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Utilization of Different Concentration Sugarcane Molasses to the Quality of Goat Feces-Chicken Excreta-Coconut Husk Organic Liquid Fertilizer

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ABSTRACT

Indonesia is an agricultural country that certainly has the potential for agricultural waste and by-products. Some of those in Indonesia are livestock manure, coconut husk, and sugarcane molasses. Utilization of this waste is limited, which is causing various environmental problems such as environmental pollution. The study is aimed to determine the quality of organic liquid fertilizer made by raw material from goat feces-chicken excreta-coconut husk with various sugarcane molasses concentrations (P0= 0%; P1= 5%; P3= 15%; P4= 20%; P5= 25%). The fermentation was carried out anaerobically for 21 days. The parameters of temperature, pH, organoleptic (color and odor), levels of C-organic, nitrogen (N) total, phosphorus (P) total, potassium (K) total, and biological tests were observed. Biological tests were conducted in the growth of mung bean (*Vigna radiata*) and spinach (*Amaranthus tricolor*). Data were analyzed using one-way ANOVA. Variations in the addition of molasses sugarcane did not affect the liquid fertilizer's temperature and pH during fermentation. However, the treatments had positive effect on organoleptic test, C-organic, N total, P total, K total, and biological tests. The addition of 15% sugarcane molasses (P3) showed a dominating performance toward most of the parameters tested. The P3 treatment produced liquid fertilizer with a pleasant smell, and the contents of C-organic, total N, total P, and total K were 2.12%, 0.25%, 0.13%, and 0.13%, respectively. and produce spinach as a biological test with plant height, number of leaves, leaf width, stem diameter, and root length were 21.82 cm, 6.66 sheets, 3.59 cm, 4.09 mm, and 14.67 cm, respectively.

Keywords: Agricultural waste, Anaerobic fermentation, Liquid fertilizer, Livestock waste, Organic fertilizer

Introduction

Indonesia is an agricultural country; most of its livelihood (40%) comes from the agricultural sector. East Java Province is in the first place, with 4.4 million people working as farmers (BPS, 2018). The agricultural sector has a strong relationship with fertilizer requirements. Currently, the primary fulfillment is still using chemical fertilizers (Byrareddy *et al.*, 2019; Hidayat *et al.*, 2020).

Chemical fertilizers are harmful to the environment if used for a long time. The negative impact that occure is a decrease in the soil's biological, chemical, and physical quality. Soil flora and fauna will decline, poisoned by chemical fertilizer residues (Subowo and Purwani, 2014). Excessive depletion of nutrients by plants, resulting in soil hardening, decreased pH and decreased water holding capacity. Other systemic problems arise, such as leaching of soil nutrients by water flow, death of soil microflora and fauna, algal blooms in rivers, and other systemic problems (Fang *et al.*, 2021).

Efforts need to be improved in order to prevent further damage to the soil. Improvement of soil conditions (biological, chemical, and physical) slowly with the substitution of organic fertilizers is a strategic step that must be started as soon as possible (Tao *et al.*, 2015; Wan *et al.*, 2021). Organic fertilizers have complete nutrients even in relatively low concentrations than chemical fertilizers, which only provide macro elements. The application of organic fertilizers in nutrient-deficient soils will slowly increase crop production. It is the result of the return of soil micro and biological elements which improve the chemical and physical conditions of the soil (Anand *et al.*, 2019).

In Indonesia, goat feces and chicken excreta are livestock waste that has not been optimally utilized. Applying animal manure to plants in fresh conditions will cause disease for plants, spread weed seeds, and pollute the environment (Singh and Rashid, 2017). Judging from its potential, Banyuwangi Regency has a large goat population compared to other commodities, as many as 125,479 heads, second only to cows, and

Banyuwangi has a chicken population of 5 million heads (BPS, 2018).

Coconut husk is a by-product of the copra, coconut milk industry, and young coconut ice drink traders. Banyuwangi Regency has a coconut plantation area was around 37,075 hectares, with a total production of 32,031 tons/year (BPS, 2018). Coconut husk has a relatively high potassium (K) content (Gbollie *et al.*, 2021). Fermentation will dissolve the K content in the husk to increase the nutrient value of liquid fertilizer. The potassium is a macro element that is important for the growth of flowers, fruit, and energy metabolism so that its role in plants is absolute (Anbuselvi and Kumar, 2017; Jamilah and Juniarti, 2014; Kadir *et al.*, 2016; Magbalot-Fernandez and Deguzman, 2019).

