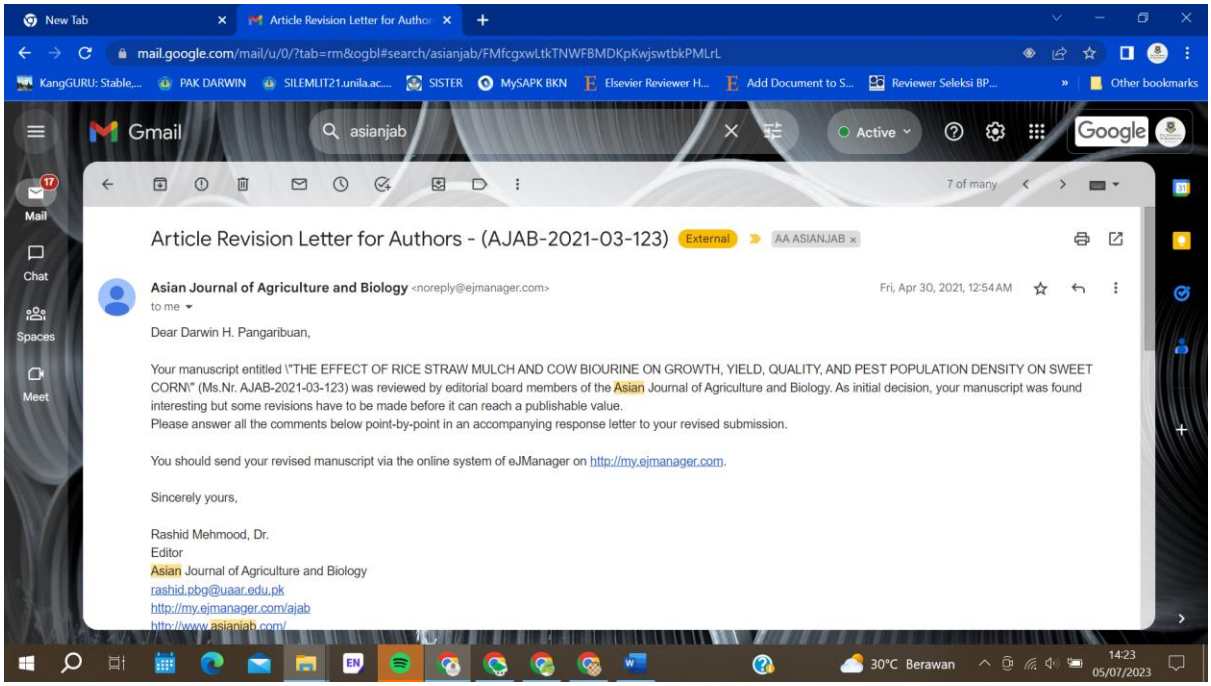

Article Revision Letter for Authors - (AJAB-2021-03-123) External AA ASIANJAB

Asian Journal of Agriculture and Biology <noreply@ejmanager.com> Fri, Apr 30, 2021, 12:54 AM
to me

Dear Darwin H. Pangaribuan,

Your manuscript entitled \"THE EFFECT OF RICE STRAW MULCH AND COW BIOURINE ON GROWTH, YIELD, QUALITY, AND PEST POPULATION DENSITY ON SWEET CORN\" (Ms.Nr. AJAB-2021-03-123) was reviewed by editorial board members of the Asian Journal of Agriculture and Biology. As initial decision, your manuscript was found interesting but some revisions have to be made before it can reach a publishable value.
Please answer all the comments below point-by-point in an accompanying response letter to your revised submission.

You should send your revised manuscript via the online system of eJManager on http://my.ejmanager.com.

Sincerely yours,

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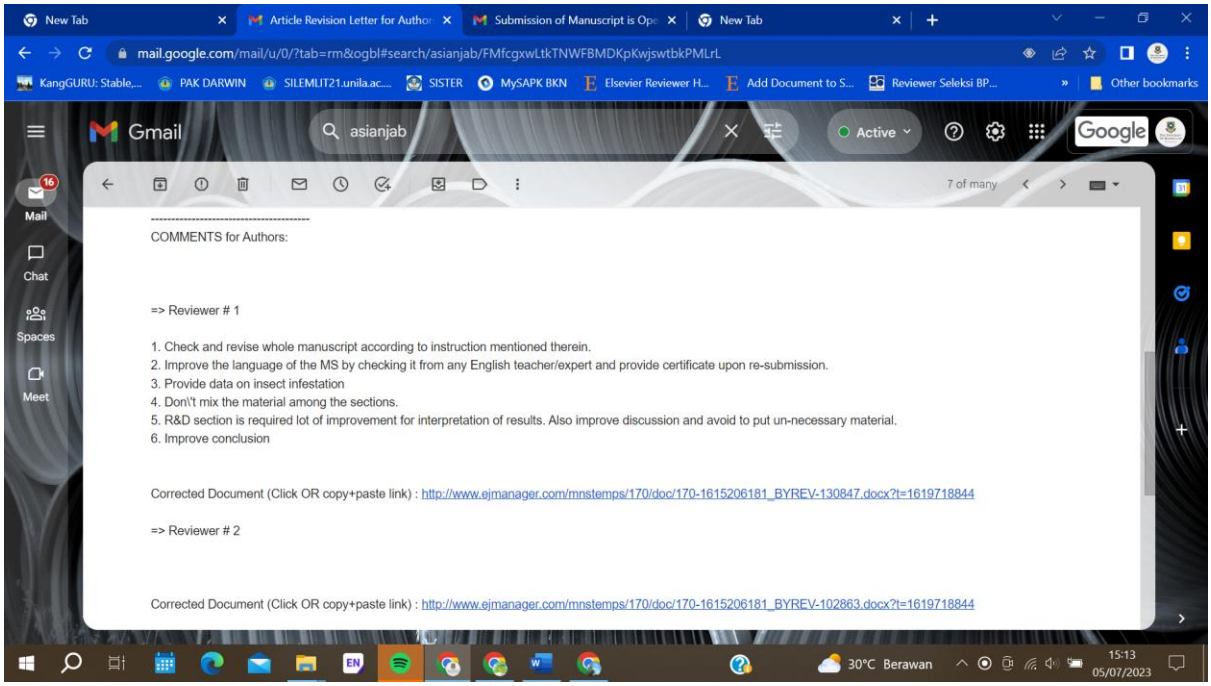

COMMENTS for Authors:

=> Reviewer # 1

1. Check and revise whole manuscript according to instruction mentioned therein.
2. Improve the language of the MS by checking it from any English teacher/expert and provide certificate upon re-submission.
3. Provide data on insect infestation
4. Don\'t mix the material among the sections.
5. R&D section is required lot of improvement for interpretation of results. Also improve discussion and avoid to put un-necessary material.
6. Improve conclusion

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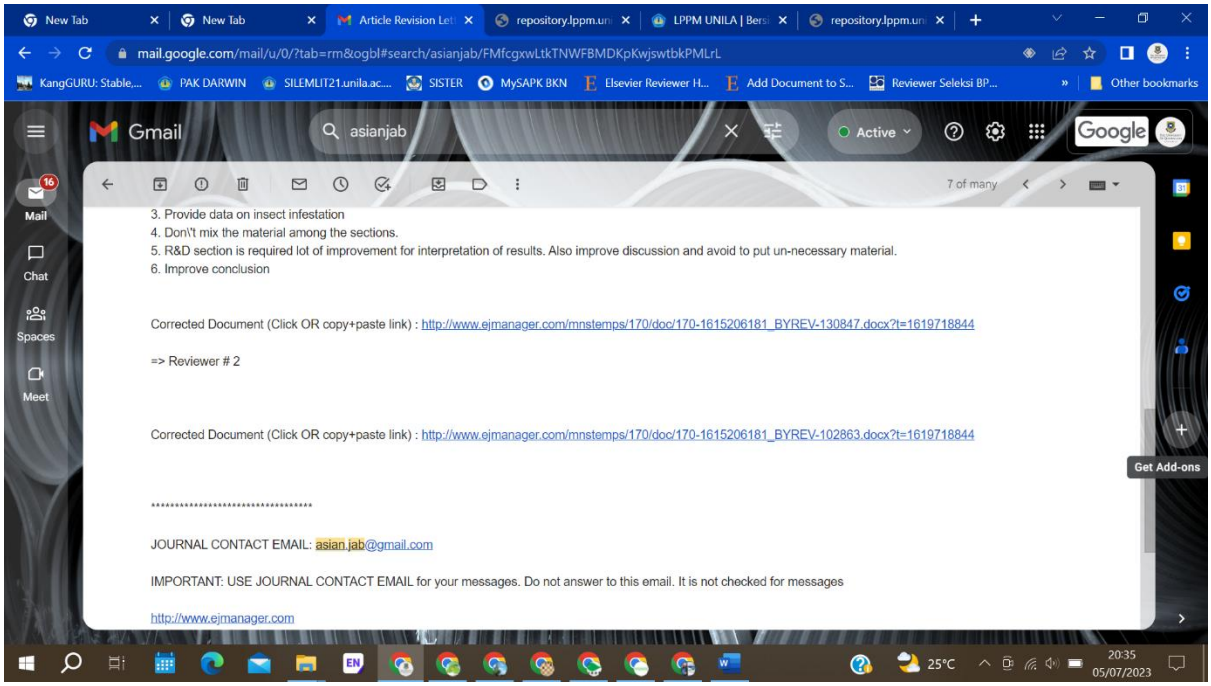
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The introduction, material and methods, results and discussion needs improvement

THE EFFECT OF RICE STRAW MULCH AND COW BIOURINE ON GROWTH, YIELD, QUALITY, AND PEST POPULATION DENSITY ON SWEET CORN

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The study aims to determine the effect of rice straw mulch and cow biourine application on growth, yield, quality, and population of sweet corn pests. This study used a 2 x 4 factorial randomized block design with 3 replications. The first factor is rice straw mulch consisting of 2 levels namely, with mulch and without mulch and the second factor is the concentration of cattle biourine consisting of 4 levels namely, 2.5 ml L^{-1}, 5.0 ml L^{-1}, 7, 5 ml L^{-1}, 10.0 ml L^{-1}. The results showed that rice straw mulch and cow biourine increased the growth, yield, and quality of sweet corn. The maximum yield of 17.87 tons ha^{-1} was achieved in the treatment of straw mulch accompanied by cattle biourine 10.0 ml L^{-1}. While the results of 15.33 tons ha^{-1} were achieved in the treatment without rice straw mulch accompanied by 10.0 ml L^{-1} cow biourine. The intensity of corn planthopper pests (Delphacidae family) ranged from 40-40.4% in 7 WAP and between 44.5 - 51.1% in 8 WAP and was not consistently affected by mulch treatment or the level of concentration of cattle biourine.

Key words: biomulch, liquid fertilizers, nitrogen uptake, organic farming,

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INTRODUCTION

The average productivity of superior sweet corn varieties in Indonesia has only reached 12.97 tonnes ha^{-1}, while the potential yield of superior sweet corn varieties can reach 20.0 tonnes ha^{-1} (Syukur and Rifianto, 2013). One technique to increase the productivity of sweet corn is to maintain soil fertility and increase of nutrients in the soil so that sweet corn plants are healthier and less susceptible to pests and diseases. One way to keep the soil fertile and loose is by mulching application. Mulch is the activity of covering the soil surface in the planting area using organic and inorganic materials. Mulch maintains soil moisture and temperature and suppress weed growth so that plants grow better (Sudjianto and Krestiani, 2009). One alternative to mulch that can be done to keep the soil fertile and loose is straw ~~straw~~. According to Mansyah (2013), the use of straw mulch can also suppress pest attacks by suppressing the growth of weeds which are hosts of pests and plant diseases, thus the use of straw mulch can maintain the sanitation of the planting environment. Some of the main pests in sweet corn plants include borer. corn stalks, caterpillars on cobs, aphids, and grasshoppers.

Sweet corn plants also need complete nutrients for optimal growth and development. One alternative for fertilization is biourine which contains microorganisms which increase the efficiency of nutrient uptake for plants so that it reduces dependence on inorganic fertilizers (N, P, K) and increase plant yields (Sofiana and Syaban, 2017). Purwar and Yadav (2003) stated that biourine and a mixture of neem leaf extracts can control pests in soybean plants. The research objective was to determine the effect

of rice straw mulch and the cow biourine on growth, N nutrient uptake, production, postharvest quality and population of sweet corn (*Zea mays* saccharata).

MATERIALS AND METHOD

This research was conducted at Sepang Jaya Garden, Labuhan Ratu District from March to June 2017. Soil analysis was conducted at the Soil Science Laboratory of the Agrotechnology Department, Faculty of Agriculture, Lampung University, BandarLampung. The materials used in this study were Jamboree cultivar seeds, rice straw mulch, cow biourine, inorganic fertilizers (SP-36 and KCl).

The study was conducted with a factorial randomized block design (2 x 4). The first factor is straw mulch (m) which consists of two levels, namely without mulch (m0) and with mulch (m1). The second factor is the application of cow biourine (b) which consists of 4 levels of bovine biourine with a concentration of 2,5 ml L^{-1} (b_1), 5,0 ml L^{-1} (b_2), 7,5 ml L^{-1} (b_3), dan 10,0 ml L^{-1} (b_4).

The research was carried out starting from the fermentation of cow biourine. The materials used were: 3 liters of cow urine, 3 maja fruit. (*Crescenta cujete* L.), 2 kg of starfruit (*Averrhora bilimbi*), 2 pineapples (*Ananas comosus*), 1 kg of temu giring (*Curcuma heyneana*), 1 kg of white turmeric (*Curcuma manga* Val.) and 1 comb of plantain (*Musa sapientum*) with a ratio of 3: 2: 2: 2: 1: 1: 1. Then all the ingredients are mashed and put in a jerry can and stir until blended. Then the jerry cans are closed tightly and given a plastic hose that is connected to a 1500 ml bottle filled with 500 ml water. After that it is fermented for 21 days, then the cow biourine is filtered, and ready to use.

Land preparation includes soil tillage by clearing the soil from growing weeds by pulling weeds to the roots. The second soil tillage was loosening the soil with a depth of 15-20 cm, then making experiments with a size of 3 m x 3 m. ~~= 9 m2~~ with a distance between plots of 50 cm. The application of rice straw mulch is to cover the soil surface with a thickness of 5 cm with rice straw. Sweet corn is planted at a spacing of 20 cm x 70 cm. The application of inorganic fertilizers is carried out with the recommended dosage of 150 kg ha^{-1} SP-36 and 100 kg ha^{-1} KCl, and cow biourine is applied every two weeks, starting from 2 weeks after planting (WAP) to 8 WAP by watering the cow biourine solution in the soil around the rooting zone of sweet corn. Harvesting is done at 10 WAP.

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The variables observed in this experiment were (1) plant height, (2) number of leaves, (3) leaf greenness using a chlorophyll meter (SPAD), (4) ILD (without units), (5) N uptake of leaves when maximum vegetative value (formula: sweet corn haradaun content (%) x dry weight (g), (6) oven dry stover weight, (7) ha-1 production, (8) ear diameter, (9) 10 weight weighted cobs, (10) weight of 10 cobs without weight, (11) post-harvest weight loss of cobs at room temperature (loss during storage) is measured by means of the difference in ear weight after the 1st, 2nd, 3rd, and 4th day of storage from the weight cobs early harvest, (10) dissolved solids content (0 Brix) day of harvest, 1st, 2nd, 3rd, and 4th after harvest measured by Refractometer, (11) intensity of pest attacks at 7 and 8 mst , and (12) insect populations at 7 and 8 mst.

RESULTS AND DISCUSSION

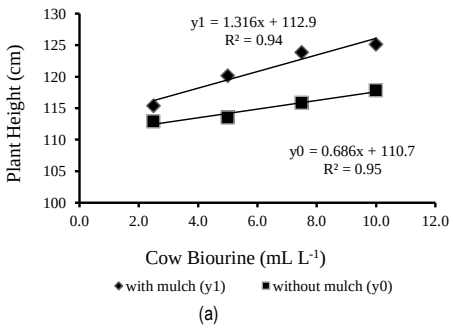
Soil analysis before planting shows that the soil pH is 6.16 which is classified as slightly acidic, available phosphorus is 2.38 ppm which is classified as very low, and the organic carbon content is 1.04%; total nitrogen by 0.10%; K-dd of 0.20 me 100 g-1; KTK of 7.31 me 100 g-1; alkaline saturation by 32.15%; included in the low criteria. In the initial soil analysis, the experiment shows that the available nutrients are still low so that fertilization is needed to add nutrients needed by the plant and add soil amendments such as rice straw mulch to improve the physical condition of the soil.

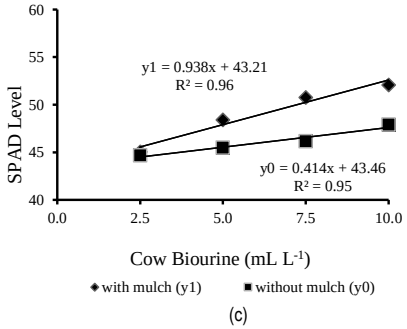
Table 1. Effect of application of rice straw mulch and cow biourine on the vegetative phase of sweet corn plants.

Treatment	Variable Observations					
	Plant height (cm)	**Number of Leaves (blades)**	**SPAD Level (%)**	**LeafArea Index (LAI)**	**Nitrogen uptake of leaves (g/ml)**	**Dry weight per plant (g)**
Straw Mulch (m)	**F-count followed by the difference value (%)**					
p_1 : m_0 vs m_1	86,23*	24,90*	35,59*	63,17*	73,38*	42,33*
	5,05%	7,18%	6,16%	16,01%	16,57%	12,06%
Biourine Cow (b)						
p_2 : b-Linier	72,21*	43,13*	55,56*	74,81*	293,90*	12,54*
p_3 : b-Kuadratik	$0,66^{ns}$	$0,00^{ns}$	$0,32^{ns}$	$1,65^{ns}$	11,55*	$0,23^{ns}$
m xb Interactions						
p_4 : p_1x p_2	7,13*	12,30*	8,35*	22,51*	7,10*	$0,37^{ns}$
p_5 : p_1x p_3	$3,14^{ns}$	$0,18^{ns}$	$2,17^{ns}$	$1,31^{ns}$	$0,00^{ns}$	$0,14^{ns}$

Information: m= Straw Mulch; b= cow biourine; m x b= Interaction straw mulch and cow biourine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to increase plant height, leaf number, leaf greenness, LAI, N nutrient uptake, and dry stover weight of sweet corn plants by 5.05%, 7.18%, 6.16%, 16,01%, 16.57%, and 12.06% higher than without rice straw mulch (Table 1).





