Bacillus* and *Pseudomonas* are effective in degrading cellulose and lignin, which are essential for straw composting. For instance, *Bacillus subtilis* and *Streptomyces* have shown significant enzymatic activity, accelerating the decomposition of cellulose and hemicellulose [6] [9]. Synergistic interactions among microbial strains—such as *Trichoderma* and *Aspergillus*—can further enhance decomposition due to complementary enzymatic activities [2]. Microbial communities facilitate nutrient cycling by breaking down organic matter and releasing essential elements like nitrogen and phosphorus, crucial for sweet corn growth. This decomposition also leads to the formation of humic substances, improving soil structure and water retention, which benefits crop performance [14]. While these synergistic microbial effects are beneficial, the complex structure of lignocellulose can limit degradation efficiency, thus requiring a diverse microbial community for optimal outcomes [15].

Similarly, increasing the rate of straw compost application improved plant height; however, applying up to 20 t ha^{-1} did not result in further increases. 15 t ha^{-1} of straw application significantly increased soil organic matter, nitrogen, phosphorus, and potassium levels, leading to higher yields and improved soil fertility [21]. However, higher application rates do not proportionally increase nutrient availability due to nutrient saturation, reducing their effectiveness [10]. Excess straw can also increase microbial activity that competes for nitrogen, potentially causing nitrogen immobilization and reduced availability for crops [19]. The optimal microbial balance was achieved at 15 t ha^{-1}, where decomposition supports nutrient cycling without overwhelming the system [4]. Furthermore, the economic benefit of straw application diminishes beyond 15 t ha^{-1} due to the higher cost of managing additional straw, which may outweigh the marginal gains in yield [18].

Days to Tasseling and Silking

The time of male flower emergence showed no significant interaction between decomposer source and rice straw compost application. However, the source of decomposer had a significant effect, while the rice straw compost dosage had no significant effect, as shown in Table 2. The type of decomposer used in rice straw compost significantly affected the timing of tassel and silk emergence in sweet corn (*Zea mays saccharata* Sturt). Different compost sources—such as cassava peel, water hyacinth, and legume-based compost—have been shown to influence not only

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growth parameters but also flowering time. Cassava peel compost promotes earlier male and female flowering, enhancing overall growth and yield [3]. While water hyacinth compost is effective, it may not accelerate flowering as much as cassava peel. Legume compost with bio-activators, especially when combined with inorganic fertilizers, also advances flowering, suggesting that microbial activity enhances nutrient availability and plant development [8]. Early flowering, driven by improved nutrient release from compost, is critical for optimizing sweet corn productivity [19].

Table 2. Effect of decomposer type and rice straw compost dose on tasseling and silking time of sweet corn

Decomposer Sources	Tasseling	Silking time
	-----------------------DAP-------------------	
Natural	61,78 b	70,11 b
EM4 Liquid	61,89 b	68,44 a
CP LOF	61,11 a	68,33 a
CV (%)	0,87	2.65

Numbers followed by the same lowercase letter in the same column are not significantly different according to DMRT at 5% level.

Ear Length Without Husk, Fresh Kernel Weight, and Ear Weight

The application of different decomposer sources and rice straw compost significantly affected ear length without husk, fresh kernel weight, and ear weight of sweet corn (Table 3). The most effective decomposer was CP LOF, followed by EM4 Liquid, and lastly the natural decomposer. Regarding compost dosage, the application of 15 t ha^{-1} rice straw compost produced the best results, although it was not significantly different from the 20 t ha^{-1} dose across all yield components.

Table 3. Effects of decomposer sources and rice straw compost doses on ear length without husk, fresh kernel weight, and ear weight of sweet corn plants

Nutrient	ear length without husk	fresh kernel weight per plot	ear weight per plot	ear weight per hectare
Decomposer Sources	cm	kg	kg	t
Natural	24,03 b	4,73 c	14,75 b	24,58 b

EM4 Liquid	24,60 a	5,16 b	16,28 ab	27,13 ab
CP LOF	24,61 a	5,64 a	18,07 a	30,12 a
Compost dosage (t ha^{-1})				
10	24.61 a	4.91 b	15.32 a	25.53 a
15	24.03 b	4.24 a	16.48 a	27.46 a
20	24.61 a	5.36 a	17.30 a	28.84 a
CV (%)	2.00	5.86	7,47	

Numbers followed by the same lowercase letter in the same column are not significantly different according to DMRT at 5% level.

CP LOF demonstrated superior performance in enhancing plant growth and yield compared to EM4 and natural decomposers [12]. Effective microorganisms can improve nutrient availability and soil health, leading to better crop performance [20]. A dose of 15 t ha^{-1} of rice straw compost was found to be the most beneficial, significantly increasing ear length and fresh kernel weight [11]. The difference in effectiveness between 15 t ha^{-1} and 20 t ha^{-1} was minimal, suggesting that higher doses may not proportionally improve yields [10]. Conversely, while the use of decomposers and compost has shown benefits, reliance on chemical fertilizers remains common in many agricultural practices, potentially overshadowing the advantages of organic amendments. These findings suggest that integrating organic amendments with appropriate nutrient management may support more sustainable sweet corn production systems.

4. Conclusion

There was no interaction between decomposer sources and rice straw compost doses on plant height and Leaf Area Index (LAI) of sweet corn. CP LOF and EM4 decomposers improved growth and yield compared to the natural decomposer, with CP LOF producing the best results. A rice straw compost dose of 15 t ha^{-1} was found to be optimal, resulting in a maximum ear weight of 27.46 t ha^{-1}.

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