The use of livestock waste, especially goat feces, chicken excreta, and coconut husk, as raw materials for making organic liquid fertilizer has been carried out (Fitriyanto *et al.*, 2019; Istanti *et al.*, 2019; Priyadi *et al.*, 2020), and this combination has relatively high nutrient content compared to other livestock waste and other agricultural waste commodities (Gbenou *et al.*, 2017). The combination of the two livestock waste (goat feces and chicken excreta) has complementary effect. Goat feces are high in C-organic but low in nitrogen content (Irshad *et al.*, 2013). This fact is the opposite of chicken excreta (Gbenou *et al.*, 2017). The combination of goat feces and chicken excreta will produce an optimal C/N ratio fertilizer for plant growth (C/N arround 20) (Tripolskaja *et al.*, 2014; Wuta and Nyamugafata, 2012). The liquid fertilizer of goat feces-chicken excreta has good quality, but the potassium (K) content is still low (Istanti *et al.*, 2019; Priyadi *et al.*, 2020), so it may be less than optimal if it is used on commodity flowering and fruiting plants, because potassium is important used in the supporting growth of plants (Magbalot-Fernandez and Deguzman, 2019). Coconut husk has a high K content, which the decomposition of this element in fertilizers has been carried out, and it has been shown to increase the concentration of potassium in fertilizers (Istanti *et al.*, 2019; Priyadi *et al.*, 2020). The limitation in the manufacture, use, and marketing of liquid fertilizer in the community is the unpleasant pungent odor (Fitriyanto *et al.*, 2019). The odor's cause is the ongoing fermentation of organic matter in the fertilizers due to a non-optimal process (Sastro *et al.*, 2013). Fermentation can be optimized with the addition of carbon (C) as an energy source for the microorganism (Wignyanto *et al.*, 2015), which is the commonly used is sugarcane molasses (Unnisa, 2015). Sugarcane molasses contains fermentable sugars which are dominated by disaccharides in the form of sucrose (60%), however, monosaccharides are also found, which are glucose and fructose (5% and 8%, respectively) (Palmonari *et al.*, 2020), these substances are an ideal energy source for isolated bacteria, because they can be easily used in bacterial metabolismi (Khoja *et al.*, 2018; Pyakurel *et al.*, 2019). Sugarcane molasses has been widely used in previous research related to biomass waste fertilizer (Hepsibha and Geetha, 2019; Priyadi *et al.*, 2020; Ruiz-Barrera *et al.*, 2018). Anaerobic fermentation of liquid fertilizers is widely applied (Fitriyanto *et al.*, 2019). The study by adding molasses gradually to making liquid fertilizer from agricultural waste is expected to improve its chemical and organoleptic quality. So this study aims to determine the quality of liquid fertilizer made from goat feces-chicken excreta-coconut husk with the addition of sugarcane molasses in different concentration.

Materials and Methods

Experimental site

The research was conducted in a field laboratory at Study Program of Livestock Product Processing Technology, Politeknik Negeri Banyuwangi, located in Banyuwangi District, East Java Province, Indonesia. Furtheremore, the research was carried out for four months started from April 2020. The research facility is located at an altitude of 62 masl and is located at 8º17'39.56"S; 114º18'25.23"E.

Experimental design and treatment

This study was conducted using a completely randomized design (CRD) with three replications. The utilization of different concentration of sugarcane molasses used in this study was 0%, 5%, 10%, 15%, 20%, and 25%, was carried out as the treatments in this study which is relative to the total solid material used. The ratio (w/w) of goat feces, chicken excreta, and coconut husk was 5: 2: 1, while the water is added with a ratio of 16 parts. The bio-activator was added by Effective Microorganism-4® (EM4®) at a rate of 10 mL/L of water. Fermentation was carried out in a tightly closed installation to maintain anaerobic conditions for 21 days. The solution was stired once a day. The biological tests carried out were The germination tests as a biological parameter was carried out using of mung bean seeds (*Vigna radiata*) (15 replicates) and spinach planting tests (*Amaranthus tricolor*) (nine replicates). The petri dish was prepared for the germination test, the seed planted on washed sand media covered with cotton on the bottom, watering the mung bean seeds as much as 20 mL/petri dish/day for five days with 20% liquid fertilizer concentration used. The application test on spinach was carried out with soil media (5 kg) in a polybag (Ø25 cm). Fertilization was done once a week as much as 250 mL by sprayingevenly on the above ground (30%) and watering at the base of the stem (70%) with a fertilizer concentration of 20%. Watering and fertilizing done in the morning.