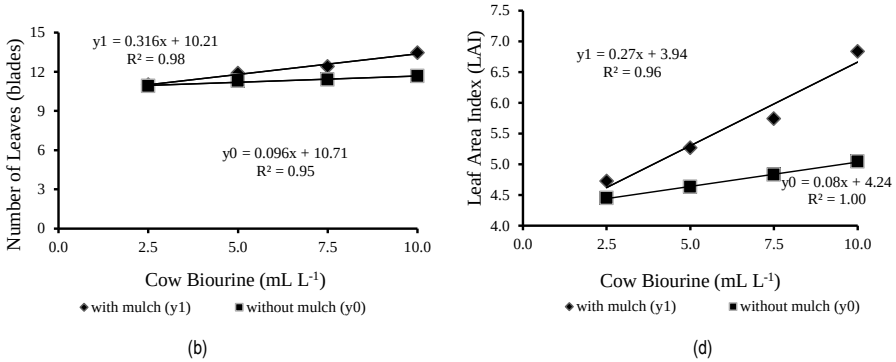


Figure 1. Effect of the interaction of rice straw mulch and cow biourine (a) plant height, (b) number of leaves, (c) level of leaf greenness, and (d) ILD.

Figure 1 it is known that every increase in the concentration of bovine biourine by 1 mlL-1 which is suitable for the application of rice straw mulch can increase plant height, number of leaves, greenness of leaves, and ILD of sweet corn plants respectively 1.32 kg, 0.32 strands , 0.94, and 0.27, while each 1 mlL-1 increase in bovine biourine concentration without rice straw mulch could increase plant height, leaf number, leaf greenness, and ILD of sweet corn plants respectively by 0, 69 kg, 0.10 strands, 0.41, and 0.08.

From Figure 1 it is known that every increase in the concentration of bovine biourine by 1 mlL-1 which is suitable for the application of rice straw mulch can increase plant height, number of leaves, greenness of leaves, and ILD of sweet corn plants respectively 1.32 kg, 0.32 strands , 0.94, and 0.27, while each 1 mlL-1 increase in bovine biourine concentration without rice straw mulch could increase plant height, leaf number, leaf greenness, and ILD of sweet corn plants respectively by 0, 69 kg, 0.10 strands, 0.41, and 0.08.

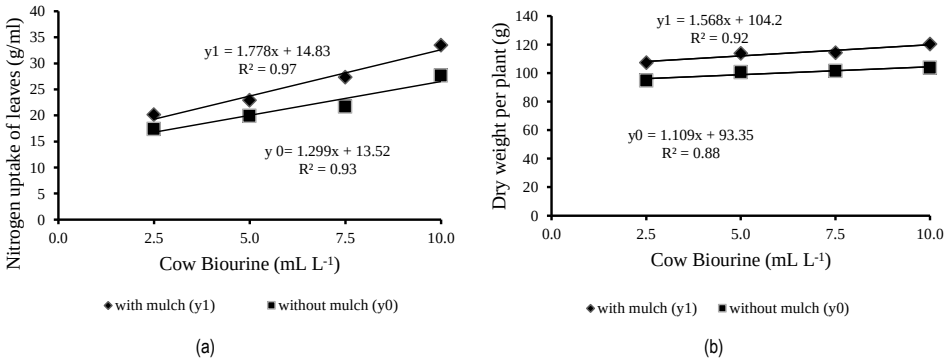


Figure 2. The effect of the interaction of rice straw mulch and cow biourin on (a) N nutrient uptake and (b) dry cage weight

From Figure 2 (a) it is known that every 1 mlL-1 increase in bovine biourine concentration accompanied by rice straw mulch can increase N nutrient uptake in sweet corn by 1.78, whereas each increase in bovine biourine concentration is 1 mlL-1 without mulch. . Rice straw can increase the N nutrient uptake of sweet corn by 1.30.

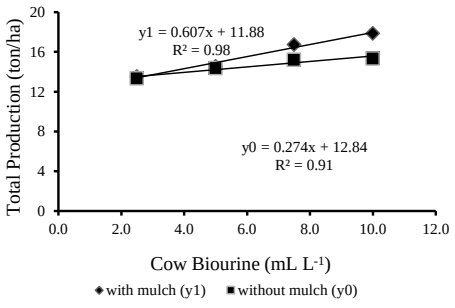
From Figure 2 (b) it is known that every 1 mlL-1 increase in the concentration of bovine biourin accompanied by the addition of rice straw mulch or without straw mulch can increase the dry stover weight of sweet corn by 1.34 g.

Table 2. Effect of application of rice straw mulch and cow biourine on yield and production components of sweet corn.

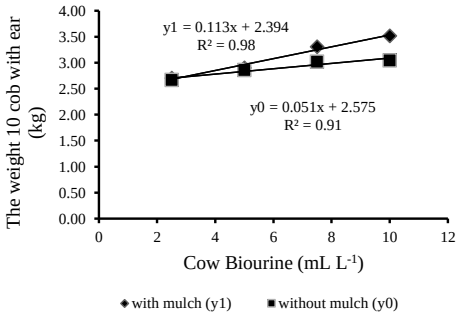
Treatment	Variable Observations			
	Total Production (ton/ha)	Cob Diameter(cm)	The weight 10 cob with ear (kg)	The weight 10 cob without ear (kg)
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	13,68*	30,46*	13,68*	28,93*
	7,14%	12,21%	6,76%	10,87%
Biourine Cow (b)				
p_2 : b-Linier	66,31*	16,81*	66,31*	153,94*
p_3 : b-Kuadratik	0,46^{ns}	0,33^{ns}	0,46^{ns}	0,44^{ns}
m xb Interactions				
p_4 : p_1x p_2	9,45*	8,45*	9,45*	8,71*
p_5 : p_1x p_3	0,46^{ns}	0,33^{ns}	0,67^{ns}	1,59^{ns}

Information: m= Straw Mulch; b= cow biourine; m x b= Interaction straw mulch and cow biourine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to increase production, ear diameter, weight of 10 cobs with husks, and weight of 10 cobs without sweet corn husks, respectively 7.14%, 12.21%, 6.76%, and 10, 87% higher than without rice straw mulch (Table 2).



(a)



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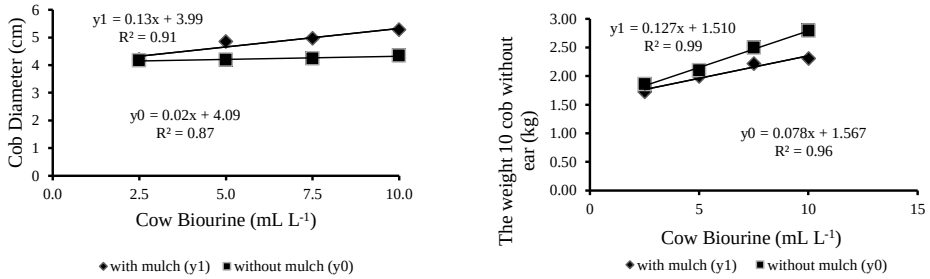

(b) (d)

Figure 3. Effect of the interaction of rice straw mulch and cow biourine on (a) production, (b) ear diameter, (c) weight of 10 cobs with husks, and (d) weight of 10 cobs without husks.

From Figure 3 it is known that each 1 mlL-1 increase in bovine biourine concentration accompanied by the application of rice straw mulch can increase the production of ha-1, ear diameter, weight of 10 cobs with husks, and weight of 10 cobs without husks. Sweet corn each of 0.61 tons, 0.13 cm, 0.11 kg, and 0.13 kg, while each increase in the concentration of bovine biourine by 1 mlL-1 without rice straw mulch can increase the production of ha-1, diameter ear, weights 10 cobs with husks, and weights 10 cobs without husks. Sweet corn is 0.27 kg, 0.02 cm, 0.05 kg, and 0.08 kg, respectively.

Sweet corn production increased due to the application of rice straw mulch. The application of rice straw mulch can improve soil conditions and create favorable environmental conditions to increase nutrient uptake for sweet corn plants. Straw mulch can improve the physical and chemical characteristics of the soil, such as maintaining water content, heat energy, and nutrients in the soil which can increase chlorophyll content, photosynthetics, crop yields, plant growth and development (Zhang *et al.,* 2015). According to Sekhon *et al.* (2008) soil moisture is a limiting factor for cultivation, straw mulch can lower soil temperature, maintain soil moisture and increase plant growth and yield. Increased crop production due to the application of straw mulch was also found in research on rice (Devasinghe *et al.,* 2013), chilies (Sekhon *et al.,* 2008), tomatoes (Rahman *et al*., 2016), and potatoes (Saha *et al*., 1997).

Biourine in this study contained high levels of N nutrient, which was 6657.08 ppm. The N content in cow biourine can provide additional nutrients for sweet corn plants. Bovine biourine also contains growth regulating hormone, namely IAA, which can accelerate the growth and development of sweet corn plants. This is supported by research by Puspadewi *et al.* (2016), which states that the element N is very influential because it is an important element for cell division that will support plant growth, both in increasing size and volume. Similarly, research by Nuraini and Asgianingrum (2017) states that the application of 600 ml L-1 of cow biourine fertilizer per plant gives the best results on pakchoy plants when compared to controls. The use of dairy cow biourine waste significantly increased plant height, leaf number, ear weight, ear length, and ear diameter compared without using fertilizers (Sastro *et al*., 2011).

The application of bovine biourine in this study increased the production of sweet corn plants by 0.27 tonnes ha-1 for every 1 ml L-1 increase in bovine biourine concentration without rice straw mulch. With the application of bovine biourine, the population of soil microorganisms increases, these microbes produce enzymes that can be absorbed by plants and can increase crop yields (Pradhan *et al*., 2017). Application of cow biourine as much as 25,510.20 liters of urine ha-1 increased the variables of the highest plant height, highest stem diameter, highest number of leaves per plant, and highest leaf area of cauliflower (Khanal *et al*., 2010). According to Patil *et al.* (2012), also stated that the application of bovine biourine to chickpeas (*Cicer arietinum* L.) 15 days after flowering could increase plant height, number of branches, leaf area index, number of pods per plant, and yield compared to controls. The highest absorption of N, P, K was from the combined application of the recommended dose of 100% fertilizer with 1200 l ha-1 of cow biourine as a basal application and 50% leaf spray cow biourine (Pradhan *et al.*, 2017). According to research by Santosa *et al.* (2015), stated that biourine 1000 L ha-1 and 100 kg N ha-1 (ZA); 50 kg P2O5 ha-1 (SP36) and 70 kg K2O ha-1 (KCl) were applied to shallot var. The Philippines showed the highest tuber yield (1,932.2 kg m-2) and the lowest showed the treatment of 5 t ha-1 organic fertilizer without biourine with a yield of 1,285.7 kg m-2 or an increase of 50.3%. According to Santosa *et al*. (2014) stated that the addition of biourine increased the growth of Ciherang rice plants (plant height, number of leaves per clump, leaf area per leaf and leaf area index and grain weight.

In a study conducted by Oliveira *et al*. (2009) stated that the application of bovine biourine at a concentration of 1.25% could produce the highest height of lettuce compared to a concentration of 0.00; 0.25; 0.50; 0.75; and 1.00%. Puspita's research (2015) states that the treatment of 20 ml L-1 cow biourine with 100% inorganic fertilizer (urea 220 kg ha -1) has reached its optimum point compared to 10 ml L-1 and 30 L-1 treatments. Qibtiyah *et al.* (2015) reported that the biourine dose consisting of 4 levels: 0, 500, 1000, 1500 and 2000 l ha-1 showed a significant effect on the growth parameters observed in rice, the application of 1500 l ha-1 and 2000 l ha- 1 can increase leaf area, number of plantlets per clump and total dry weight of plants better than other treatments. According to research by Widjajanto *et al*. (2017) the use of local microorganisms (LoM) from rotten fruits and vegetables in fermenting cow biourine into liquid organic fertilizer was determined by the incubation period, especially at 18 days incubation. Therefore, the biourine fermentation process is needed before it is applied to plants.

The application of rice straw mulch and bovine biourine provided an interaction with the vegetative phase of sweet corn plants such as plant height, leaf number, leaf greenness level, and leaf area index (Table 1). With good environmental conditions, the provision of bovine biourine which contains nutrients and ZPT can be absorbed optimally by sweet corn plants. The application of rice straw mulch and cow biourine 10.0 ml L-1 had a significant effect on plant height, leaf number, leaf greenness, ILD, and N nutrient uptake at 6 weeks after planting. In accordance with the research of Zhang *et al*. (2015), which showed that the highest chlorophyll content of corn was the application of rice straw mulch as

much as 12,000 kg ha-1. According to Hisani *et al.* (2015) stated that the use of rice straw mulch and cow urine POC and seaweed POC can increase plant height and number of branches in soybean plants compared to not using POC. Good vegetative growth of sweet corn plants will result in good generative growth. The best production in the treatment of rice straw mulch and cow biourine 10 ml L-1 resulted in a production of 17.87 tonnes ha-1. This is thought to be due to the increase in nutrient uptake in sweet corn plants given cow biourine resulting in a photosynthetic process that goes well and can produce sweet corn cobs of corn properly. This is supported by the research of Taufik *et al.* (2010), which states that if the photosynthesis process goes well, the photosynthate yield will increase in a favorable environment and increase nutrient uptake.

Table 3. The interaction of rice straw mulch and cow biourine application on weight loss of cob without husk and sweetness level of corn after harvest.

Treatment	Variable Observations			
	Diffetence weight loss between 70 and 71 DAP (%)	Diffetence weight loss between 70 and 72 DAP (%)	Sucrose level 71 DAP	Sucrose level 72 DAP
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	14,77*	13,44*	35,57*	38,94*
	43,50%	38,62%	6,12%	6,68%
Biourine Cow (b)				
p_2 : b-Linier	39,73*	34,04*	116,42*	127,46*
p_3 : b-Kuadratik	$3,55^{ns}$	$1,85^{ns}$	$1,84^{ns}$	$2,01^{ns}$
m xb Interactions				
p_4 : p_1x p_2	5,77*	6,24*	$2,12^{ns}$	$2,32^{ns}$
p_5 : p_1x p_3	$0,39^{ns}$	$1,28^{ns}$	$1,18^{ns}$	$1,29^{ns}$

Information: m= Mulch of Straw; b= cow biourine; m x b= Interaction mulch of straw and cow biourine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to reduce weight loss of sweet corn cobs without husks on the 1st and 2nd day after harvest, respectively by 43.50%, and 38.62% lower than without rice straw mulch. and the application of rice straw mulch was able to increase the level of sweetness of sweet corn without husked corn at 71 days and 72 days respectively by 5.56% and 6.12% higher than without rice straw mulch (Table 3).

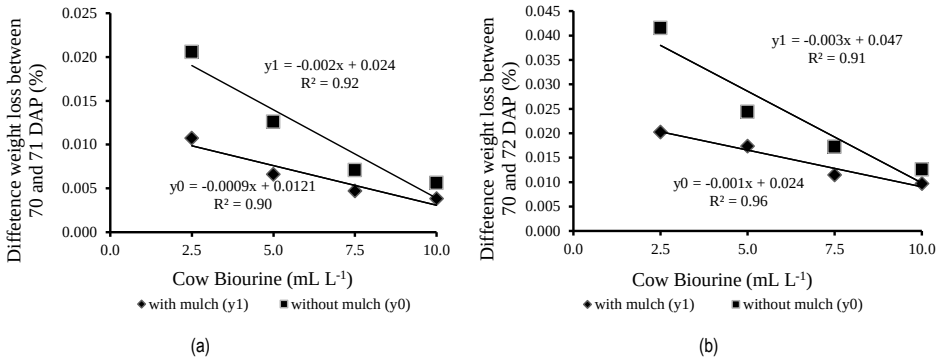

Figure 4. The effect of the interaction of rice straw mulch and cow biourine on weight loss of sweet corn cobs without husks on (a) day 1, (b) day 2 after harvest.

From Figure 4 it is known that each 1 mlL-1 increase in bovine biourine concentration accompanied by the application of rice straw mulch can reduce weight loss of sweet corn cobs without husks on the 1st day, and the 2nd day after harvesting respectively by 0.0009%, and 0.002%, while each 1 mlL-1 increase in the concentration of bovine biourine without rice straw mulch can reduce weight loss of sweet corn cobs without husks on the 1st and 2nd day after harvesting respectively 0.002% and 0.004% .

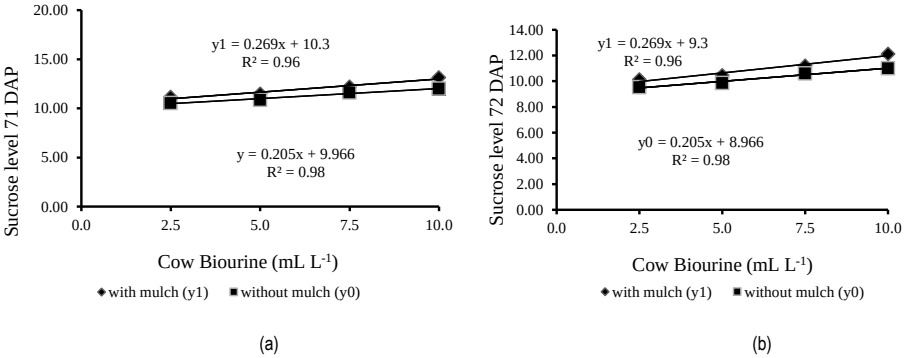

Figure 5. The effect of the interaction of rice straw mulch and cow biourine on the sweetness level of corn at (a) 71 days after planting(b) 72 days after planting.

From Figure 5 it is known that each increase in the concentration of bovine biourine by 1 mlL-1 accompanied by the application of rice straw mulch or without rice straw mulch can increase the sweetness of sweet corn at 71 and 72 days after planting, which is 0.59 ^{0}brix.

