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Cost Production Evaluation and Effect of Lactic Acid Bacteria (*Lactobacillus plantarum*) as Starter with Different Molasses Addition

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ABSTRACT: This research aims to determine the level of molasses addition to the quality of lactic acid bacteria (LAB) as starter and to calculate cost production of the starter for silage fermentation. By conducting this study, it will be a feasible consideration in utilization of the LAB production by farmers. The variables of the starter quality were the change of pH, lactic acid production, total carbohydrates, total dry matter, total organic matter, and fermentation weight during fermentation. This research used the lactic acid bacteria (*Lactobacillus plantarum*) which inoculate as much as 5% of the rice bran media. It incubated the bacteria at room temperature for seven days. The treatments were the addition of molasses with concentration of 0% (T0M), 1% (T1M), and 2% (T2M). The result of the study shows that the addition of molasses at different levels and fermentation time are significant (P<0,05) for the pH and weight of fermented rice bran, but it does not give significant effect on lactic acid production, total carbohydrate, levels of dry matter, and levels of organic matter. The treatment of 2% molasses and five days fermentation were the best treatment due to the lowest pH obtained was 3,81. The cost production of the starter is Rp 11,780 per kilogram, thus it increases the total cost production at 24.06%. Starter production by farmers is not yet feasible because farmers are only able to anticipate the increase in the total livestock cost production of 18.47%.

Keywords: *Lactobacillus plantarum*, starter, molasses, production cost

INTRODUCTION

Forage preservation by silage method aims to keep availability of forages for ruminant throughout the year (Hanafi, 2008). Various number and total number of microbe, substrate, temperature, pH, air, toxic compound, and fermentation time affect fermentation process (McDonald *et al*., 2002). Lactic acid bacteria (LAB) which are added to silage aims to reach critical pH (pH 4) as earlier as possible, so that they produce good quality silage (Lamid, 2008).

Feed cost percentage of feedlot in South Minahasa Regency is about 50.20% from total cost of production (Tumober *et al*., 2014). Production cost is utilized by production factors that are converted to appropriate money with valid market cost (Gilarso, 2003).

This research aims to determine the level of optimal molasses addition in order to get LAB as good quality starter and to find out cost production of per unit starter of LAB based on rice bran as a consideration of feasibility of the starter production by farmers.

MATERIALS AND METHODS

Materials

Lactic acid bacteria that was used is *Lactobacillus plantarum* from Laboratory of Nutritional Biochemistry Gadjah Mada University's collection. The medium for LAB growth used rice bran (*Oryza sativa*) as medium. Additional material in the inoculation of LAB used sugarcane molasses (*Saccharum officinarum*). Acetate buffer solution with pH 4.5 was used to regulate water content and to make pH of growing media become acidic.

Methods

This research was started by further inoculation of bacteria in a solid growing medium (MRS gel). The bacteria were incubated in an oven at 37°C for 24 hours. Production of LAB used liquid medium (MRS broth) as starter. The research was continued by inoculating bacteria by using medium based on 4.5 kg rice bran. Addition of starter to rice bran medium is 5%. Buffer solution with pH 4.5 was added to make water content become 45% and to reduced pH value to be acid. Molasses given in each treatment was as much as 0% (T0M), 1% (T1M), and 2% (T2M). Medium which was inoculated with bacteria anaerobicallay and incubated for 7 days at room temperature.

The variables observed in this study were pH and weight changes which were conducted on day 0, 1, 3, 5, and 7. While lactic acid contents was observed when rice bran fermented reaches the lowest pH value. Total of carbohydrate, dry matter, and organic matter were observed at day 0 and when rice bran fermented reaches the lowest pH value. The data from the study, then, was analyzed to determine the best treatment, and, then, which was used for starter on the next culture.

The value of pH observation was conducted every day. Rice bran as medium fermentation that was reached in the critical pH was used as a starter to grow bacteria in the next stage. By utilisation of the best tretament, bacteria then grows in 20 kg of rice bran as growing medium in which their products are used for the calculation of the cost of production of rice bran based starter. The pH value and weight were designed with completely randomized factorial design with different levels of molasses factor and fermentation time and mean different due to the tretaments compared by Duncan's new Multiple Range Test (DMRT). While Lactic acid levels, total of dry matter, total of organic matter, and total of carbohydrates were analyzed using ANOVA and mean different due to the tretaments compared by Duncan's new Multiple Range Test (DMRT) (Astuti, 2007). Calculation of production cost per kilogram LAB as starter was formulated according to Gilarso (2003).