Data collection and sampling procedures

Fermentation data including pH and temperature of the solution was collected once a week for 21 days of fermentation (Fitriyanto *et al.*, 2019; Priyadi *et al.*, 2020). Liquid fertilizer samples were collected by separating the solids by filtering the solution. The filtered liquid fertilizer was deposited overnight, then the sediment that appears was removed. Fertilizer samples were placed in glass bottles and then tested for their chemical content (C-organic, N, P, and K). The parameter observed in the germination test was the height of mung bean sprouts (mm) which was measured every day for five days. The parameters observed in the growth test of spinach were plant height (cm), number of leaves (sheets), leaf width (mm), root length (cm), and stem diameter (mm), which were collected at the age of 30 days after planting.

Physical and chemical analyses

Physical parameters of liquid fertilizers include pH, temperature, odor, and color. A digital pH meter was used (Ohaus ST3100-B, USA), while the temperature measurement used a digital thermometer (Fisherbrand S01595, USA). Odor and color parameters were measured organoleptically. Liquid fertilizers free from the sediment were tested for chemical content including C-organic, N, P, and K. The levels of C-organic and P were tested using spectrophotometry. N content was tested using the Kjeldahl method. K levels were tested using a flame photometer.

Statistical analyses

The data obtained (temperature, pH, germination height, plant height, number of leaves, leaf width, stem diameter, root length) were subjected to Analysis of Variance (ANOVA) using the Generalized Linear Model (GLM). Duncan's Multiple Range Test (DMRT) was a post hoc test used to measure specific differences ($P<0.05$) between pairs of means. The data were checked for normality and homogeneity before being analyzed using ANOVA.

Results and Discussion

Temperature and pH during anaerobic fermentation (21 days) did not show any significant changes ($P>0.05$) (Table 1) in all treatments. the average temperature during fermentation in the first to third weeks was 25.18ºC, 26.04ºC, and 26.98ºC, respectively. This value was lower than the average room temperature (29.1ºC). While the average value of pH in the first to third weeks was 7.62, 7.71, and 7.72, respectively, the liquid fertilizers had a slightly alkaline characteristic. Meanwhile, variations in the addition of molasses affect the organoleptic characteristics (Table 2) of liquid fertilizer. The addition of molasses at 15% showed a positive effect on the color (yellowish-brown) and the odor (pleasant smell) of liquid fertilizer.

The chemical content (C-organic, N, P, K) of liquid fertilizer was tested periodically (once a week) during the fermentation period of 21 days. The C-organic content tended to increase ($P<0.05$) with the addition of more molasses and the longer the fermentation was carried out (Table 3), although the C-organic content in the third week fermentation treatment was not different ($P>0.05$) compared to the second week fermentation. There was a positive interaction between the addition of molasses and the length of fermentation time. The positive interaction that emerged was a significant increase in the C-organic value ($P<0.05$) with the use of 20% sugarcane molasses with 2 weeks of fermentation.

Table 1. Average temperature and pH of the liquid fertilizer solution during fermentation

Molasses addition	1st week	2nd week	3rd week	Average
	Temperature			
P0 (0%)	25.24±0.52	26.18±0.60	26.97±0.28	26.13±0.86
P1 (5%)	25.12±0.27	26.02±0.84	26.87±0.39	26.00±0.90
P2(10%)	25.24±0.41	25.93±1.41	26.97±0.31	26.05±1.09
P3 (15%)	25.19±0.37	26.02±0.51	27.00±0.40	26.09±0.95
P4 (20%)	25.37±0.21	26.57±0.49	25.43±0.57	25.79±0.87
P5 (25%)	25.10±0.32	26.07±0.68	27.10±0.34	26.09±0.95
Average	25.18±0.36	26.04±0.81	26.98±0.33	
	pH			
P0 (0%)	7.84±0.08	7.75±0.35	7.80±0.26	7.79±0.25
P1 (5%)	7.74±0.27	7.80±0.29	7.73±0.29	7.75±0.27
P2(10%)	7.57±0.34	7.68±0.35	7.68±0.28	7.64±0.31
P3 (15%)	7.48±0.23	7.65±0.28	7.77±0.38	7.63±0.31
P4 (20%)	7.63±0.11	7.10±0.36	7.30±0.00	7.34±0.22
P5 (25%)	7.49±0.22	7.65±0.26	7.65±0.28	7.59±0.25
Average	7.62±0.27	7.71±0.29	7.72±0.28	