Postharvest sweet corn can be seen in the variable weight loss and sweetness content of corn (^{0}brix). The weight loss variables and brix in this study were observed on the harvest day, 1,2,3, and 4 days after the sweet corn was harvested at room temperature. On the 1st, 2nd, 3rd, and 4th day of harvest, there was

a treatment interaction between rice straw mulch and cow biourine. Based on this, it can be said that the use of straw mulch and biourine applications can reduce weight loss. The weight loss in sweet corn is related to the amount of water that evaporates and the process of respiration occurs during the storage process. The ^{0}brix value of sweet corn in the rice straw mulch treatment has a higher ^{0}brix value than without rice straw mulch, and the increasing dose of cow biourine also gives a ^{0}brix value. which is getting higher. For sweet corn that is still fresh, the sugar content is still high. The sweetness level of sweet corn (^{0}brix) decreases every day after harvest. This is because sweet corn is still in the process of respiration after being harvested. The process of respiration results in the metabolism of carbohydrates and fats which produce carbon dioxide, water and heat. Higher temperatures (to the point where enzyme activity is lost) tends to speed up respiration, as well as higher water content. Water and heat generated by respiration will facilitate the growth of microorganisms and pests in addition to increasing the rate of respiration (Widaningrum *et al.*, 2010).

In the 7 mst and 8 mst observations, several types of insect pests were found in sweet corn plants, including the Delphacidae, Noctuidae, and Pyralidae families. And also some insects as natural enemies, namely the family Mantidae, Coccinellidae, Oxyopidae, and Staphylinidae. The highest pest population in this study was the corn planthopper (*Family Delphacidae*).

The intensity of pest attacks at 7 MST ranged from 40-44.4%. The highest damage intensity was found in the m_0b_3 treatment, namely 44.44%. Then on 8 MS observations, the intensity of pest attacks ranged from 44.5 to 51.1%. The intensity of m_0b_3 damage increased to 51.11% and was the highest percentage of damage. The difference in the intensity of damage to cow biourin and rice straw mulch was not much different and did not show a consistent difference in effect, either with mulch treatment or biourin concentration.

The insect pests of the Noctuidae family that were found were the corncob borer. The female insects of this insect will lay eggs on the corn silk and shortly after hatching the larvae will invade the cob and will eat the seeds that are experiencing development. This insect infestation can reduce the quality and quantity of corn cobs (Pabbage *et al*., 2007). This pest was only found in the 7 mst observation in the m0b1 treatment and 8 mst in the m_1b_4 treatment. This pest can be said not to affect the production of sweet corn plants because its appearance is approaching harvest time and the attack from this pest is not serious because it has not entered the inner part of the cob. The Pyralidae family found in sweet corn plantations is the corn stem borer. The corn stem borer (*Ostrinia furnacalis*) is one of the most important pests in maize. Corn stem borer larvae can damage leaves, stems, and male and female flowers (Nonci, 2004).

Corn stem borer populations are most often found at 7 mst and 8 mst, but the population is relatively low. From the observed population, both mulch and no mulch treatment and some cow biourine concentrations did not have a consistent effect on the maize stem borer population. Apart from insect pests, there are also some natural enemy insects that are found in the sweet corn fields. Natural enemies

(predators) are animals or insects that eat other animals or insects. The insects found were from the Coccinellidae, Oxyopidae, Staphylinidae, Mantidae, and Anisolabidae families. The population of natural enemies at the 7 mst and 8 mst observations was classified as low and did not affect the pest population.

The Delphacidae familli insects found were *Stenocranus pacificus.* The presence of *S. pacificus* is the most common among other insect pests. The female insects have a white waxy coating on the ventral part of the abdomen. The appearance of *S. pacificus* on sweet corn plants was followed by the appearance of white wax on the lower surface along the leaf bones. The white candle is where *S. pacificus* lays the eggs. The large attack of these insects can cause plants to experience *hopperburn* (Susilo *et al.,* 2017). In this observation, it can be seen that between mulch treatment and without mulch and some cow biourine concentrations did not have a consistent effect on the population of *S. pacificus (Family Delphacidae).*

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The family Pyralidae found in sweet corn plantations are corn stem borer. The corn stem borer (*Ostrinia furnacalis*) is one of the most important pests in maize. Corn stem borer larvae can damage leaves, stems, and male and female flowers (Nonci, 2004). Corn stem borer populations are most often found at 7 mst and 8 mst, but the population is relatively low. From the observed population, both mulch and no mulch treatment and some cow biourine concentrations did not have a consistent effect on the maize stem borer population. Apart from insect pests, there are also some natural enemy insects that are found in the sweet corn fields. Natural enemies (predators) are animals or insects that eat other animals or insects. The insects found were from the Coccinellidae, Oxyopidae, Staphylinidae, Mantidae, and Anisolabidae families. The population of natural enemies at the 7 mst and 8 mst observations was classified as low and did not affect the pest population.

The population of the maize planthopper (*Family Delphacidae*) is the most dominant among other pests. The intensity of attack of corn leafhoppers (*Family Delphacidae*) which was observed on the leaf bone had symptoms like white wax ranging from 40-40.4% in sweet corn plants aged 7 mst and between 44.5-51.1% at 8 mst and not consistently influenced by mulch treatment and the level of cow biourine concentration. The low pest attack in this study is due to the fact that the liquid biourine fertilizer for cattle also contains fermented vegetable pesticides. According to Tembo *et al.* (2018) stated that the use of pesticide plant extracts to control pests is as effective as the use of synthetic pesticides in terms of yield, while the tritrophic effect is reduced, and can conserve non-target anthropods that provide important ecosystem services such as pollination and pest regulation.

Based on other research, the application of straw mulch combined with biourine fertilizer improved the sweet corn growth, yield, postharvets quality parameters grown in acid soils. In addition, it also had no effect on pest intensity. Furthermore, the application of biourine-organic fertilizer combined with straw mulch is recommended for organic farming practices in the tropics.

Conclusion

The combination of rice straw mulch and cow biourine increases vegetative growth, yield, quality of sweet corn harvest rather than without the application of rice straw mulch. The use of beef biourine with a concentration of at least 10 ml l-1 can be an alternative fertilizer source of Nitrogen. The combination of rice straw mulch with cow biourine can be recommended in organic sweet corn cultivation. The pest population found in this study was low, the pests found were from the Delphacidae, Pyralidae, and Nocturdae families.

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THE EFFECT OF RICE STRAW MULCH AND COW BIOURINE ON GROWTH, YIELD, QUALITY, AND PEST POPULATION DENSITY ON SWEET CORN

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The study aims to determine the effect of rice straw mulch and cow biourine application on growth, yield, quality, and population of sweet corn pests. This study used a 2 x 4 factorial randomized block design with 3 replications. The first factor is rice straw mulch consisting of 2 levels namely, with mulch and without mulch and the second factor is the concentration of cattle biourine consisting of 4 levels namely, 2.5 ml L-1, 5.0 ml L-1, 7.5 ml L-1, 10.0 ml L-1. The results showed that rice straw mulch and cow biourine increased the growth, yield, and quality of sweet corn. The maximum yield of 17.87 tons ha-1 was achieved in the treatment of straw mulch accompanied by cattle biourine 10.0 ml L -1. While the results of 15.33 tons ha-1 were achieved in the treatment without rice straw mulch accompanied by 10.0 ml L -1 cow biourine. The intensity of corn planthopper pests (Delphacidae family) ranged from 40-40.4% in 7 WAP and between 44.5 - 51.1% in 8 WAP and was not consistently affected by mulch treatment or the level of concentration of cattle biourine.

Key words: biomulch, liquid fertilizers, nitrogen uptake, organic farming,

INTRODUCTION

The average productivity of superior sweet corn varieties in Indonesia has only reached 12.97 tonnes ha^{-1}, while the potential yield of superior sweet corn varieties can reach 20.0 tonnes ha^{-1} (Syukur and Rifianto, 2013). One technique to increase the productivity of sweet corn is to maintain soil fertility and increase of nutrients in the soil so that sweet corn plants are healthier and less susceptible to pests and diseases. One way to keep the soil fertile and loose is by mulching application. Mulch is the activity of covering the soil surface in the planting area using organic and inorganic materials. Mulch maintains soil moisture and temperature and suppress weed growth so that plants grow better (Sudjianto and Krestiani, 2009). One alternative to mulch that can be done to keep the soil fertile and loose is straw straw. According to Mansyah (2013), the use of straw mulch can also suppress pest attacks by suppressing the growth of weeds which are hosts of pests and plant diseases, thus the use of straw mulch can maintain the sanitation of the planting environment. Some of the main pests in sweet corn plants include borer. corn stalks, caterpillars on cobs, aphids, and grasshoppers.

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Sweet corn plants also need complete nutrients for optimal growth and development. One alternative for fertilization is biourine which contains microorganisms that ~~which~~ increase the efficiency of nutrient uptake for plants so that it reduces dependence on inorganic fertilizers (N, P, K) and increase plant yields (Sofiana and Syaban, 2017). Purwar and Yadav (2003) stated that biourine and a mixture of neem leaf extracts can control pests in soybean plants. The research objective of this study was to determine the effect of rice straw mulch and the cow biourine on growth, N nutrient uptake, production, postharvest quality and population of sweet corn (*Zea mays* saccharata).

MATERIALS AND METHOD

This research was conducted at Sepang Jaya Garden, Labuhan Ratu District from March to June 2017. Soil analysis was conducted at the Soil Science Laboratory of the Agrotechnology Department, Faculty of Agriculture, Lampung University, BandarLampung. The materials used in this study were Jamboree cultivar seeds, rice straw mulch, cow biourine, inorganic fertilizers (SP-36 and KCl).

The study was conducted with a factorial randomized block design (2 x 4). The first factor is straw mulch (m) which consists of two levels, namely without mulch (m0) and with mulch (m1). The second factor is the application of cow biourine (b) which consists of 4 levels of bovine biourine with a concentration of 2.5 ml L^{-1} (b_1), 5.0 ml L^{-1} (b_2), 7.5 ml L^{-1} (b_3), dan 10.0 ml L^{-1} (b_4).

The research was carried out starting from the fermentation of cow biourine. The materials used were: 3 liters of cow urine, 3 maja fruit. (*Crescenta cujete* L.), 2 kg of starfruit (*Averrhora bilimbi*), 2 pineapples (*Ananas comosus*), 1 kg of temu giring (*Curcuma heyneana*), 1 kg of white turmeric (*Curcuma manga* Val.) and 1 comb of plantain (*Musa sapientum*) with a ratio of 3: 2: 2: 2: 1: 1: 1. Then all the ingredients are mashed and put in a jerry cane and stir until blended. Then the jerry cans are closed tightly and given a plastic hose that is connected to a 1500 ml bottle filled with 500 ml water. After that it is fermented for 21 days, then the cow biourine is filtered, and ready to use.

Land preparation includes primary soil tillage by clearing the soil from growing weeds by pulling weedsthem to the roots. The second soil tillage was done to loosening the soil upto with a depth of 15-20 cm. After that , then making experimental plots were made s with dimention of with a size of 3 m×x 3 m . = 9 m2 with having a distance of 0.5 m between each plots of 50 cm. . The application of rice straw mulch is to cover the soil surface with a thickness of 5 cm with rice straw. Sweet corn is planted at a spacing of 20 cm x 70 cm. The application of inorganic fertilizers is carried out with the recommended dosage of 150 kg ha-1 SP-36 and 100 kg ha-1 KCl, and cow biourine is applied every two weeks, starting from 2 weeks after planting (WAP) to 8 WAP by watering the cow biourine solution in the soil around the rooting zone of sweet corn. Harvesting is done at 10 WAP.

The variables observed in this experiment were (1) plant height, (2) number of leaves, (3) leaf greenness using a chlorophyll meter (SPAD), (4) ILD (without units), (5) N uptake of leaves when maximum vegetative value (formula: sweet corn haradaun content (%) x dry weight (g), (6) oven dry stover weight, (7) ha-1 production, (8) ear diameter, (9) 10 weight weighted cobs, (10) weight of 10 cobs without weight, (11) post-harvest weight loss of cobs at room temperature (loss during storage) is measured by means of the difference in ear weight after the 1st, 2nd, 3rd, and 4th day of storage from the weight cobs early harvest, (10) dissolved solids content (0 Brix) day of harvest, 1st, 2nd, 3rd, and 4th after harvest measured by Refractometer, (11) intensity of pest attacks at 7 and 8 mst , and (12) insect populations at 7 and 8 mst.

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RESULTS AND DISCUSSION

Soil analysis before planting shows that the soil pH is 6.16 which is classified as slightly acidic, available phosphorus is 2.38 ppm ~~which is classified as very low~~, ~~and the~~ organic carbon content is 1.04%; total nitrogen by 0.10%; K-dd of 0.20 me 100 g-1; KTK of 7.31 me 100 g-1; alkaline saturation by 32.15%; included in the low criteria. In the initial soil analysis showd that , ~~the~~ level of ~~experiment shows that the a~~available nutrients are ~~still~~ low for good plant growth so th~~e at~~ fertilization is needed to add nutrients required~~needed~~ by the plant alongwith ~~and add~~ soil amendments such as rice straw mulch to improve the physical condition of the soil.

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Table 1. Effect of application of rice straw mulch and cow biourine on the vegetative phase of sweet corn plants.

Treatment	Variable Observations					
	Plant height (cm)	**Number of Leaves (blades)**	**SPAD Level (%)**	**LeafArea Index (LAI)**	**Nitrogen uptake of leaves (g/ml)**	**Dry weight per plant (g)**
Straw Mulch (m)	**F-count followed by the difference value (%)**					
p_1 : m_0 vs m_1	86,23*	24,90*	35,59*	63,17*	73,38*	42,33*
	5,05%	7,18%	6,16%	16,01%	16,57%	12,06%
Biourine Cow (b)						
p_2 : b-Linier	72,21*	43,13*	55,56*	74,81*	293,90*	12,54*
p_3 : b-Kuadratik	0,66^{ns}	0,00^{ns}	0,32^{ns}	1,65^{ns}	11,55*	0,23^{ns}
m xb Interactions						
p_4 : p_1x p_2	7,13*	12,30*	8,35*	22,51*	7,10*	0,37^{ns}
p_5 : p_1x p_3	3,14^{ns}	0,18^{ns}	2,17^{ns}	1,31^{ns}	0,00^{ns}	0,14^{ns}

Information: m= Straw Mulch; b= cow biourine; m x b= Interaction straw mulch and cow biourine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

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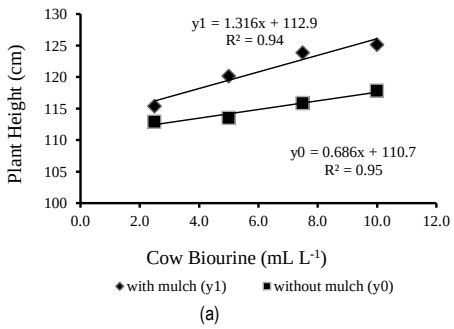
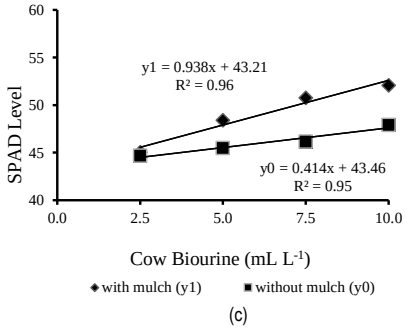
The results showed that the application of rice straw mulch was able to increase plant height, leaf number, leaf greenness, LAI, N nutrient uptake, and dry stover weight of sweet corn plants by 5.05%, 7.18%, 6.16%, 16,01%, 16.57%, and 12.06% higher than without rice straw mulch (Table 1).





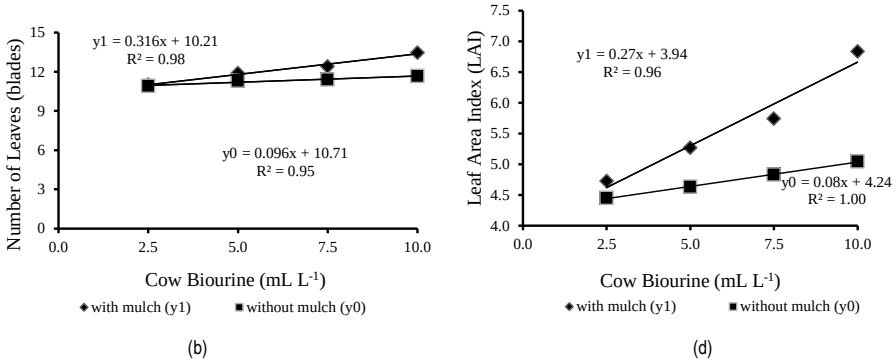


Figure 1. Effect of the interaction of rice straw mulch and cow biourine (a) plant height, (b) number of leaves, (c) level of leaf greenness, and (d) ILD.

Figure 1 it is revealed~~known~~ that every increase in the concentration of bovine biourine by 1 mlL-1 which is suitable for the application of rice straw mulch can increase plant height, number of leaves, greenness of leaves, and ILD of sweet corn, -plants respectively by 1.32 kg, 0.32 strands , 0.94, and 0.27, while each 1 mlL-1 increase in bovine biourine concentration without rice straw mulch could increase plant height, leaf number, leaf greenness, and ILD of sweet corn plants, respectively by 0, 69 kg, 0.10 strands, 0.41, and 0.08.

From Figure 1 it is clear~~known~~ that every increase in the concentration of bovine biourine by 1 mlL-1 which is suitable for the application of rice straw mulch can increase plant height, number of leaves, greenness of leaves, and ILD of sweet corn plants, respectively 1.32 kg, 0.32 strands , 0.94, and 0.27, while each 1 mlL-1 increase in bovine biourine concentration without rice straw mulch could increase plant height, leaf number, leaf greenness, and ILD of sweet corn plants respectively, by 0, 69 kg, 0.10 strands, 0.41, and 0.08.