RESULT AND DISCUSSION

The addition of different molasses level and fermentation time gives significant change ($P<0.05$) in pH value. LAB lactic acid production during fermentation, according to Tamang (2010), can decrease pH level of feed. The 2% molasses level gives the lowest pH value due to high lactic acid production. The treatment of 2% molasses produces highest lactic acid level up to 411.93 mg/100g. However different molasses level did not affect lactic acid level ($P<0.05$) due to other organic acid production in addition of lactic acid production. Soluble carbohydrate was higher due to the addition of 2% molasses. It caused better growth of lactic acid bacteria and higher lactic acid production. Supriyanto *et al*. (2012) stated that *L. plantarum* which is incubated in medium with addition of 2% molasses has higher total cell at the end of incubation time.

The addition of different molasses level did not give significant effect ($P<0.05$) on total carbohydrate in 5 days fermented rice bran, but there was a decrease of total carbohydrate in each treatment. Total decrease of carbohydrate affected decrease of lactic acid bacteria quality. Addition of different level of molasses did not affect total dry matter of rice bran. However, total dry matter decreases in each treatment. Treatment of 0% molasses gives the lowest dry matter weight. Ridwan *et al*. (2005) stated that percentage of weight loss is assumed as dry matter weight loss. Percentage of dry matter weight loss under 10% is normal range.

The addition of different level of molasses did not give a significant influence in the decrease of total organic matter (OM) rice bran. Reduced content of OM showed that LAB utilizes content of rice bran. The decrease of OM content was caused by utilization carbohydrates by LAB to produce lactic acid. Rif'an (2009) stated that overhauled of soluble carbohydrates by LAB into organic acids are useful to decrease pH.

Each addition of molasses in a different level and time of fermentation gave significant effect ($P <0.05$) against the decrease of rice bran weight during fermentation, while interaction between

those two factors did not have a significant influence. The average of highest percentage of weight loss occured in the fermentation day 1 by 0.28%, and, then, was always decreased thorough day 7 by 0.11%.

Weight loss in rice bran produces gas during fermentation. Molin (2008) stated that, *L. plantarum* could convert 1 mol of pentose into 1 mol of lactic acid, acetic acid, and CO_2. Percentage of weight loss occurs until the seventh day of fermentation. Duncan test resulted in the addition level of molasses indicates that addition of 2% molasses gave a significant different ($P < 0,05$) with 0% molasses, but not gave a significant different from 1% molasses. Treatment with 2% molasses addition had the greatest average weight loss.

Starter cost production calculation was performed to determine cost of per unit starter production or per kilogram. Total cost (TC) or the total cost was the sum of fixed costs and variable costs (Boediono, 2008). Total cost incurring for production within a month is IDR 10,413,613, Total cost (TC) to produce a number of stuff, if divided by a number of production (Q), obtains average total cost (AC) (Sukirno, 2005). The average of total cost production for starter LAB is IDR 11,780. Praharsa *et al*. (2014) stated that beef cattle business is only able to anticipate the increase in livestock production costs at most 18.47%. The cost of livestock production at the beginning was IDR 563,017,97 per month. Additional fee for a starter which was IDR 135,470 in every month will increase the cost of livestock production into 24.06%. The percentage of increase livestock production costs was higher than the ability of farmers to anticipateed increased production costs. Starter production at a price of IDR 11,780 per kilogram is not feasible to implement.

CONCLUSION

Treatment with 2% molasses with fermentation time for five days was set as the most optimal treatment because it produces the lowest pH at 3.81. Production cost of rice bran based starter is IDR 11,780 per kilogram, increasing the total cost of livestock production amount by 24.06%. Production starter was not feasible, because it exceeds the ability of farmers to anticipate the increase of total costs of livestock production by 18.47%.

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