P0: 0% molasses liquid fertilizer; P1: 5% molasses liquid fertilizer; P2: 10% molasses liquid fertilizer; P3: 15% molasses liquid fertilizer; P4: 20% molasses liquid fertilizer; P5: 25% molasses liquid fertilizer.

Table 2. Organoleptict on liquid fertilizer

Molasses addition	Colour	Odor
P0 (0%)	Blackish-green	Stink
P1 (5%)	Blackish-green	Stink
P2(10%)	Blackish-green	Stink
P3 (15%)	yellowish-brown	Pleasant smell
P4 (20%)	yellowish-brown	Pleasant smell
P5 (25%)	yellowish-brown	Pleasant smell

P0: 0% molasses liquid fertilizer; P1: 5% molasses liquid fertilizer; P2: 10% molasses liquid fertilizer; P3: 15% molasses liquid fertilizer; P4: 20% molasses liquid fertilizer; P5: 25% molasses liquid fertilizer.

Table 3. Average C-organic (%) content on liquid fertilizer

Molasses addition	1st week	2nd week	3rd week	Average
P0 (0%)	0.27±0.01[a]	0.36±0.07[a]	0.55±0.03[a]	0.36±0.17[a]
P1 (5%)	0.42±0.03[b]	0.91±0.17[b]	0.71±0.24[ab]	0.62±0.34[a]
P2(10%)	0.76±0.08[c]	1.07±0.07[b]	1.43±0.03[bc]	0.91±0.53[b]
P3 (15%)	1.28±0.03[c]	2.08±0.36[c]	2.12±0.06[cd]	1.48±0.94[c]
P4 (20%)	1.23±0.16[c]	2.83±0.06[d]	1.95±1.23[cd]	1.67±1.30[cd]
P5 (25%)	1.26±0.10[c]	2.74±0.02[d]	2.58±0.19[d]	1.84±1.22[d]
Average	0.87±0.43[x]	1.67±0.97[y]	1.56±0.88[y]	

P0: 0% molasses liquid fertilizer; P1: 5% molasses liquid fertilizer; P2: 10% molasses liquid fertilizer; P3: 15% molasses liquid fertilizer; P4: 20% molasses liquid fertilizer; P5: 25% molasses liquid fertilizer.
Different superscripts for the same column (a, b, c, d) and in the same rows (x, y) were significantly different (P<0.05).

Table 4. Average N total (%) content on liquid fertilizer

Molasses addition	1st week	2nd week	3rd week	Average
P0 (0%)	0.16±0.01[a]	0.17±0.03[a]	0.20±0.00	0.18±0.02[a]
P1 (5%)	0.22±0.01[b]	0.24±0.05[bc]	0.23±0.04	0.23±0.03[b]
P2(10%)	0.22±0.01 [b]	0.20±0.01[ab]	0.24±0.01	0.22±0.02[b]
P3 (15%)	0.23±0.01 [b]	0.20±0.07[ab]	0.25±0.02	0.23±0.04[b]
P4 (20%)	0.22±0.04 [b]	0.28±0.01[d]	0.24±0.08	0.25±0.05[b]
P5 (25%)	0.19±0.02 [b]	0.23±0.00[abc]	0.23±0.01	0.22±0.02[b]
Average	0.21±0.03[x]	0.22±0.05[xy]	0.23±0.03[y]	

P0: 0% molasses liquid fertilizer; P1: 5% molasses liquid fertilizer; P2: 10% molasses liquid fertilizer; P3: 15% molasses liquid fertilizer; P4: 20% molasses liquid fertilizer; P5: 25% molasses liquid fertilizer.
Different superscripts for the same column (a, b, c, d) and in the same rows (x, y) were significantly different (P<0.05).