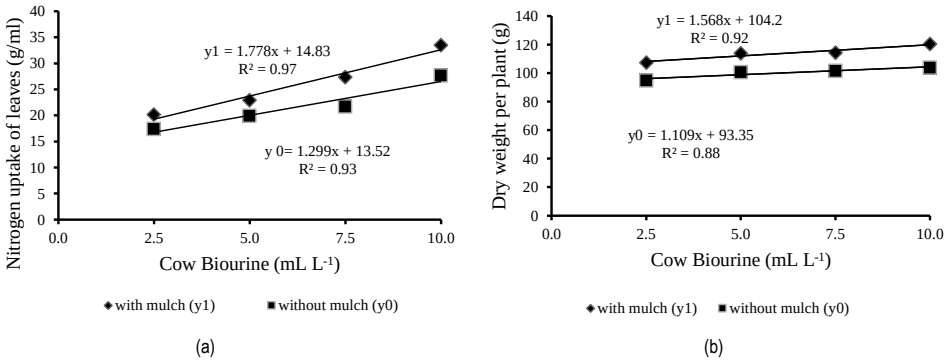


Figure 2. The effect of the interaction of rice straw mulch and cow biourin on (a) N nutrient uptake and (b) dry cage weight

~~From~~ Figure 2 (a) indicated ~~it is known~~ that every 1 mlL-1 increase in bovine biourine concentration accompanied by rice straw mulch can increase N nutrient uptake in sweet corn by 1.78, whereas each increase in bovine biourine concentration is 1 mlL-1 without mulch. . Rice straw can increase the N nutrient uptake of sweet corn by 1.30.

From Figure 2 (b) it is known that every 1 mlL-1 increase in the concentration of bovine biourin accompanied by the addition of rice straw mulch or without straw mulch can increase the dry stover weight of sweet corn by 1.34 g.

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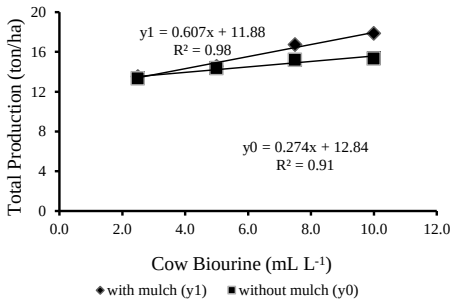
Table 2. Effect of application of rice straw mulch and cow biourine on yield and production components of sweet corn.

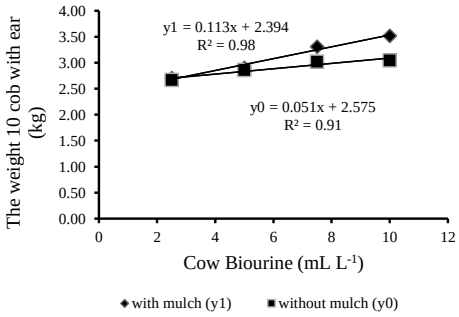
Treatment	Variable Observations			
	Total Production (ton/ha)	Cob Diameter(cm)	The weight 10 cob with ear (kg)	The weight 10 cob without ear (kg)
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	13,68* 7,14%	30,46* 12,21%	13,68* 6,76%	28,93* 10,87%
Biourine Cow (b)				
p_2 : b-Linier	66,31*	16,81*	66,31*	153,94*
p_3 : b-Kuadratik	0,46^{ns}	0,33^{ns}	0,46^{ns}	0,44^{ns}
m xb Interactions				
p_4 : p_1x p_2	9,45*	8,45*	9,45*	8,71*
p_5 : p_1x p_3	0,46^{ns}	0,33^{ns}	0,67^{ns}	1,59^{ns}

Information: m= Straw Mulch; b= cow biourine; m x b= Interaction straw mulch and cow biourine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to increase production, ear diameter, weight of 10 cobs with husks, and weight of 10 cobs without sweet corn husks, respectively by 7.14%, 12.21%, 6.76%, and 10, 87% higher than without rice straw mulch (Table 2).



(a)



(c)

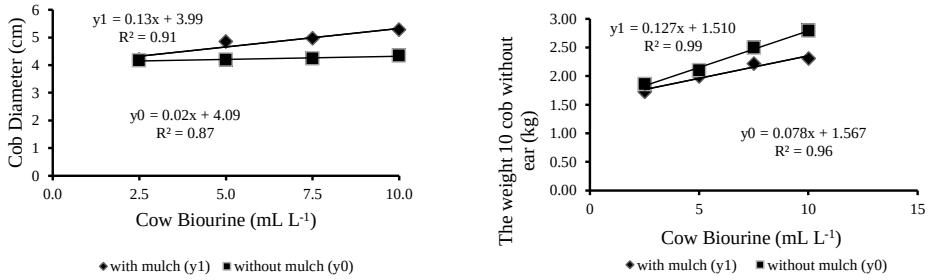


Figure 3. Effect of the interaction of rice straw mulch and cow biourine on (a) production, (b) ear diameter, (c) weight of 10 cobs with husks, and (d) weight of 10 cobs without husks.

From Figure 3 it is known that each 1 mlL-1 increase in bovine biourine concentration accompanied by the application of rice straw mulch can increase the production of ha-1, ear diameter, weight of 10 cobs with husks, and weight of 10 cobs without husks. Sweet corn each of 0.61 tons, 0.13 cm, 0.11 kg, and 0.13 kg, while each increase in the concentration of bovine biourine by 1 mlL-1 without rice straw mulch can increase the production of ha-1, diameter ear, weights 10 cobs with husks, and weights 10 cobs without husks. Sweet corn is 0.27 kg, 0.02 cm, 0.05 kg, and 0.08 kg, respectively.

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Sweet corn production increased due to the application of rice straw mulch. The application of rice straw mulch can improve soil conditions and create favorable environmental conditions to increase nutrient uptake for sweet corn plants. Straw mulch can improve the physical and chemical characteristics of the soil, such as maintaining water content, heat energy, and nutrients in the soil which can increase chlorophyll content, photosynthetics, crop yields, plant growth and development (Zhang *et al.*, 2015). According to Sekhon *et al.* (2008) soil moisture is a limiting factor for cultivation, straw mulch can lower soil temperature, maintain soil moisture and increase plant growth and yield. Increased crop production due to the application of straw mulch was also found in research on rice (Devasinghe *et al.*, 2013), chilies (Sekhon *et al.*, 2008), tomatoes (Rahman *et al*., 2016), and potatoes (Saha *et al*., 1997).

Biourine in this study contained high levels of N nutrient, which was 6657.08 ppm. The N content in cow biourine can provide additional nutrients for sweet corn plants. Bovine biourine also contains growth regulating hormone, namely IAA, which can accelerate the growth and development of sweet corn plants. This is supported by research of~~by~~ Puspadewi *et al.* (2016), which states that the element N is very influential because it is an important element for cell division that will support plant growth, both in increasing size and volume. Similarly, research by Nuraini and Asgianingrum (2017) states that the application of 600 ml L-1 of cow biourine fertilizer per plant gives the best results on pakchoy plants when compared to controls. The use of dairy cow biourine waste significantly increased plant height, leaf number, ear weight, ear length, and ear diameter compared without using fertilizers (Sastro *et al*., 2011).

The application of bovine biourine in this study increased the production of sweet corn plants by 0.27 tonnes ha-1 for every 1 ml L-1 increase in bovine biourine concentration without rice straw mulch. With the application of bovine biourine, the population of soil microorganisms increases, these microbes produce enzymes that can be absorbed by plants and can increase crop yields (Pradhan *et al*., 2017). Application of cow biourine as much as 25,510.20 liters of urine ha-1 increased the variables of the highest plant height, highest stem diameter, highest number of leaves per plant, and highest leaf area of cauliflower (Khanal *et al*., 2010). According to Patil *et al.* (2012), also stated that the application of bovine biourine to chickpeas (*Cicer arietinum* L.) 15 days after flowering could increase plant height, number of branches, leaf area index, number of pods per plant, and yield compared to controls. The highest absorption of N, P, K was from the combined application of the recommended dose of 100% fertilizer with 1200 l ha-1 of cow biourine as a basal application and 50% leaf spray cow biourine (Pradhan *et al.*, 2017). According to research by Santosa *et al.* (2015), stated that biourine 1000 L ha-1 and 100 kg N ha-1 (ZA); 50 kg P2O5 ha-1 (SP36) and 70 kg K2O ha-1 (KCl) were applied to shallot var. The Philippines showed the highest tuber yield (1,932.2 kg m-2) and the lowest showed the treatment of 5 t ha-1 organic fertilizer without biourine with a yield of 1,285.7 kg m-2 or an increase of 50.3%. According to Santosa *et al*. (2014) stated that the addition of biourine increased the growth of Ciherang rice plants (plant height, number of leaves per clump, leaf area per leaf and leaf area index and grain weight.

In a study conducted by Oliveira *et al*. (2009) stated that the application of bovine biourine at a concentration of 1.25% could produce the highest height of lettuce compared to a concentration of 0.00; 0.25; 0.50; 0.75; and 1.00%. Puspita's research (2015) states that the treatment of 20 ml L-1 cow biourine with 100% inorganic fertilizer (urea 220 kg ha -1) has reached its optimum point compared to 10 ml L-1 and 30 L-1 treatments. Qibtiyah *et al.* (2015) reported that the biourine dose consisting of 4 levels: 0, 500, 1000, 1500 and 2000 l ha-1 showed a significant effect on the growth parameters observed in rice, the application of 1500 l ha-1 and 2000 l ha- 1 can increase leaf area, number of plantlets per clump and total dry weight of plants better than other treatments. According to research by Widjajanto *et al*. (2017) the use of local microorganisms (LoM) from rotten fruits and vegetables in fermenting cow biourine into liquid organic fertilizer was determined by the incubation period, especially at 18 days incubation. Therefore, the biourine fermentation process is needed before it is applied to plants.

The application of rice straw mulch and bovine biourine provided an interaction with the vegetative phase of sweet corn plants such as plant height, leaf number, leaf greenness level, and leaf area index (Table 1). With good environmental conditions, the provision of bovine biourine which contains nutrients and ZPT can be absorbed optimally by sweet corn plants. The application of rice straw mulch and cow biourine 10.0 ml L-1 had a significant effect on plant height, leaf number, leaf greenness, ILD, and N nutrient uptake at 6 weeks after planting. In accordance with the research of Zhang *et al*. (2015), which showed that the highest chlorophyll content of corn was the application of rice straw mulch as

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much as 12,000 kg ha-1. According to Hisani *et al.* (2015) stated that the use of rice straw mulch and cow urine POC and seaweed POC can increase plant height and number of branches in soybean plants compared to not using POC. Good vegetative growth of sweet corn plants will result in good generative growth. The best production in the treatment of rice straw mulch and cow biourine 10 ml L-1 resulted in a production of 17.87 tonnes ha-1. This is thought to be due to the increase in nutrient uptake in sweet corn plants given cow biourine resulting in a photosynthetic process that goes well and can produce sweet corn cobs of corn properly. This is supported by the research of Taufik *et al.* (2010), which states that if the photosynthesis process goes well, the photosynthate yield will increase in a favorable environment and increase nutrient uptake.

Table 3. The interaction of rice straw mulch and cow biourine application on weight loss of cob without husk and sweetness level of corn after harvest.

Treatment	Variable Observations			
	Diffetence weight loss between 70 and 71 DAP (%)	Diffetence weight loss between 70 and 72 DAP (%)	Sucrose level 71 DAP	Sucrose level 72 DAP
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	14,77*	13,44*	35,57*	38,94*
	43,50%	38,62%	6,12%	6,68%
Biourine Cow (b)				
p_2 : b-Linier	39,73*	34,04*	116,42*	127,46*
p_3 : b-Kuadratik	$3,55^{ns}$	$1,85^{ns}$	$1,84^{ns}$	$2,01^{ns}$
m xb Interactions				
p_4 : p_1x p_2	5,77*	6,24*	$2,12^{ns}$	$2,32^{ns}$
p_5 : p_1x p_3	$0,39^{ns}$	$1,28^{ns}$	$1,18^{ns}$	$1,29^{ns}$

Information: m= Mulch of Straw; b= cow biourine; m x b= Interaction mulch of straw and cow biourine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to reduce weight loss of sweet corn cobs without husks on the 1st and 2nd day after harvest, respectively by 43.50%, and 38.62% lower than without rice straw mulch. and the application of rice straw mulch was able to increase the level of sweetness of sweet corn without husked corn at 71 days and 72 days respectively by 5.56% and 6.12% higher than without rice straw mulch (Table 3).

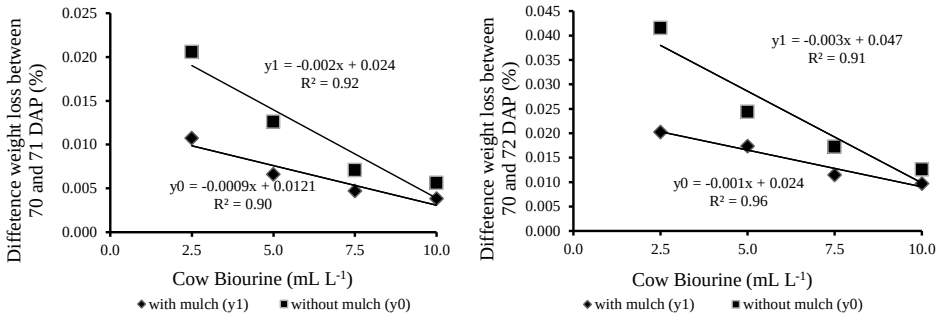

Figure 4. The effect of the interaction of rice straw mulch and cow biourine on weight loss of sweet corn cobs without husks on (a) day 1, (b) day 2 after harvest.

From Figure 4 it is known that each 1 mlL-1 increase in bovine biourine concentration accompanied by the application of rice straw mulch can reduce weight loss of sweet corn cobs without husks on the 1st day, and the 2nd day after harvesting respectively by 0.0009%, and 0.002%, while each 1 mlL-1 increase in the concentration of bovine biourine without rice straw mulch can reduce weight loss of sweet corn cobs without husks on the 1st and 2nd day after harvesting respectively 0.002% and 0.004% .

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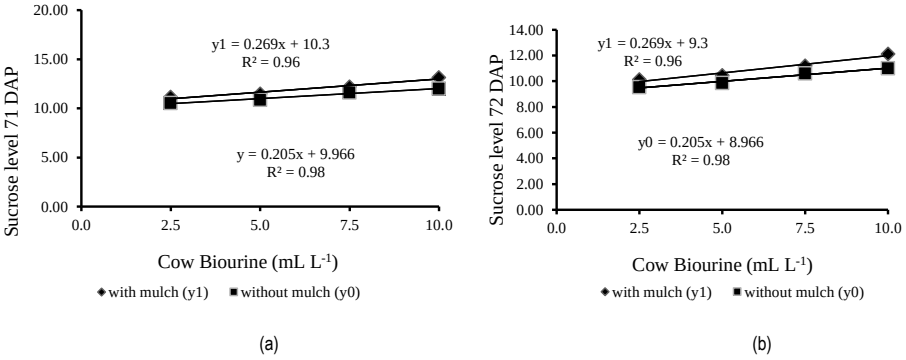

Figure 5. The effect of the interaction of rice straw mulch and cow biourine on the sweetness level of corn at (a) 71 days after planting(b) 72 days after planting.

From Figure 5 it is known that each increase in the concentration of bovine biourine by 1 mlL-1 accompanied by the application of rice straw mulch or without rice straw mulch can increase the sweetness of sweet corn at 71 and 72 days after planting, which is 0.59 ^{0}brix.

Postharvest sweet corn can be seen in the variable weight loss and sweetness content of corn (^{0}brix). The weight loss variables and brix in this study were observed on the harvest day, 1,2,3, and 4 days after the sweet corn was harvested at room temperature. On the 1st, 2nd, 3rd, and 4th day of harvest, there was

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a treatment interaction between rice straw mulch and cow biourine. Based on this, it can be said that the use of straw mulch and biourine applications can reduce weight loss. The weight loss in sweet corn is related to the amount of water that evaporates and the process of respiration occurs during the storage process. The ^{0}brix value of sweet corn in the rice straw mulch treatment has a higher ^{0}brix value than without rice straw mulch, and the increasing dose of cow biourine also gives a ^{0}brix value. which is getting higher. For sweet corn that is still fresh, the sugar content is still high. The sweetness level of sweet corn (^{0}brix) decreases every day after harvest. This is because sweet corn is still in the process of respiration after being harvested. The process of respiration results in the metabolism of carbohydrates and fats which produce carbon dioxide, water and heat. Higher temperatures (to the point where enzyme activity is lost) tends to speed up respiration, as well as higher water content. Water and heat generated by respiration will facilitate the growth of microorganisms and pests in addition to increasing the rate of respiration (Widaningrum *et al.*, 2010).

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In the 7 mst and 8 mst observations, several types of insect pests were found in sweet corn plants, including the Delphacidae, Noctuidae, and Pyralidae families. And also some insects as natural enemies, namely the family Mantidae, Coccinellidae, Oxyopidae, and Staphylinidae. The highest pest population in this study was the corn planthopper (*Family Delphacidae*).

The intensity of pest attacks at 7 MST ranged from 40-44.4%. The highest damage intensity was found in the m_0b_3 treatment, namely 44.44%. Then on 8 MS observations, the intensity of pest attacks ranged from 44.5 to 51.1%. The intensity of m_0b_3 damage increased to 51.11% and was the highest percentage of damage. The difference in the intensity of damage to cow biourin and rice straw mulch was not much different and did not show a consistent difference in effect, either with mulch treatment or biourin concentration.

The insect pests of the Noctuidae family that were found were the corncob borer. The female insects of this insect will lay eggs on the corn silk and shortly after hatching the larvae will invade the cob and will eat the seeds that are experiencing development. This insect infestation can reduce the quality and quantity of corn cobs (Pabbage *et al*., 2007). This pest was only found in the 7 mst observation in the m0b1 treatment and 8 mst in the m_1b_4 treatment. This pest can be said not to affect the production of sweet corn plants because its appearance is approaching harvest time and the attack from this pest is not serious because it has not entered the inner part of the cob. The Pyralidae family found in sweet corn plantations is the corn stem borer. The corn stem borer (*Ostrinia furnacalis*) is one of the most important pests in maize. Corn stem borer larvae can damage leaves, stems, and male and female flowers (Nonci, 2004).

Corn stem borer populations are most often found at 7 mst and 8 mst, but the population is relatively low. From the observed population, both mulch and no mulch treatment and some cow biourine concentrations did not have a consistent effect on the maize stem borer population. Apart from insect pests, there are also some natural enemy insects that are found in the sweet corn fields. Natural enemies

(predators) are animals or insects that eat other animals or insects. The insects found were from the Coccinellidae, Oxyopidae, Staphylinidae, Mantidae, and Anisolabidae families. The population of natural enemies at the 7 mst and 8 mst observations was classified as low and did not affect the pest population.