The average N content of liquid fertilizer (Table 4) in the first week was lower (P<0.05) than the others. While the highest N value was observed in the P4 treatment in the second week, with a value of 0.28%. This pattern was similar to the mean value of P and K levels (Table 5), that was second and third weeks of fermentation significantly (P<0.05) increased P and K levels compared to the first week of fermentation. A similar pattern also occurred in the interactions between the fermentation time and the addition of molasses on the N, P, and K content. As also happened in the C-organic test results, it was observed that there was a positive interaction in the P4 treatment which was indicated by a significant increase in value compared to other treatments.

Biological tests were carried out by germination on growth of mung bean (*Vigna radiata*) seeds and growth planting on spinach (*Amaranthus tricolor*). The germination test (Table 7) showed that the average 10% dilution has a lower yield than the 5% dilution (p<0.05), but was significantly higher (P<0.05) than the control. This indicates that at a dilution of more than 10%, it is possible that phytotoxic activity is more visible and has the potential to adversely affect germination (Hepsibha and Geetha, 2019). Meanwhile, on the average total addition of molasses, the P3 treatment showed significantly differences (P<0.05) than the control. The parameters to observe the growth of spinach (Table 8) were the number of leaves, leaf width, stem diameter, and root length. The use of liquid fertilizer did not produce a difference (P>0.05) in plant high. Significant effect (P<0.05) was observed in the other treatments, it was proven that there was a difference between the control and the addition of molasses. The highest number of leaves (P<0.05) was shown in treatments P1, P3, and P4. In the leaf width parameter, the P0-P3 treatment showed a significantly higher value (P<0.05) than the control. In the parameter stem diameter, P1 and P2 treatments showed a significantly higher value (P<0.05) than the control. Meanwhile, in the root length parameter, the P1-P3 treatments showed a significantly higher value (P<0.05) than the control. The addition of 25% molasses (P5), had a tendency to decrease the growth characteristics of spinach in all parameters.

During the fermentation of liquid fertilizers, there was no increase in temperature and pH per week (P>0.05) (Table 1). The fermentation temperature was below the ambient temperature. Liquid organic waste fermentation in the tropics has a temperature ranging from 2ºC below the ambient temperature, which has an average ambient temperature of 28ºC (Karyono, 2015). Fermentation occurs in a neutral pH range. Anaerobic composting bacteria have an optimum pH to develop at 6.5 to 7.5 (Suriani *et al.*, 2013). The pH and temperature values in the composting process of liquid fertilizer were similar to previous studies (Fitriyanto *et al.*, 2019; Priyadi *et al.*, 2020), which were in the normal range. Microorganisms in the bio-activator (effective microorganisms) can work at a pH value that tends to be normal, such as *Lactobacillus* spp, *Actinomycetes*, photosynthetic bacteria yeasts (Mouhamad *et al.*, 2017).

Composting on liquid materials does not cause an increase in temperature as in composting solid materials because the high water content causes the heat release reaction to being suppressed during the process of organic matter transformation (Srimeena *et al.*, 2014), similar results were shown in previous studies (Fitriyanto *et al.*, 2019). The temperature range during fermentation is classified as mesophilic fermentation (25ºC to 45ºC); most of the fermentation process of liquid organic matter takes place in that temperature range (Grubel *et al.*, 2014).

The addition of molasses has a positive impact on the odor and color of liquid fertilizer. The addition of molasses starting from 15% produces a liquid fertilizer that has not smell bad and has a distinctive aroma of sugar fermentation, with a lighter color than the P0-P2 treatment (Table 2). This study's results were similar to those of previous report (Fitriyanto *et al.*, 2019; Sastro *et al.*, 2013), that the use of sugar sources below 10% will produce dark and stinky liquid fertilizer. The addition of more than 10% molasses in liquid fermentation will increase bacterial activity, especially in anaerobic conditions with sufficient N content (Ruiz-Barrera *et al.*, 2018; Sastro *et al.*, 2013). This can be seen from the color and odor of the liquid fertilizer on P3-P5, which characterizes better organic matter degradation. Providing a simple sugar source has also been shown to affect the aroma of fermentation to be more acceptable (Sastro *et al.*, 2013).

Based on the test results, the fermentation time and molasses concentration showed differences result ($P<0.05$) between treatments. There was an interaction between the molasses addition and the fermentation duration on the liquid fertilizer C-organic content. This interaction was seen in the second week, which showed an increase in C-organic concentration compared to the first week ($P<0.05$), the interaction was significant in the P3-P4 treatment. On average, P5 showed the highest C-organic value compared to P0-P3, although not different ($P>0.05$) from P4. There was a decrease in C-organic concentration at third week compared to second week, although not significant ($P>0.05$). This decrease is due to carbon, nitrogen, and bacteria for fulfillment in the synthesis process (metabolism) (Diender *et al.*, 2015). Besides, C-organic content in raw materials has been optimally dissolved after fermentation in the second week (Muhialdin *et al.*, 2019). This dissolution is caused by bacteria and fungi found in the starter, they can degrade C-organic in the material to dissolve in the solution liquid fertilizers (Raden *et al.*, 2017).

The results of the study showed that the value of total N-content was similar to previous research, which is below 0.5% (Fitriyanto *et al.*, 2019; Priyadi *et al.*, 2020) but lower than liquid fertilizer from chicken slaughtering, which ranges from 0.6%-0.9% (Sastro *et al.*, 2013). Molasses are a source of energy for microorganism commonly used in agricultural waste's fermentation process (Sastro *et al.*, 2013; Unnisa, 2015). Microorganisms use sugar compounds for energy sources in metabolism along with N sources for cell synthesis (Muhialdin *et al.*, 2019). The higher ($P<0.05$) nitrogen content on the liquid fertilizer was along with the addition of molasses, this were due to the presence of nitrogen retained due to bacterial metabolism (nitrification) in addition to the results of manure N degradation (Widowati *et al.*, 2014). Previous studies have shown that molasses' presence increases nitrifying bacteria's population ten times (Balogun *et al.*, 2016).

There was an interaction between fermentation time and the addition of molasses to P dan C-organic levels. A surge in P concentration was seen after the second week. The degradation of P content in coconut husks was strongly suspected if the P solubilizing bacteria positively correlates with the molasses added. The bacteria in EM4 have been shown to effectively dissolve P in raw materials (Maass *et al.*, 2020). Moreover, the coconut husk is a K and P source and has good water solubility (Gbollie *et al.*, 2021), so its addition is proven to increase the phosphorus content of liquid fertilizer. Phosphorus is a nutrient that is needed in large quantities, so that its presence is one of the limiting factors for crop production. However, if it is given excessively, it will reduce the plant's quality because soil P becomes imbalanced and will also increase soil pH (Arniana *et al.*, 2012).

There was an anomaly that was shown in the P4 and P5 treatments. There was a decrease in the K concentration with the addition of 20 and 25% molasses. It is strongly suspected that adding a sugar source at an extreme level will inhibit the growth of K solubilizing bacteria. For example, *Bacillus* ssp will be suppressed by alcohol-

Table 5. Average P (%) content on liquid fertilizer

Molasses addition	1st week	2nd week	3rd week	Average
P0 (0%)	$0.05±0.05^{a}$	$0.10±0.01^{a}$	$0.11±0.01^{a}$	$0.09±0.04^{a}$
P1 (5%)	$0.05±0.05^{a}$	$0.11±0.03^{ab}$	$0.14±0.03^{ab}$	$0.10±0.05^{ab}$
P2(10%)	$0.11±0.03^{b}$	$0.12±0.03^{ab}$	$0.15±0.02^{ab}$	$0.13±0.03^{bc}$
P3 (15%)	$0.13±0.00^{b}$	$0.16±0.03^{b}$	$0.13±0.02^{a}$	$0.14±0.04^{cd}$
P4 (20%)	$0.19±0.03^{c}$	$0.17±0.07^{b}$	$0.13±0.02^{ab}$	$0.16±0.05^{d}$
P5 (25%)	$0.05±0.00^{a}$	$0.17±0.04^{b}$	$0.18±0.06^{c}$	$0.14±0.07^{cd}$
Average	$0.08±0.06^{x}$	$0.12±0.05^{y}$	$0.14±0.04^{y}$	

P0: 0% molasses liquid fertilizer; P1: 5% molasses liquid fertilizer; P2: 10% molasses liquid fertilizer; P3: 15% molasses liquid fertilizer; P4: 20% molasses liquid fertilizer; P5: 25% molasses liquid fertilizer.
Different superscripts for the same column$^{(a, b, c, d)}$ and in the same rows$^{(x, y)}$ were significantly different ($p<0.05$).