The Delphacidae familli insects found were *Stenocranus pacificus.* The presence of *S. pacificus* is the most common among other insect pests. The female insects have a white waxy coating on the ventral part of the abdomen. The appearance of *S. pacificus* on sweet corn plants was followed by the appearance of white wax on the lower surface along the leaf bones. The white candle is where *S. pacificus* lays the eggs. The large attack of these insects can cause plants to experience *hopperburn* (Susilo *et al.*, 2017). In this observation, it can be seen that between mulch treatment and without mulch and some cow biourine concentrations did not have a consistent effect on the population of *S. pacificus (Family Delphacidae).*

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The population of the maize planthopper (*Family Delphacidae*) is the most dominant among other pests. The intensity of attack of corn leafhoppers (*Family Delphacidae*) which was observed on the leaf bone had symptoms like white wax ranging from 40-40.4% in sweet corn plants aged 7 mst and between 44.5-51.1% at 8 mst and not consistently influenced by mulch treatment and the level of cow biourine concentration. The low pest attack in this study is due to the fact that the liquid biourine fertilizer for cattle also contains fermented vegetable pesticides. According to Tembo *et al.* (2018) stated that the use of pesticide plant extracts to control pests is as effective as the use of synthetic pesticides in terms of yield, while the tritrophic effect is reduced, and can conserve non-target anthropods that provide important ecosystem services such as pollination and pest regulation.

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Based on other research, the application of straw mulch combined with biourine fertilizer improved the sweet corn growth, yield, postharvets quality parameters grown in acidic soils. In addition, it also had no effect on pest intensity. Furthermore, the application of biourine-organic fertilizer combined with straw mulch is recommended for organic farming practices in the tropics.

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Conclusion

The combination of rice straw mulch and cow biourine increases vegetative growth, yield, quality of sweet corn harvest rather than without the application of rice straw mulch. The use of beef biourine with a concentration of at least 10 ml l-1 can be an alternative fertilizer source of Nitrogen. The combination of rice straw mulch with cow biourine can be recommended in organic sweet corn cultivation. The pest population found in this study was low, the pests found were from the Delphacidae, Pyralidae, and Nocturdae families.

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=> Reviewer # 1

1. Check and revise whole manuscript according to instruction mentioned therein.
2. Improve the language of the MS by checking it from any English teacher/expert and provide certificate upon re-submission.
3. Provide data on insect infestation
4. Don\'t mix the material among the sections.
5. R&D section is required lot of improvement for interpretation of results. Also improve discussion and avoid to put un-necessary material.
6. Improve conclusion

Comments to reviewer 1.

Question 1,2, 5 & 6

Response: I Agree with Reviewer. The manuscript has been revised thoroughly according to instruction mention including improvement in English after consultation and discussion with English expert.

Question 3.

I agree with Reviewer. Data on insect infestation has been provided in the last paragraph of discussion

Question 4

I agree with reviewer. There is no longer mix the material among sections.

Reviewer 2:

The introduction, material and methods, results and discussion needs improvement

Response

I totally agree with Reviewer 2. The manuscripts have been revised completely with improvement in Introduction, Materials and Methods, and Results and Discussion

THE EFFECT OF RICE STRAW MULCH AND COW URINE ON GROWTH, YIELD, QUALITY ON SWEET CORN AND PEST POPULATION DENSITY

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Organic matter such as paddy straw mulch and cow urine could be used to improve the soil structure. The study aims to determine the effect of rice straw mulch and cow urine application on growth, yield, quality, and population of sweet corn pests. This study used a 2 x 4 factorial randomized block design with three replications. The first factor is rice straw mulch consisting of 2 levels, namely, with mulch and without mulch, and the second factor is the concentration of cattle urine composed of 4 levels, namely 2.5 ml L^{-1}, 5.0 ml L^{-1}, 7,5 ml L^{-1}, 10.0 ml L^{-1}. The results showed that rice straw mulch and cow urine increased sweet corn's growth, yield, and quality. The maximum yield of 17.87 t ha^{-1} was achieved in the treatment of straw mulch accompanied by cattle urine 10.0 ml L^{-1}. In comparison, the results of 15.33 t ha^{-1} were achieved in the treatment without rice straw mulch accompanied by 10.0 ml L^{-1} cow urine. The intensity of corn planthopper pests (Delphacidae family) ranged from 40-40.4% in 7 WAP and between 44.5 - 51.1% in 8 WAP and was not consistently affected by mulch treatment or the level of concentration of cattle urine.

Keywords: liquid fertilizers, nitrogen uptake, organic farming, postharvest, soil structure

INTRODUCTION

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In Indonesia, sweet corn cultivation has not yet reached its optimum production. Maintaining soil fertility and enhancing nutrients to make sweet corn plants healthier and less susceptible to pests and diseases is one way of increasing sweet corn yield. Organic materials, such as paddy straw mulch and cow urine, keep the soil productive and good soil structure. Mulch covers the soil surface in the planting area using organic and inorganic materials (Iqbal *et al*., 2020).

Paddy straw can function as a mulch that maintains soil moisture and temperature and suppresses weed growth (Paul *et al*., 2021) so that plants grow better. According to Adnan *et al*., (2020), the use of straw mulch can help reduce pest attacks by reducing the growth of weeds that serve as hosts for pests and plant diseases, ensuring that the planting environment is kept clean. Some of the main pests in sweet corn plants include borer, corn stalks, caterpillars on cobs, aphids, and grasshoppers. The Pyralidae family found in sweet corn plantations is the corn stem borer. The corn stem borer (*Ostrinia furnacalis*) is one of the most important pests in maize. Corn stem borer larvae can damage leaves, stems, and male and female flowers (Nonci, 2004).

Sweet corn (*Zea mays* subs. mays) requires full nutrients for proper growth and development. Cow urine is a source of nitrogen, phosphate, potassium, calcium, magnesium, chlorite, and sulphate (Pradhan *et. al*., 2018). It contains microorganisms that increase the efficiency of nutrient uptake for plants so that it reduces dependence on inorganic fertilizers and increases plant yields (Sofiana and Syaban, 2017). Many positive results have been shown on the application of urine. A study conducted by Oliveira *et al*. (2009) stated that the application of urine at a concentration of 1.25% and 1.00% for leaf and soil applications, respectively, could produce the highest height of lettuce. Puspita's research (2015) states that the treatment of 20 ml L^{-1} cow urine with 100% inorganic fertilizer (urea 220 kg ha^{-1}) has reached its optimum point compared to 10 ml L^{-1} and 30 ml L^{-1} treatments. Qibtiyah *et al.*, (2015) reported that the application of urine 1500 and 2000 l ha^{-1} showed a significant effect on the growth parameters observed in rice. Result of Pradhan *et al*., (2017), the highest absorption of N, P, K was from the combined application of the recommended dose of 100% fertilizer with 1200 l ha^{-1} of cow urine as a basal application and 50% leaf spray cow urine. According to Santosa *et al.* (2015) urine combined with inorganic fertilizers had resulted in a higher yield of shallot than without urine. The urine fermentation process is needed before it is applied to plants. Research by Widjajanto *et al*. (2017) showed that the use of local microorganisms (LoM) from rotten fruits and vegetables in fermenting cow urine into liquid organic fertilizer was determined by the incubation period, especially at 18 days incubation. In general, cow urine has been used to improve the growth of food crops such as rice (Santosa, 2014), chickpeas (Patil *et al*., 2012), and used as biopesticides (Patel *et al*., 2019).

Little information exists on the combination effect of mulch and urine. The research objective was to determine the effect of rice straw mulch and the fermented cow urine on growth, N nutrient uptake, yield, postharvest quality of sweet corn, and pest population density

MATERIALS AND METHOD

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This research was conducted at Kebun Lapang experimental site located at 5°22'23"S 105°15'49"E, 374 m above sea level, Bandar Lampung, Indonesia, from March to June 2017. The soil type experimental plot was sandy clay loam in texture, neutral in reaction, medium in available nitrogen, phosphorous, potassium. It belonged to the order Ultisol of shallow to medium depth.

The study was conducted with a factorial Randomized Block Design 2 x 4. The first factor is straw mulch (m) which consists of two levels, namely without mulch (m0) and with mulch (m1). The second factor is the application of cow urine (b) which consists of 4 levels of urine with a concentration of 2.5 ml L^{-1} (b_1), 5.0 ml L^{-1} (b_2), 7.5 ml L^{-1} (b_3), and 10.0 ml L^{-1} (b_4).

The research was carried out starting from the fermentation of cow urine. The materials used were: 3 liters of cow urine, 3 kg mojo fruit (*Aegle marmelos*), 2 kg of starfruit (*Averrhora bilimbi*), 2 kg pineapples (*Ananas comosus*), 1 kg of curcuma (*Curcuma heyneana*), 1 kg of white turmeric (*Curcuma*

manga Val.) and 1 kg of banana corm (*Musa paradisiaca*) with a ratio of 3: 3: 2: 2: 1: 1: 1. Then all the ingredients are mashed and put in a jerrycan, and blended. Then the jerrycan is closed tightly and given a plastic hole connected to a 1500 ml bottle filled with 500 ml water. After that, it is fermented for 21 days, the cow urine is filtered and ready to use.

Land preparation includes soil tillage by clearing the soil from growing weeds by pulling weeds to the roots. The second soil tillage was loosening the soil with a depth of 15-20 cm, then plotting the size of 3 m x 3 m = 9 m^2 with a distance between plots of 50 cm. The application of rice straw mulch is to cover the soil surface with a thickness of 5 cm with rice straw. Sweet corn is planted at a spacing of 20 cm x 70 cm. Recommended inorganic fertilizers are applied at a rate of 150 kg N ha^{-1}, 100 kg SP-36 ha^{-1}, and 100 kg KCL ha^{-1}. The fermented cow urine is applied every two weeks by watering the cow urine solution into the soil around the sweet corn rooting zone (soil drench). Weeds were controlled manually. Pest and diseases were relatively free from the experimental site. Harvesting is done at 11 WAP.

The variables observed in this experiment were (1) plant height, (2) number of leaves, (3) leaf greenness using a chlorophyll meter (SPAD value), (4) N uptake of leaves when maximum vegetative, (5) oven-dry stover weight, (6) yield, (7) ear diameter, (8) weight of 10 cobs from the tagged plants with husk and (9) without husk, (10) postharvest weight loss of cobs at room temperature (loss during storage) is measured through the difference in ear weight after the 1^{st}, 2^{nd}, 3^{rd}, and 4^{th} day of storage from the weight cobs early harvest, (11) soluble solids content (°Brix) day of harvest at 1^{st} & 2^{nd} after harvest measured by Refractometer, (12) intensity of pest attacks at 7 and 8 WAP, and (13) insect populations at 7 and 8 WAP.

RESULTS AND DISCUSSION

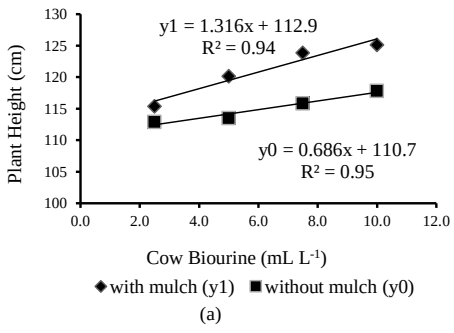
Before planting, soil analysis revealed that the pH was 6.16, which is slightly acidic, available phosphorus was 2.38 ppm, which is very low, and the organic carbon content was 1.04%; total nitrogen was 0.10%; K-dd was 0.20 me 100 g^{-1}; CEC was 7.31 me 100 g^{-1}; alkaline saturation was 32.15%, all of which met the low criteria. In the initial soil analysis, the experiment shows that the available nutrients are still low so that fertilization is needed to add nutrients needed by the plant and add soil amendments such as rice straw mulch to improve the physical condition of the soil.

Table 1. Effect of rice straw mulch and cow urine on the vegetative phase of sweet corn plants.

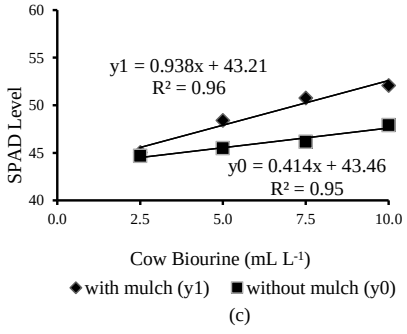
Treatment	Variable Observations				
	Plant height (cm)	Number of Leaves (blades)	SPAD Level (%)	Nitrogen uptake of leaves (g/ml)	Dry weight per plant (g)
Straw Mulch (m)	**F-count followed by the difference value (%)**				
p_1 : m_0 vs m_1	86.23*	24.90*	35.59*	73.38*	42.33*
	5.05%	7.18%	6.16%	16.57%	12.06%
Urine Cow (b)					
p_2 : b-linear	72.21*	43.13*	55.56*	293.90*	12.54*
p_3 : b-quadratic	0.66^{ns}	0.00^{ns}	0.32^{ns}	11.55*	0.23^{ns}
m xb Interactions					
p_4 : p_1x p_2	7.13*	12.30*	8.35*	7.10*	0.37^{ns}
p_5 : p_1x p_3	3.14^{ns}	0.18^{ns}	2.17^{ns}	0.00^{ns}	0.14^{ns}

Notes: m= Straw Mulch; b= cow urine; m x b= Interaction straw mulch and cow urine,
*= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to increase plant height, leaf number, SPAD value, N nutrient uptake, and dry weight of sweet corn plants by 5.05%, 7.18%, 6.16%, 16.57%, and 12.06% higher than without rice straw mulch (Table 1).



(a)



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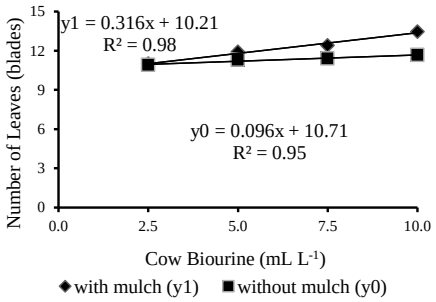
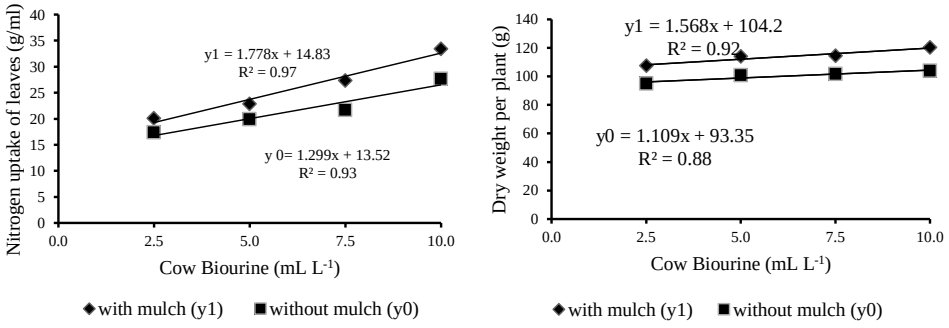


(b) (d)

Figure 1. Effect of the interaction of rice straw mulch and cow urine (a) plant height, (b) the number of leaves, (c) level of leaf greenness.

Figure 1 shows that every increase in urine concentration by 1 ml L^{-1} with rice straw mulch increased plant height, the number of leaves, SPAD value, of sweet corn plants, respectively 1.32 kg, 0.32 leaves, 0.94 unit. Then, each 1 ml L^{-1} increase in urine concentration without rice straw mulch increased plant height, leaf number, and leaf greenness of sweet corn plants respectively by 0, 69 kg, 0.10 leaves, and 0.41 unit. Leaves with a darker green color have a higher chlorophyll concentration, allowing plants to maximize their photosynthesis process (Shah, 2017; Reis et al., 2009).



(a) (b)

Figure 2. The effect of the interaction of rice straw mulch and cow urine on (a) N nutrient uptake and (b) dry weight

Figure 2 (a) showes that every 1 ml L^{-1} increase in urine concentration accompanied by rice straw mulch increased N nutrient uptake in sweet corn by 1.78. In contrast, each increase in urine concentration 1 ml L^{-1} without mulch rice straw increased the N nutrient uptake of sweet corn by 1.30. Urine act as a source of energy and food for microbes. The application of urine enhances nitrogen uptake, leading to an increase in protoplasm, which increases plant cell wall thickness (Pradhan *et al*.,

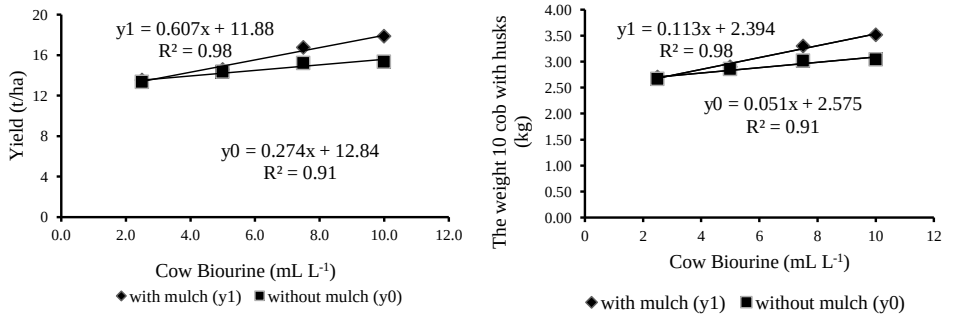
2018; Muratore *et al*. 2021). Figure 2 (b) shows that increasing the concentration of urine by 1 mL L-1 with or without the addition of rice straw mulch increased the dry stover weight of sweet corn by 1.34 g.

Table 2. Effect of rice straw mulch and cow urine on yield and production components of sweet corn.

Treatment	Variable Observations			
	Yield (t ha^{-1})	**Cob Diameter (cm)**	**The weight 10 cob with ear (kg)**	**The weight 10 cob without ear (kg)**
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
$p_1 : m_0$ vs m_1	13.68*	30.46*	13.68*	28.93*
	7.14%	12.21%	6.76%	10.87%
Urine Cow (b)				
p_2 : b-linear	66.31*	16.81*	66.31*	153.94*
p_3 : b-quadratic	0.46^{ns}	0.33^{ns}	0.46^{ns}	0.44^{ns}
m xb Interactions				
$p_4 : p_1$x p_2	9.45*	8.45*	9.45*	8.71*
$p_5 : p_1$x p_3	0.46^{ns}	0.33^{ns}	0.67^{ns}	1.59^{ns}

Notes: m= Straw Mulch; b= cow urine; m x b= Interaction straw mulch and cow urine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results revealed that using rice straw mulch increased yield, ear diameter, the weight of 10 cobs with husks, and weight of 10 cobs without husks by 7.14 %, 12.21 %, 6.76 %, and 10.87 %, respectively, compared to not using rice straw mulch (Table 2).



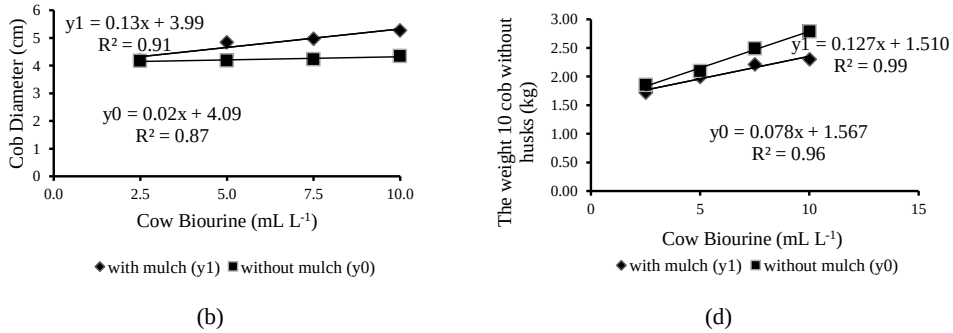


Figure 3. Effect of the interaction of rice straw mulch and cow urine on (a) production, (b) ear diameter, (c) weight of 10 cobs with husks, and (d) weight of 10 cobs without husks.

Figure 3 shows that increasing urine concentration by 1 mL L^{-1} and applying rice straw mulch increased yield, cob diameter, the weight of 10 cobs with husks, and weight of 10 cobs without husks, respectively, to 0.61 t, 0.13 cm, 0.11 kg, and 0.13 kg. The use of rice straw mulch increased the yield of sweet corn. Rice straw mulch enhances soil conditions and creates favorable environmental conditions (Kavian *et al*., 2020) for sweet corn plant nutrient uptake. Straw mulch improves the soil's physical and chemical features, such as water content, thermal energy, and nutritional content (Paul *et al*., 2021). As a result, indirect increases in chlorophyll content, photosynthetic activity, crop yields, and plant growth and development would follow (Zhang *et al.,* 2015). Soil moisture is a limiting issue for cultivation. According to Sekhon *et al.* (2008) straw mulch could lower soil temperature, retain soil moisture, and promote plant growth and yield. Increased crop production due to the application of straw mulch was also found in research on rice (Devasinghe *et al.,* 2013) and chillies (Rani *et al*., 2020).

The application of urine to sweet corn plants boosted yield by 0.61 t ha^{-1} for every 1 ml L^{-1} rise in urine concentration with rice straw mulch in this study. The population of soil microorganisms rises when urine is applied, and these bacteria create enzymes that may be absorbed by plants, increasing crop yields (Pradhan *et al*., 2017). Urine in this study had a high level of N nutrient, with a concentration of 6657.08 ppm. Cow urine contains nitrogen, which can supply additional nutrients to sweet corn plants. In addition to uric acid, urine contains IAA, a growth-regulating hormone that can speed up the growth and development of sweet corn plants. According to Pradhan *et al.* (2018), cow urine includes 95% water, 2.5% urea, and the remaining 2.5% contains mineral salts, hormones, and enzymes. According to Puspadewi *et al.* (2016)(Puspadewi et al 2016) and Adu *et al*. (2019), the element N has a significant impact since it is essential for cell division, which promotes plant growth in terms of both size and volume. Similar results were also found by Nuraini and Asgianingrum (2017), who stated that the application of 600 ml L^{-1} of cow urine fertilizer per plant gives the best results on pak choi plants when compared to controls. The treatment of rice straw mulch and cow urine 10 ml L^{-1} yielded the highest yield of 17.87 t ha^{-1}. Urine includes nutrients and growth hormones, causing a quick photosynthetic process. Gibsona *et al*. (2011) found that increasing photosynthetic efficiency led to greater yield.

The rice straw mulch and urine application showed an interaction with the vegetative phase of sweet corn plants, such as plant height, leaf number, and SPAD value (Table 1). Sweet corn plants would absorb urine optimally under optimum environmental conditions. Plant height, leaf number, leaf greenness, and N nutritional uptake were all significantly affected by rice straw mulch and cow urine 10.0 ml L^{-1}. According to Zhang et al. (2015), the application of rice straw mulch resulted in the maximum

chlorophyll content of corn. Sweet corn plants with good vegetative growth will support plants generative growth.

Table 3. The interaction of rice straw mulch and cow urine application on weight loss of cob without husk and sweetness level of corn after harvest.

Treatment	Variable Observations			
	Diffetence weight loss between 70 and 71 DAP (%)	Diffetence weight loss between 70 and 72 DAP (%)	Sucrose level 71 DAP	Sucrose level 72 DAP
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	14.77*	13.44*	35.57*	38.94*
	43.50%	38.62%	6.12%	6.68%
Urine Cow (b)				
p_2 : b-linear	39.73*	34.04*	116.42*	127.46*
p_3 : b-quadratic	3.55^{ns}	1.85^{ns}	1.84^{ns}	2.01^{ns}
m xb Interactions				
p_4 : p_1x p_2	5.77*	6.24*	2.12^{ns}	2.32^{ns}
p_5 : p_1x p_3	0.39^{ns}	1.28^{ns}	1.18^{ns}	1.29^{ns}

Notes: m= Mulch of Straw; b= cow urine; m x b= Interaction mulch of straw and cow urine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that using rice straw mulch reduced weight loss of sweet corn cobs without husks by 43.50% and 38.62% on the first and second days after harvest, respectively, compared to not using rice straw mulch. The use of rice straw mulch increased the sweetness of sweet corn by 6.12% and 6.68% at 71 and 72 days, respectively, compared to not using rice straw mulch (Table 3).

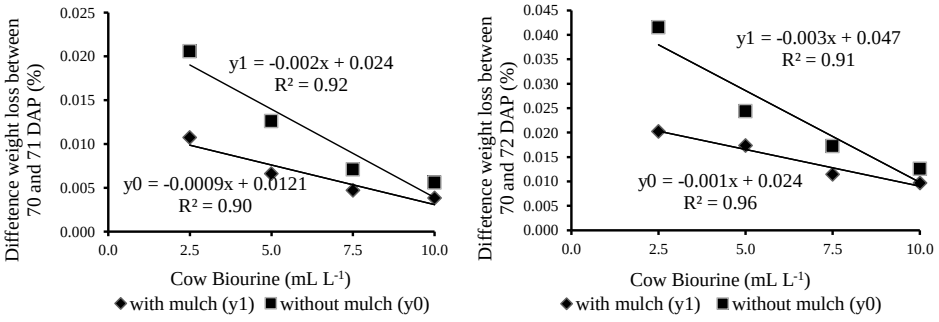
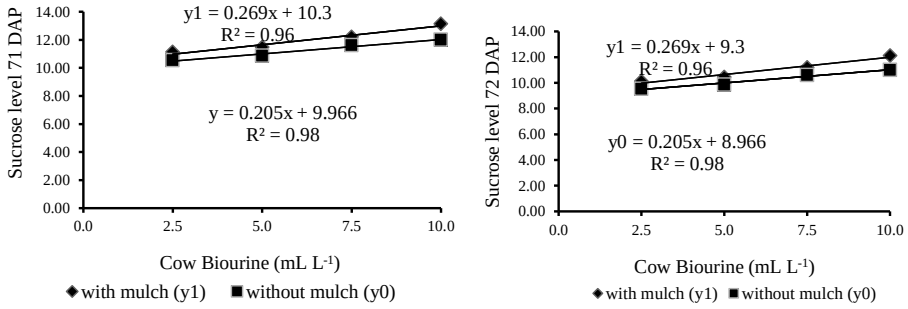


Figure 4. The effect of the interaction of rice straw mulch and cow urine on weight loss of sweet corn cobs without husks on (a) day 1, (b) day 2 after harvest.

Figure 4 shows that a 1 mL L-1 increase in urine concentration combined with the application of rice straw mulch reduced weight loss of sweet corn during storage by 0,0009% on the first day (Fig 4a) and 0.001% on the second day (Fig 4b).



(a) (b)

Figure 5. The effect of the interaction of rice straw mulch and cow urine on the sweetness level of corn at (a) 71 days after planting(b) 72 days after planting.

Figure 5 shows that increasing the urine concentration by 1 mL L-1 and applying rice straw mulch raised the sweetness of sweet corn by 0.27 ^{0}Brix on the first day of storage at 71 DAP and 0.27 ^{0}Brix on the second day of storage at 72 DAP. The dynamic weight loss and sugar level of sweet corn could be used to assess postharvest quality. There was a weight loss reduction when rice straw mulch and cow urine were used together. Wills *et al.* (2007) found that weight loss in sweet corn is proportional to the amount of water that evaporates and the process of respiration that happens during storage. Sweet corn with rice straw mulch has a higher sugar level than sweet corn without rice straw mulch. Similarly, increasing the amount of cow urine resulted in a higher level of sucrose. Every day following harvest, the sucrose content of sweet corn (^{0}Brix) drops, as sweet corn is still respiring after being harvested. However, this study found that using straw mulch and urine maintains the quality of sweet corn during storage, as seen by the increased amount of sucrose after using straw mulch and urine.

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Several insect pests were found in sweet corn plants during the 7 WAP and 8 WAP observations, including the Delphacidae, Noctuidae, and Pyralidae families. Insects from the families Mantidae, Coccinellidae, Oxyopidae, and Staphylinidae serve as natural enemies. Corn planthoppers were the most prevalent pest population in this study (Family Delphacidae).

At 7 WAP, the intensity of pest infestations ranged from 40 to 44.4%. The treatment with no mulch and a concentration of urine 7.5 ml L-1, i.e. 44.44%, caused the most damage. The intensity of pest attacks ranged from 44.50 to 51.10% on 8 WAP observations. The treatment without mulch and a concentration of urine 7.5 ml L^{-1} consistently resulted in the highest percentage of damage, 51.10%. The

Commented [dh4]: Ranged of pest infestation has been added

amount of plant damage differed little and did not reveal a significant difference between the various treatments of cow urine concentration and straw mulch.

The corncob borer was found among the insect pests of the Noctuidae family. The female insects of this insect lay their eggs on the corn silk, and the larvae will infiltrate the cob and consume the developing seeds immediately after hatching. The quality and quantity of corn cobs can be harmed by this insect invasion (Pabbage *et al*., 2007). Only the 7 WAP observation in the without mulch and 2.5 ml L^{-1} treatment and the 8 WAP observation in the with mulch and 10 ml L-1 treatment had this pest. This insect isn't affecting sweet corn plant yield because its appearance coincides with harvest season, and the pest's attack isn't severe because it hasn't reached the inner part of the cob.

Stenocranus pacificus, a Delphacidae family insect, was discovered. Among other insect pests, the presence of *S. pacificus* is the most common. On the ventral part of the abdomen, female insects have a white waxy coating. Following the development of *S. pacificus* on sweet corn plants, white wax appeared on the lower surface along the leaf bones. *S. pacificus* lays its eggs on the white candle. Hopperburn can occur when these insects strike in high numbers (Susilo *et al*., 2017). This observation shows no consistent influence on the population of *S. pacificus* between mulch treatment and no mulch, and cow urine concentrations treatment did not have a consistent effect on the population of *S. pacificus* (Family Delphacidae).

Corn stem borer belongs to the Pyralidae family, found in sweet corn plantations. One of the most common maize pests is the corn stem borer (*Ostrinia furnacalis*). Corn stem borer larvae can cause problems on leaves, stems, and male and female flowers, according to Nonci (2004). Corn stem borer populations are most common at 7 WAP and 8 WAP, but their numbers are small. Mulch and no mulch treatments and cow urine concentrations had no consistent effect on the maize stem borer population in the observed population. In addition to insect pests, certain natural enemy insects can be found in the fields. Animals or insects that consume other animals or insects are known as natural enemies (predators). The Coccinellidae, Oxyopidae, Staphylinidae, Mantidae, and Anisolabidae families of insects were discovered. Natural enemies were found in low numbers at the 7 WAP and 8 WAP observations, and had little effect on the pest population.

Among other pests, the maize planthopper (Family Delphacidae) population dominates. Corn leafhoppers (Family Delphacidae) attack intensity on the leaf bone had symptoms like white wax ranging from 40-40.4% in sweet corn plants aged 7 WAP to 44.5-51.1% in sweet corn plants aged 8 WAP, and was not consistently influenced by mulch treatment or the level of fermented cow urine concentration. The liquid urine fertilizer contains fermented vegetable pesticides that operate as biopesticide, resulting in reduced insect attack in this study. Adajar and Taer (2021) have used fermented plant extract to increase corn yield. Kumar *et al*., (2021) suggest that plant extract could be used as a biopesticide. According to Tembo et al. (2018), using pesticide plant extracts to manage pests is as successful as using synthetic pesticides in terms of yield, while the tritrophic effect is decreased, and could save non-target anthropods

that produce a balanced environment. Based on this study, using straw mulch with urine fertilizer increased sweet corn growth, yield, and postharvest quality parameters in acid soils. As a result, for organic farming practices in the tropics, using urine-organic fertilizer in combination with straw mulch is recommended.

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Conclusion

Sweet corn vegetative growth, yield, and quality were enhanced when rice straw mulch and cow urine were applied. The application of straw mulch on sweetcorn farming improved productivity and quality. Urine at a concentration of 10 mL L^{-1} could be used as an alternative nitrogen fertilizer and hence could be recommended for organic sweet corn growth. Pests from the Delphacidae, Pyralidae, and Nocturdae families were detected in this study, with a low pest population.

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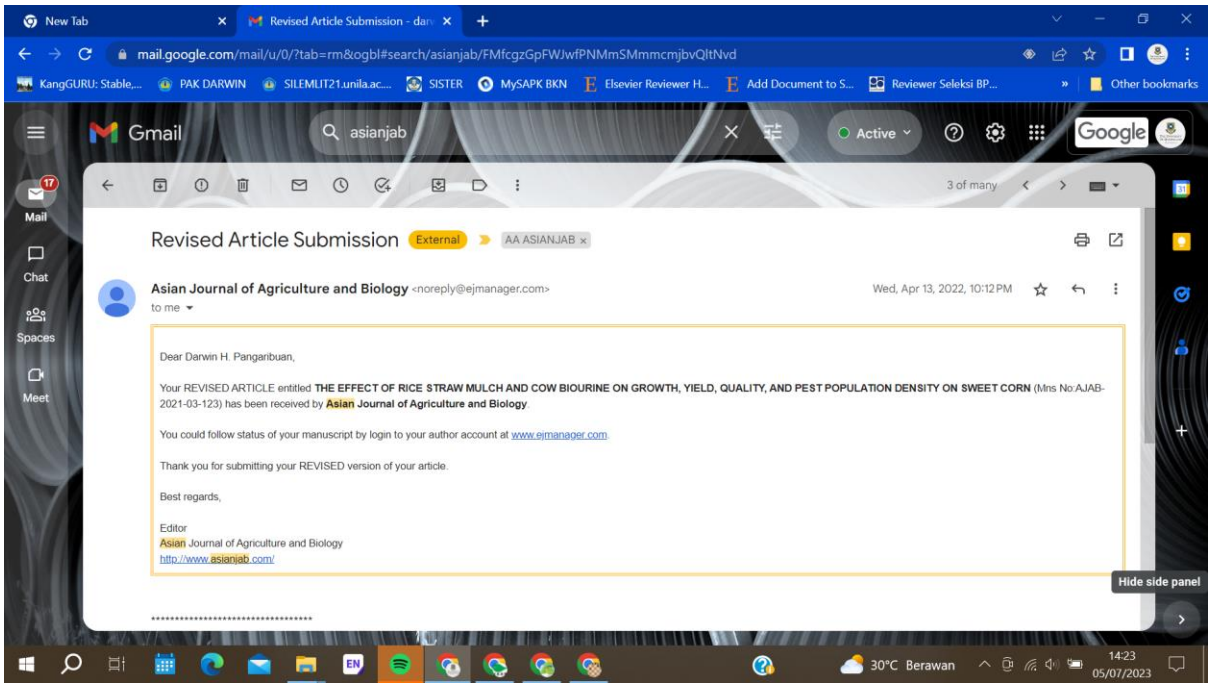
Contribution of Authors