Table 6. Average K (%) content on liquid fertilizer

Molasses addition	1st week	2nd week	3rd week	Average
P0 (0%)	$0.11±0.01^{b}$	$0.11±0.00^{a}$	$0.11±0.01^{a}$	$0.11±0.01^{a}$
P1 (5%)	$0.11±0.02^{b}$	$0.14±0.03^{cd}$	$0.14±0.03^{c}$	$0.13±0.02^{b}$
P2(10%)	$0.12±0.01^{b}$	$0.15±0.03^{d}$	$0.15±0.02^{c}$	$0.14±0.01^{b}$
P3 (15%)	$0.13±0.01^{b}$	$0.13±0.03^{bc}$	$0.13±0.02^{c}$	$0.13±0.01^{b}$
P4 (20%)	$0.13±0.02^{b}$	$0.15±0.07^{d}$	$0.13±0.02^{b}$	$0.13±0.02^{b}$
P5 (25%)	$0.09±0.01^{a}$	$0.12±0.04^{ab}$	$0.18±0.06^{ab}$	$0.11±0.02^{a}$
Average	$0.11±0.02^{x}$	$0.13±0.05^{y}$	$0.14±0.04^{y}$	

P0: 0% molasses liquid fertilizer; P1: 5% molasses liquid fertilizer; P2: 10% molasses liquid fertilizer; P3: 15% molasses liquid fertilizer; P4: 20% molasses liquid fertilizer; P5: 25% molasses liquid fertilizer.
Different superscripts $^{(a, b, c, d)}$ for the same column were significantly different ($p<0.05$).

Table 7. Mean of mung bean sprouts height (mm)

Molasses addition	Liquid fertilizer concentration (%)			
	Control (water)	5	10	Average
Control (water)	50.85±3.93			50.85±3.93[a]
P0 (0%)		62.30±14.00	53.31±0.55	57.80±9.61[ab]
P1 (5%)		63.03±13.76	63.03±10.22	63.03±10.84[ab]
P2(10%)		72.77±9.81	63.70±5.63	68.23±8.71[ab]
P3 (15%)		78.90±2.31	66.47±14.31	72.68±11.42[b]
P4 (20%)		77.36±3.41	64.86±10.12	71.12±8.21[ab]
P5 (25%)		76.83±10.65	62.30±16.17	69.57±14.60[ab]
Average	50.85±3.93[x]	71.37±11.24[z]	62.36±10.47[y]	

Control: Watering with water; P0: Watering with 0% molasses liquid fertilizer; P1: Watering with 5% molasses liquid fertilizer; P2: Watering with 10% molasses liquid fertilizer; P3: Watering with 15% molasses liquid fertilizer; P4: Watering with 20% molasses liquid fertilizer; P5: Watering with 25% molasses liquid fertilizer.
Superscripts with different columns (X, Y, Z) and the same rows (a, b) were significantly different (p<0.05).

Table 8. Average spinach growth measurement results

Treatment	High (cm)	Number of leaves (sheets)	Leaf width (cm)	Stem diameter (mm)	Root length (cm)
Control	23.98±1.79[bc]	6.00±0.65[a]	2.96±0.22[a]	3.48±1.15[a]	7.72±1.64[a]
P0 (0%)	23.90±6.25[bc]	6.10±0.67 [a]	3.66±0.27[c]	4.57±1.29[abc]	13.25±3.31[cd]
P1 (5%)	25.29±5.21[c]	6.66±0.48[b]	3.69±0.42[c]	5.14±1.25[bc]	14.39±4.82[d]
P2(10%)	25.57±5.30[c]	6.39±0.69[ab]	3.59±0.49[c]	4.94±1.33[bc]	14.17±3.86[d]
P3 (15%)	21.82±2.95[ab]	6.66±0.59[b]	3.59±0.43[c]	4.09±1.22[ab]	14.67±3.67[d]
P4 (20%)	23.41±2.72[bc]	6.61±0.50[b]	3.56±0.46[bc]	4.03±0.93[ab]	12.36±3.29[abc]
P5 (25%)	19.93±1.32[a]	6.44±0.61[ab]	3.38±0.22[a]	3.37±0.92[a]	9.78±4.19[ab]
Average	24.21±4.79	6.45±0.67	3.49±0.70	4.60±1.83	12.43±4.46