DHP: Manuscript Write UP. Statistical analysis and data interpretation
SW: Critically reviewed and results interpretation
AMH: Crop pretection analysis
SS: Data collection and laboratory analyses
MIS: Ddata collection and pest inspection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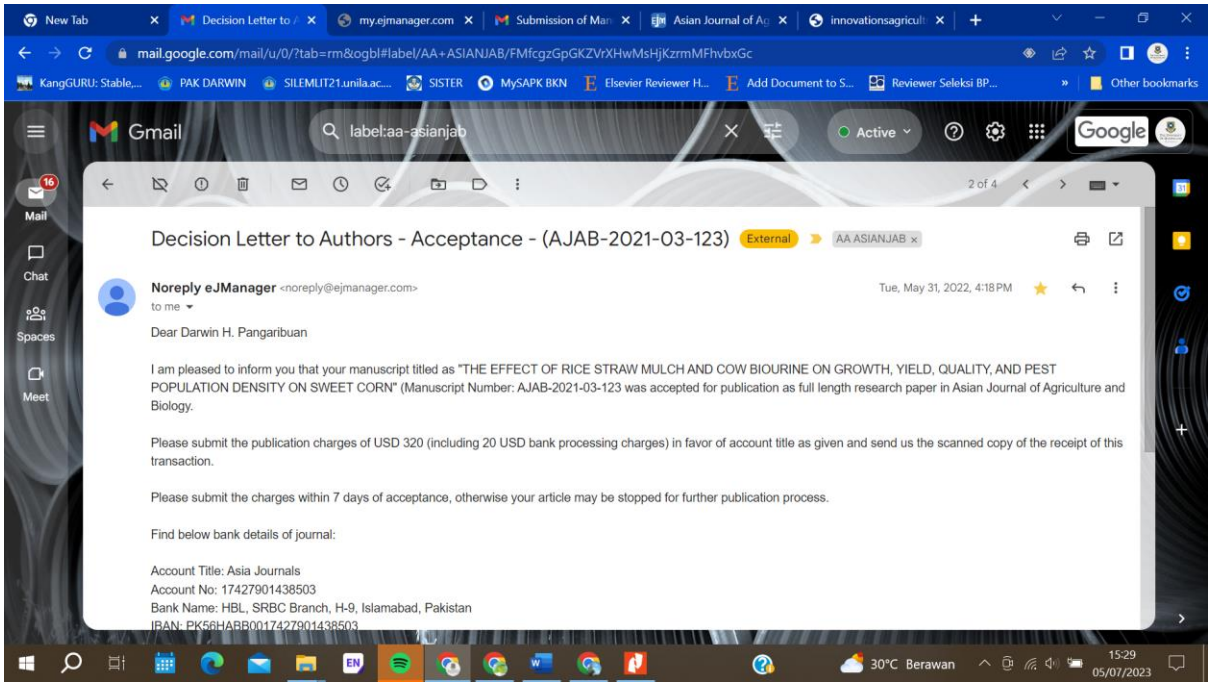
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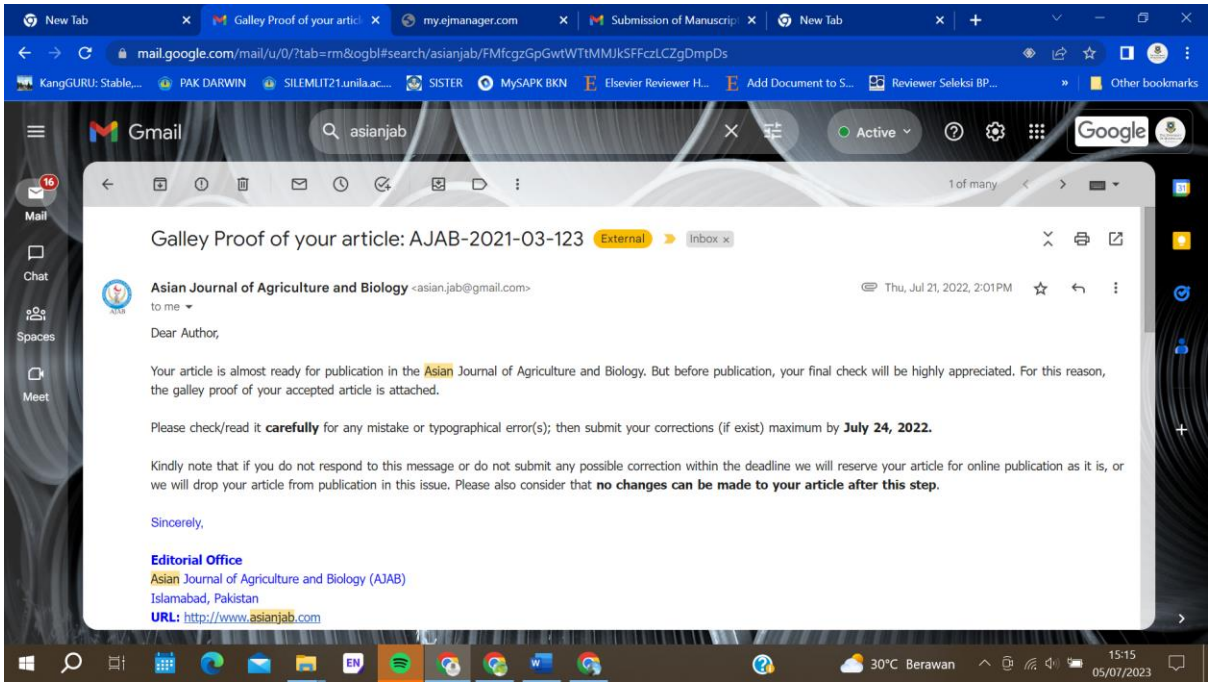
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Original Article

The effect of rice straw mulch and cow urine on growth, yield, quality on sweet corn and pest population density

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Abstract

Organic matter such as paddy straw mulch and cow urine could be used to improve the soil structure. The study aims to determine the effect of rice straw mulch and cow urine application on growth, yield, quality, and population of sweet corn pests. This study used a 2 x 4 factorial randomized block design with three replications. The first factor is rice straw mulch consisting of 2 levels, namely, with mulch and without mulch, and the second factor is the concentration of cattle urine composed of 4 levels, namely 2.5 ml L^{-1}, 5.0 ml L^{-1}, 7,5 ml L^{-1}, 10.0 ml L^{-1}. The results showed that rice straw mulch and cow urine increased sweet corn's growth, yield, and quality. The maximum yield of 17.87 t ha^{-1} was achieved in the treatment of straw mulch accompanied by cattle urine 10.0 ml L^{-1}. In comparison, the results of 15.33 t ha^{-1} were achieved in the treatment without rice straw mulch accompanied by 10.0 ml L^{-1} cow urine. The intensity of corn planthopper pests (Delphacidae family) ranged from 40-40.4% in 7 WAP and between 44.5 - 51.1% in 8 WAP and was not consistently affected by mulch treatment or the level of concentration of cattle urine.

Keywords: Liquid fertilizers, Nitrogen uptake, Organic farming, Postharvest, Soil structure

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Introduction

In Indonesia, sweet corn cultivation has not yet reached its optimum production. Maintaining soil fertility and enhancing nutrients to make sweet corn plants healthier and less susceptible to pests and diseases is one way of increasing sweet corn yield. Organic materials, such as paddy straw mulch and cow urine, keep the soil productive and good soil structure. Mulch covers the soil surface in the planting area using organic and inorganic materials (Iqbal et al., 2020). Paddy straw can function as a mulch that maintains soil moisture and temperature and suppresses weed growth (Paul et al., 2021) so that plants grow better. According to Adnan et al. (2020), the use of straw mulch can help reduce pest attacks by reducing the growth of weeds that serve as hosts for pests and plant diseases, ensuring that the planting environment is kept clean. Some of the main pests in sweet corn plants include borer, corn stalks, caterpillars on cobs,

aphids, and grasshoppers. The Pyralidae family found in sweet corn plantations is the corn stem borer. The corn stem borer (*Ostrinia furnacalis*) is one of the most important pests in maize. Corn stem borer larvae can damage leaves, stems, and male and female flowers (Nonci, 2004).

Sweet corn (*Zea mays* subs. mays) requires full nutrients for proper growth and development. Cow urine is a source of nitrogen, phosphate, potassium, calcium, magnesium, chlorite, and sulphate (Pradhan et. al., 2018). It contains microorganisms that increase the efficiency of nutrient uptake for plants so that it reduces dependence on inorganic fertilizers and increases plant yields (Sofiana and Syaban, 2017). Many positive results have been shown on the application of urine. A study conducted by Oliveira et al. (2009) stated that the application of urine at a concentration of 1.25% and 1.00% for leaf and soil applications, respectively, could produce the highest height of lettuce. Puspita et al. (2015) research states that the treatment of 20 ml L^{-1} cow urine with 100% inorganic fertilizer (urea 220 kg ha^{-1}) has reached its optimum point compared to 10 ml L^{-1} and 30 ml L^{-1} treatments. Qibtiyah et al. (2015) reported that the application of urine 1500 and 2000 l ha^{-1} showed a significant effect on the growth parameters observed in rice. Result of Pradhan et al. (2017), the highest absorption of N, P, K was from the combined application of the recommended dose of 100% fertilizer with 1200 l ha^{-1} of cow urine as a basal application and 50% leaf spray cow urine. According to Santosa et al. (2015) urine combined with inorganic fertilizers had resulted in a higher yield of shallot than without urine. The urine fermentation process is needed before it is applied to plants. Research by Widjajanto et al. (2017) showed that the use of local microorganisms (LoM) from rotten fruits and vegetables in fermenting cow urine into liquid organic fertilizer was determined by the incubation period, especially at 18 days incubation. In general, cow urine has been used to improve the growth of food crops such as rice (Santosa et al., 2014), chickpeas (Patil et al., 2012), and used as biopesticides (Patel et al., 2019).

Little information exists on the combination effect of mulch and urine. The research objective was to determine the effect of rice straw mulch and the fermented cow urine on growth, N nutrient uptake, yield, postharvest quality of sweet corn, and pest population density

Material and Methods

This research was conducted at Kebun Lapang experimental site located at 5°22'23"S 105°15'49"E, 374 m above sea level, Bandar Lampung, Indonesia, from March to June 2017. The soil type experimental plot was sandy clay loam in texture, neutral in reaction, medium in available nitrogen, phosphorous, potassium. It belonged to the order Ultisol of shallow to medium depth.

The study was conducted with a factorial Randomized Block Design 2 x 4. The first factor is straw mulch (m) which consists of two levels, namely without mulch (m0) and with mulch (m1). The second factor is the application of cow urine (b) which consists of 4 levels of urine with a concentration of 2.5 ml L^{-1} (b_1), 5.0 ml L^{-1} (b_2), 7.5 ml L^{-1} (b_3), and 10.0 ml L^{-1} (b_4).

The research was carried out starting from the fermentation of cow urine. The materials used were: 3 liters of cow urine, 3 kg mojo fruit (*Aegle marmelos*), 2 kg of starfruit (*Averrhora bilimbi*), 2 kg pineapples (*Ananas comosus*), 1 kg of curcuma (*Curcuma heyneana*), 1 kg of white turmeric (*Curcuma manga* Val.) and 1 kg of banana corm (*Musa paradisiaca*) with a ratio of 3: 3: 2: 2: 1: 1: 1. Then all the ingredients are mashed and put in a jerrycan, and blended. Then the jerrycan is closed tightly and given a plastic hole connected to a 1500 ml bottle filled with 500 ml water. After that, it is fermented for 21 days, the cow urine is filtered and ready to use.

Land preparation includes soil tillage by clearing the soil from growing weeds by pulling weeds to the roots. The second soil tillage was loosening the soil with a depth of 15-20 cm, then plotting the size of 3 m x 3 m = 9 m^2 with a distance between plots of 50 cm. The application of rice straw mulch is to cover the soil surface with a thickness of 5 cm with rice straw. Sweet corn is planted at a spacing of 20 cm x 70 cm. Recommended inorganic fertilizers are applied at a rate of 150 kg N ha^{-1}, 100 kg SP-36 ha^{-1}, and 100 kg KCL ha^{-1}. The fermented cow urine is applied every two weeks by watering the cow urine solution into the soil around the sweet corn rooting zone (soil drench). Weeds were controlled manually. Pest and diseases were relatively free from the experimental site. Harvesting is done at 11 WAP.

The variables observed in this experiment were (1) plant height, (2) number of leaves, (3) leaf greenness using a chlorophyll meter (SPAD value), (4) N uptake of leaves when maximum vegetative, (5) oven-dry stover weight, (6) yield, (7) ear diameter, (8) weight

of 10 cobs from the tagged plants with husk and (9) without husk, (10) postharvest weight loss of cobs at room temperature (loss during storage) is measured through the difference in ear weight after the 1st, 2nd, 3rd, and 4th day of storage from the weight cobs early harvest, (11) soluble solids content (°Brix) day of harvest at 1st & 2nd after harvest measured by Refractometer, (12) intensity of pest attacks at 7 and 8 WAP, and (13) insect populations at 7 and 8 WAP.

Results and Discussion

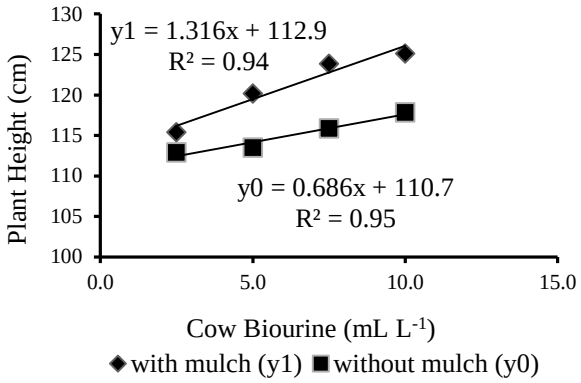
Before planting, soil analysis revealed that the pH was 6.16, which is slightly acidic, available phosphorus was 2.38 ppm, which is very low, and the organic carbon content was 1.04%; total nitrogen was 0.10%; K-dd was 0.20 me 100 g^{-1}; CEC was 7.31 me 100 g^{-1}; alkaline saturation was 32.15%, all of which met the low criteria. In the initial soil analysis, the experiment shows that the available nutrients are still low so that fertilization is needed to add nutrients needed by the plant and add soil amendments such as rice straw mulch to improve the physical condition of the soil.

Table-1. Effect of rice straw mulch and cow urine on the vegetative phase of sweet corn plants.

Treatment	Variable Observations				
	Plant height (cm)	Number of Leaves (blades)	SPAD Level (%)	Nitrogen uptake of leaves (g/ml)	Dry weight per plant (g)
Straw Mulch (m)	**F-count followed by the difference value (%)**				
$p_1 : m_0$ vs m_1	86.23*	24.90*	35.59*	73.38*	42.33*
	5.05%	7.18%	6.16%	16.57%	12.06%
Urine Cow (b)					
p_2 : b-linear	72.21*	43.13*	55.56*	293.90*	12.54*
p_3 : b-quadratic	0.66^{ns}	0.00^{ns}	0.32^{ns}	11.55*	0.23^{ns}
m xb Interactions					
$p_4 : p_1 x\ p_2$	7.13*	12.30*	8.35*	7.10*	0.37^{ns}
$p_5 : p_1 x\ p_3$	3.14^{ns}	0.18^{ns}	2.17^{ns}	0.00^{ns}	0.14^{ns}

Notes: m= Straw Mulch; b= cow urine; m x b= Interaction straw mulch and cow urine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results showed that the application of rice straw mulch was able to increase plant height, leaf number, SPAD value, N nutrient uptake, and dry weight of sweet corn plants by 5.05%, 7.18%, 6.16%, 16.57%, and 12.06% higher than without rice straw mulch (Table 1).



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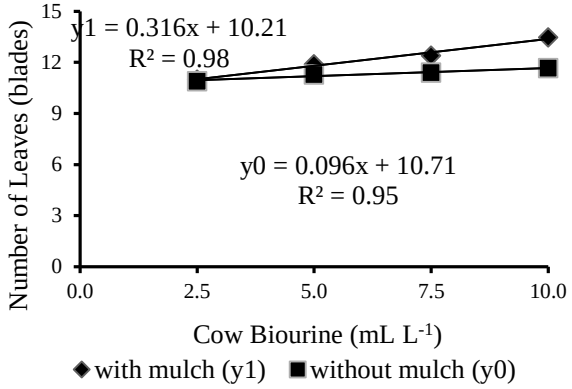

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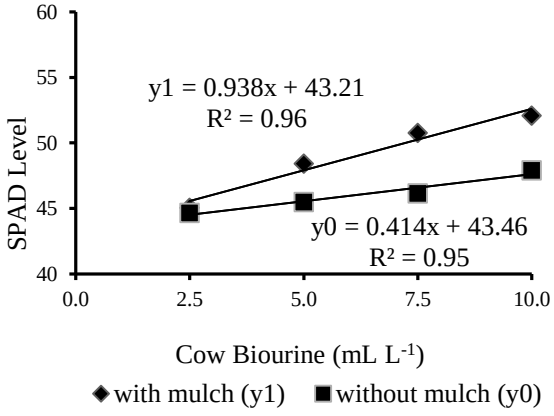
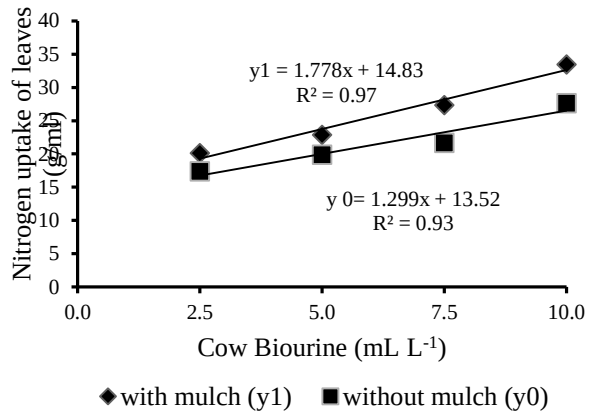


(c)

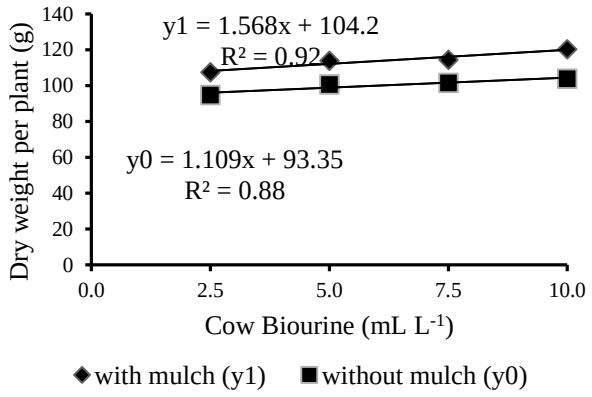
Figure-1. Effect of the interaction of rice straw mulch and cow urine (a) plant height, (b) the number of leaves, (c) level of leaf greenness.

Figure 1 showes that every increase in urine concentration by 1 ml L^{-1} with rice straw mulch increased plant height, the number of leaves, SPAD value, of sweet corn plants, respectively 1.32 kg, 0.32 leaves, 0.94 unit. Then, each 1 ml L^{-1} increase in urine concentration without rice straw mulch increased plant height, leaf number,

and leaf greenness of sweet corn plants respectively by 0, 69 kg, 0.10 leaves, and 0.41 unit. Leaves with a darker green color have a higher chlorophyll concentration, allowing plants to maximize their photosynthesis process (Shah et al., 2017; Reis et al., 2009).



(a)



(b)

Figure 2. The effect of the interaction of rice straw mulch and cow urine on (a) N nutrient uptake and (b) dry weight

Figure 2 (a) showes that every 1 ml L^{-1} increase in urine concentration accompanied by rice straw mulch increased N nutrient uptake in sweet corn by 1.78. In contrast, each increase in urine concentration 1 ml L^{-1} without mulch rice straw increased the N nutrient uptake of sweet corn by 1.30. Urine act as a source of energy and food for microbes. The application of urine enhances nitrogen uptake, leading to an increase in protoplasm, which increases plant cell wall thickness (Pradhan et al., 2018; Muratore et al. 2021). Figure 2 (b) shows that increasing the concentration of urine by 1 mL L-1 with or without the addition of rice straw mulch increased the dry stover weight of sweet corn by 1.34 g.

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Table-2. Effect of rice straw mulch and cow urine on yield and production components of sweet corn.

Treatment	Variable Observations			
	Yield (t ha^{-1})	Cob Diameter (cm)	The weight 10 cob with ear (kg)	The weight 10 cob without ear (kg)
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	13.68*	30.46*	13.68*	28.93*
	7.14%	12.21%	6.76%	10.87%
Urine Cow (b)				
p_2 : b-linear	66.31*	16.81*	66.31*	153.94*
p_3 : b-quadratic	0.46^{ns}	0.33^{ns}	0.46^{ns}	0.44^{ns}
m xb Interactions				
p_4 : p_1x p_2	9.45*	8.45*	9.45*	8.71*
p_5 : p_1x p_3	0.46^{ns}	0.33^{ns}	0.67^{ns}	1.59^{ns}

Notes: m= Straw Mulch; b= cow urine; m x b= Interaction straw mulch and cow urine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.

The results revealed that using rice straw mulch increased yield, ear diameter, the weight of 10 cobs with husks, and weight of 10 cobs without husks by 7.14 %, 12.21 %, 6.76 %, and 10.87 %, respectively, compared to not using rice straw mulch (Table 2). Figure 3 shows that increasing urine concentration by 1 mL L^{-1} and applying rice straw mulch increased yield, cob diameter, the weight of 10 cobs with husks, and weight of 10 cobs without husks, respectively, to 0.61 t, 0.13 cm, 0.11 kg, and 0.13 kg. The use of rice straw mulch increased the yield of sweet corn. Rice straw mulch enhances soil conditions and creates favorable environmental conditions (Kavian et al., 2020) for sweet corn plant nutrient uptake. Straw mulch improves the soil's physical and chemical features, such as water content, thermal energy, and nutritional content (Paul et al., 2021). As a result, indirect increases in chlorophyll content, photosynthetic activity, crop yields, and plant growth and development would follow (Zhang et al., 2015). Soil moisture is a limiting issue for cultivation. According to Sekhon et al. (2008) straw mulch could lower soil temperature, retain soil moisture, and promote plant growth and yield. Increased crop production due to the application of straw mulch was also found in research on rice (Devasinghe et al., 2013) and chillies (Rani et al., 2020).

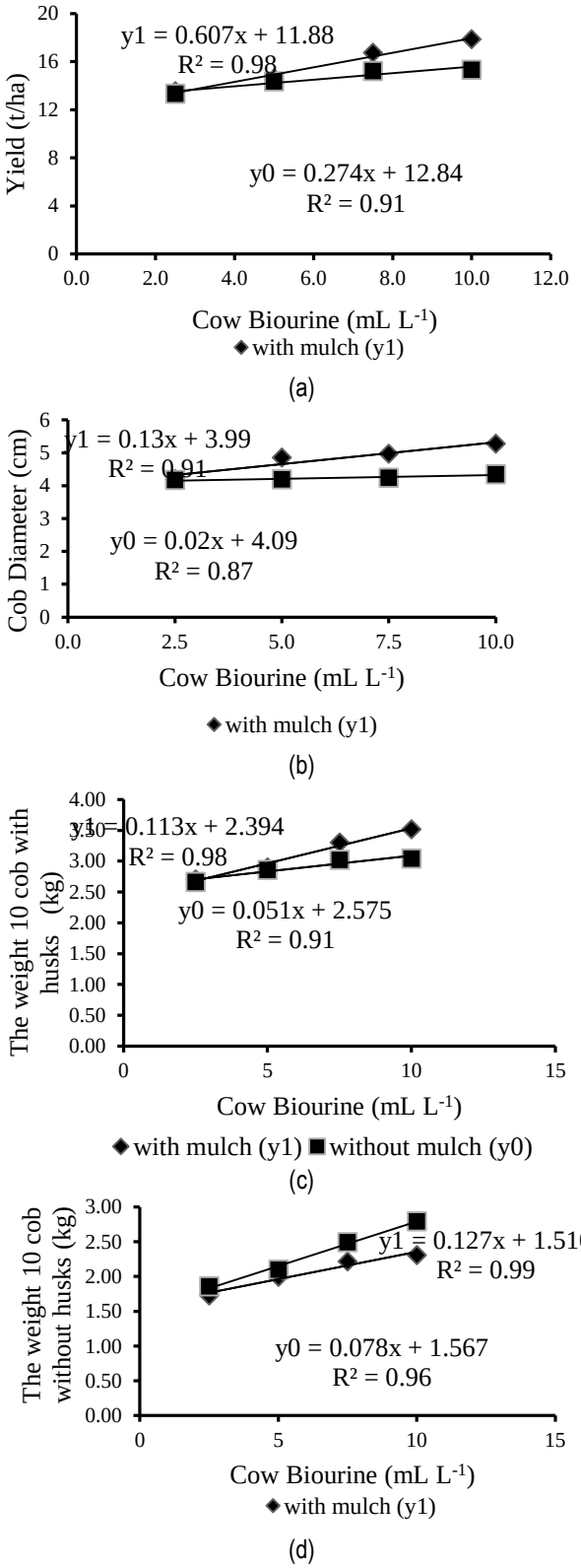


Figure-3. Effect of the interaction of rice straw mulch and cow urine on (a) production, (b) ear diameter, (c) weight of 10 cobs with husks, and (d) weight of 10 cobs without husks.

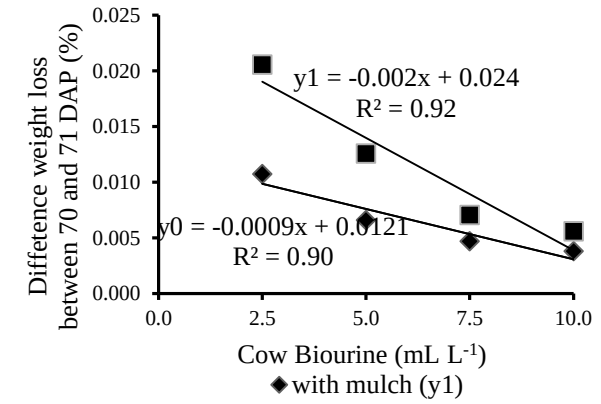
The application of urine to sweet corn plants boosted yield by 0.61 t ha^{-1} for every 1 ml L^{-1} rise in urine concentration with rice straw mulch in this study. The population of soil microorganisms rises when urine is applied, and these bacteria create enzymes that may be absorbed by plants, increasing crop yields (Pradhan et al., 2017). Urine in this study had a high level of N nutrient, with a concentration of 6657.08 ppm. Cow urine contains nitrogen, which can supply additional nutrients to sweet corn plants. In addition to uric acid, urine contains IAA, a growth-regulating hormone that can speed up the growth and development of sweet corn plants. According to Pradhan et al. (2018), cow urine includes 95% water, 2.5% urea, and the remaining 2.5% contains mineral salts, hormones, and enzymes. According to Puspadewi et al. (Puspadewi et al., 2016) and Adu et al. (2018), the element N has a significant impact since it is essential for cell division, which promotes plant growth in terms of both size and volume. Similar results were also found by Nuraini and Asgianingrum (2017), who stated that the application of 600 ml L^{-1} of cow urine fertilizer per plant gives the best results on pak choi plants when compared to controls. The treatment of rice straw mulch and cow urine 10 ml L^{-1} yielded the highest yield of 17.87 t ha^{-1}. Urine includes nutrients and growth hormones, causing a quick photosynthetic process. Gibsona et al. (2011) found that increasing photosynthetic efficiency led to greater yield.

The rice straw mulch and urine application showed an interaction with the vegetative phase of sweet corn plants, such as plant height, leaf number, and SPAD value (Table 1). Sweet corn plants would absorb urine optimally under optimum environmental conditions. Plant height, leaf number, leaf greenness, and N nutritional uptake were all significantly affected by rice straw mulch and cow urine 10.0 ml L^{-1}. According to Zhang et al. (2015), the application of rice straw mulch resulted in the maximum chlorophyll content of corn. Sweet corn plants with good vegetative growth will support plants generative growth.

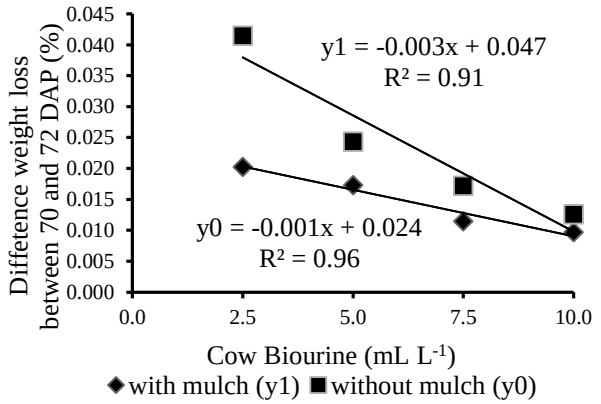
Table-3. The interaction of rice straw mulch and cow urine application on weight loss of cob without husk and sweetness level of corn after harvest.

Treatment	Variable Observations			
	Diffetence weight loss between 70 and 71 DAP (%)	Diffetence weight loss between 70 and 72 DAP (%)	Sucrose level 71 DAP	Sucrose level 72 DAP
Mulch of Straw (m)	**F-count followed by the difference value (%)**			
p_1 : m_0 vs m_1	14.77*	13.44*	35.57*	38.94*
	43.50%	38.62%	6.12%	6.68%
Urine Cow (b)				
p_2 : b-linear	39.73*	34.04*	116.42*	127.46*
p_3 : b-quadratic	3.55^{ns}	1.85^{ns}	1.84^{ns}	2.01^{ns}
m xb Interactions				
p_4 : p_1x p_2	5.77*	6.24*	2.12^{ns}	2.32^{ns}
p_5 : p_1x p_3	0.39^{ns}	1.28^{ns}	1.18^{ns}	1.29^{ns}

Notes: m= Mulch of Straw; b= cow urine; m x b= Interaction mulch of straw and cow urine, *= differs markedly of α 5%; ns=not significantly different at 5 % of α level.



(a)



(b)

Figure-4. The effect of the interaction of rice straw mulch and cow urine on weight loss of sweet corn cobs without husks on (a) day 1, (b) day 2 after harvest.

The results showed that using rice straw mulch reduced weight loss of sweet corn cobs without husks by 43.50% and 38.62% on the first and second days after harvest, respectively, compared to not using rice straw mulch. The use of rice straw mulch increased the sweetness of sweet corn by 6.12% and 6.68% at 71 and 72 days, respectively, compared to not using rice straw mulch (Table 3).

Figure 4 shows that a 1 mL L-1 increase in urine concentration combined with the application of rice straw mulch reduced weight loss of sweet corn during storage by 0,0009% on the first day (Fig 4a) and 0.001% on the second day (Fig 4b).

Figure 5 shows that increasing the urine concentration by 1 mL L-1 and applying rice straw mulch raised the sweetness of sweet corn by 0.27 ^{0}Brix on the first day of storage at 71 DAP and 0.27 ^{0}Brix on the second day of storage at 72 DAP. The dynamic weight loss and sugar level of sweet corn could be used to assess postharvest quality. There was a weight loss reduction when rice straw mulch and cow urine were used together. Wills et al. (2007) found that weight loss in sweet corn is proportional to the amount of water that evaporates and the process of respiration that happens during storage. Sweet corn with rice straw mulch has a higher sugar level than sweet corn without rice straw mulch. Similarly, increasing the amount of cow urine resulted in a higher level of sucrose. Every day following harvest, the sucrose content of sweet corn (^{0}Brix) drops, as sweet corn is still respiring after being harvested. However, this study found that using straw mulch and urine maintains the quality of sweet corn during storage, as seen by the increased amount of sucrose after using straw mulch and urine.

Several insect pests were found in sweet corn plants during the 7 WAP and 8 WAP observations, including the Delphacidae, Noctuidae, and Pyralidae families. Insects from the families Mantidae, Coccinellidae, Oxyopidae, and Staphylinidae serve as natural enemies. Corn planthoppers were the most prevalent pest population in this study (Family Delphacidae).

At 7 WAP, the intensity of pest infestations ranged from 40 to 44.4%. The treatment with no mulch and a concentration of urine 7.5 ml L-1, i.e. 44.44%, caused the most damage. The intensity of pest attacks ranged from 44.50 to 51.10% on 8 WAP observations. The treatment without mulch and a concentration of urine 7.5 ml L^{-1} consistently resulted in the highest percentage of damage, 51.10%. The amount of plant

damage differed little and did not reveal a significant difference between the various treatments of cow urine concentration and straw mulch.

The corncob borer was found among the insect pests of the Noctuidae family. The female insects of this insect lay their eggs on the corn silk, and the larvae will infiltrate the cob and consume the developing seeds immediately after hatching. The quality and quantity of corn cobs can be harmed by this insect invasion (Pabbage et al., 2007). Only the 7 WAP observation in the without mulch and 2.5 ml L^{-1} treatment and the 8 WAP observation in the with mulch and 10 ml L-1 treatment had this pest. This insect isn't affecting sweet corn plant yield because its appearance coincides with harvest season, and the pest's attack isn't severe because it hasn't reached the inner part of the cob.

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Stenocranus pacificus, a Delphacidae family insect, was discovered. Among other insect pests, the presence of *S. pacificus* is the most common. On the ventral part of the abdomen, female insects have a white waxy coating. Following the development of *S. pacificus* on sweet corn plants, white wax appeared on the lower surface along the leaf bones. *S. pacificus* lays its eggs on the white candle. Hopperburn can occur when these insects strike in high numbers (Susilo et al., 2017). This observation shows no consistent influence on the population of *S. pacificus* between mulch treatment and no mulch, and cow urine concentrations treatment did not have a consistent effect on the population of *S. pacificus* (Family Delphacidae).

Corn stem borer belongs to the Pyralidae family, found in sweet corn plantations. One of the most common maize pests is the corn stem borer (*Ostrinia furnacalis*). Corn stem borer larvae can cause problems on leaves, stems, and male and female flowers, according to Nonci (2004). Corn stem borer populations are most common at 7 WAP and 8 WAP, but their numbers are small. Mulch and no mulch treatments and cow urine concentrations had no consistent effect on the maize stem borer population in the observed population. In addition to insect pests, certain natural enemy insects can be found in the fields. Animals or insects that consume other animals or insects are known as natural enemies (predators). The Coccinellidae, Oxyopidae, Staphylinidae, Mantidae, and Anisolabidae families of insects were discovered. Natural enemies were found in low numbers at the 7 WAP and 8 WAP observations, and had little effect on the pest population.

Among other pests, the maize planthopper (Family Delphacidae) population dominates. Corn leafhoppers (Family Delphacidae) attack intensity on the leaf bone had symptoms like white wax ranging from 40-40.4% in sweet corn plants aged 7 WAP to 44.5-51.1% in sweet corn plants aged 8 WAP, and was not consistently influenced by mulch treatment or the level of fermented cow urine concentration. The liquid urine fertilizer contains fermented vegetable pesticides that operate as biopesticide, resulting in reduced insect attack in this study. Adajar and Taer (2021) have used fermented plant extract to increase corn yield. Kumar et al. (2021) suggest that plant extract could be used as a biopesticide. According to Tembo et al. (2018), using pesticide plant extracts to manage pests is as successful as using synthetic pesticides in terms of yield, while the tritrophic effect is decreased, and could save non-target anthropods that produce a balanced environment. Based on this study, using straw mulch with urine fertilizer increased sweet corn growth, yield, and postharvest quality parameters in acid soils. As a result, for organic farming practices in the tropics, using urine-organic fertilizer in combination with straw mulch is recommended.

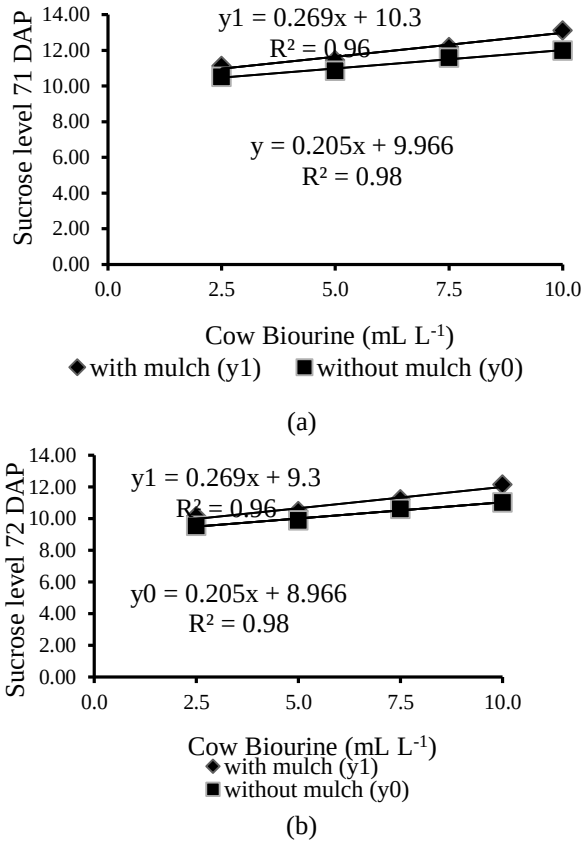

Figure-5. The effect of the interaction of rice straw mulch and cow urine on the sweetness level of corn at (a) 71 days after planting(b) 72 days after planting.

Conclusion

Sweet corn vegetative growth, yield, and quality were enhanced when rice straw mulch and cow urine were applied. The application of straw mulch on sweetcorn farming improved productivity and quality. Urine at a concentration of 10 mL L^{-1} could be used as an alternative nitrogen fertilizer and hence could be recommended for organic sweet corn growth. Pests from the Delphacidae, Pyralidae, and Nocturdae families were detected in this study, with a low pest population.

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Contribution of Authors

Pangaribuan DH: Data analysis and interpretation and manuscript write up
Widagdo S: Critically review and editing of manuscript and data interpretation
Hariri AM: Crop pretection analysis and data collection and manuscript write up
Siregar S: Data collection and laboratory analyses
Sardio MI: Data collection and pest inspection

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