Control: Watering with water; P0: Watering with 0% molasses liquid fertilizer; P1: Watering with 5% molasses liquid fertilizer; P2: Watering with 10% molasses liquid fertilizer; P3: Watering with 15% molasses liquid fertilizer; P4: Watering with 20% molasses liquid fertilizer; P5: Watering with 25% molasses liquid fertilizer.
Different superscripts (a, b, c) in the same column were significantly different (p<0.05).

producing bacteria (Teotia *et al.*, 2017; Thomas, 2012). Potassium in liquid fertilizer comes from two primary sources: coconut husk and chicken excreta (Gbenou *et al.*, 2017). The K element in liquid fertilizers is one of the quality parameters because the K element for plants is a regulatory function in several biochemicals related to energy metabolism, protein synthesis, enzyme activation, photosynthesis, and active transport (Hasanuzzaman *et al.*, 2018), deficiency of K mineral in plants resulting in brown leaf edges, shortening of internodes, root stress, and stunted plants (Hafsi *et al.*, 2014; Hasanuzzaman *et al.*, 2018).

Trends in data indicate that the provision of liquid fertilizer to a concentration of 10% does not have a negative effect on mung bean germination. This effect was indicated by sprouts' height in all treatments that exceeded the control sprouts' height. The mean of treatment P4 showed the highest growth and difference (P<0.05) from other treatments. Fertilizer application with a concentration of 10% showed smaller growth (P<0.05) compared to the treatment of 5% liquid fertilizer solution, although the average was above the control. This result indicates that the content of phytotoxic substances in the liquid fertilizer solution is in a low concentration. It does not inhibit the germination process of mung bean seeds. However, the fact shows that the sprouts' height decreases with increasing the concentration of the solution, showing that in a more concentrated dilution, the phytotoxic substances contained in the solution will be sufficient to inhibit the growth process.

The phytotoxic contained in liquid fertilizers is a byproduct of bacterial metabolism or substances in raw materials that are released during fermentation, for example, organic acids, ammonia, amino acids, peptides, hydrogen cyanide or ethylene, which can inhibit plant growth (Glick, 2012; Hepsibha and Geetha, 2019). Phytotoxic can suppress the germination process by inhibiting the metabolism of protein, nucleic acid, ion balance, water balance, photosynthesis, and respiration (El-Gawad *et al.*, 2015), blocking the work of enzymes and growth hormones, suppressing the hydrolysis of nutritious materials in early growth embryos (Imatomi *et al.*, 2015).There was a decreasing trend (P<0.05) in the performance of spinach with the extreme molasses addition (> 15%), as seen in plant height, leaf width, stem diameter, and root length. In plant height parameters, P5 treatment showed the smallest value (P<0.05), while P1 and P2 showed the highest value (P<0.05) but not different (P>0.05) with the control treatment, P0, and P4. The number of leaves was in the range of 6 sheets per plant, treatment P1, P3, and P4 had the greatest value (P<0.05) compared to the control treatment and P0, although not different (P>0.05) compared to P2 and P5. The leaf width parameters, stem diameter, and root length showed similar results as the number of leaves and P2 treatment shown dominated than other treatments. The tendency of plant performance to decrease with the addition of extreme molasses may be caused by a compound produced by bacterial metabolism in liquid fertilizer, which can interfere with plant growth (Ogden *et al.*, 2018). This result is similar to previous research with extreme liquid goat feces treatment, resulting in decreased vegetable growth (Sunaryo *et al.*, 2018). It is possible that the compounds that inhibit the growth of these compounds are phenolic, which is a secondary metabolite in the plant (goat freed) as raw material for fertilizer and dissolved in ethanol produced by fermented molasses (Christofoletti *et al.*, 2013). Phenolic compounds significantly interfere with plant growth. However, organic compounds such as acetic acid or other organic acids can have phytotoxic activity at high concentration levels (Olejar *et al.*, 2019).

Conclusions

The addition of molasses sugarcane with a concentration of 15% showed dominant results in most of the research parameters, including organoleptic, organic C, P, K, germination test and biological test (number and width of leaves, root length). The use of liquid fertilizer from goat feces-chicken excreta-coconut husk with the addition of molasses (15%) can increase the growth of spinach and does not have a negative effect on plant germination.

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