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The Effect of Leucaena Leaf Meal (*Leucaena leucocephala*) Fermented by *Bacillus laterosporus* and *Trichoderma viride* in the Ration on Performance of Pitalah Ducks

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Abstract: Here we try to determine the effect of fermented leucaena leaf meal in the ration of Pitalah ducks. The research design used Randomized Completely Block of Design (RCBD) with 7 treatments, 3 replications and each replication consist of 6 laying duck. The treatment of this research were RO (control), R1 (10% leucaena leaf meal without fermentation), R2 (10% leucaena leaf meal fermented by *Bacillus laterosporus)*, R3 (20% leucaena leaf meal fermented by *Bacillus laterosporus*), R4 (10% leucaena leaf meal fermented by *Trichoderma viride*), R5 (20% leucaena leaf meal fermented by *Trichoderma viride*), R6 (10% leucaena leaf meal fermented by *Bacillus laterosporus*+10% leucaena leaf meal fermented by *Trichoderma viride*). Parameter which are observed like: feed consumption, egg production, egg weight and feed conversion. The results showed that the ration treatment influenced different highly significant ($p<0.01$) for feed consumption, egg weight and egg mass ration treatment but influenced different significantly ($p<0.05$) on egg production and feed conversion treatment. The use of the product leucaena leaf fermentation with *Trichoderma viride* and *Bacillus laterosporus* as much as 20% in Pitalah ducks rations and R2 treatment increase feed consumption (897.47g/bird/week), egg production (59.66%), egg weight 56.23 g/grain, egg mass (234.86g/head/week) and feed conversion (3.58 for R6 treatment). Treatment ration (R2, R3, R4, R5 and R6) is better than control ration and can improve performance of Pitalah ducks.

Key words: Leucaena leaf meal; *Bacillus laterosporus*; *Trichoderma viride*; Pitalah ducks

INTRODUCTION

Pitalah duck, one of biodiversity (nutfah plasm) of West Sumatera, is a type of potential duck meat and egg-producer in Indonesia. It has a unique egg shell color, bluish green. It comes from Pitalah region in West Sumatera. Approximately 70-80% of production cost is influenced by the cost of feed (Tangenjaya, 2007; Kompiang, 2009). The use of local agricultural products and waste can reduce the cost of rations. That is why it is necessary to find materials which are easily found, inexpensive, widely available, good quality and do not compete with human needs. Leucaena (*Leucena leucocephala*) is a legume tree species that is an alternative potential animal feed particularly poultry feed raw materials and locally has a great opportunity because of its potential to be used as alternative feed which produces green waste containing good nutrients, easily grown to continuously provide feed and can replace fish meal and soybean in poultry rations. Leucaena content is 22.69% crude protein, 1.55% fat, 16.77% crude fiber, 11.25% ash, 1.92% Ca, 0.25% P and β-carotene 972.75 ppm.

Amino acid composition of leucaena leaf meal is almost balance with fish meal, except lysine and methionine which is lower, whereas when it is compared with soybean meal except acid glutamate, other amino acids is quite balanced. Leucaena leaf meal is also a good source of vitamin A which contains relatively high β-carotene that can lower cholesterol. Xantofil contained (888, 72 mg/kg DM) is also higher than yellow corn and alfalfa leaf containing only 300mg/kg DM. Xantofil acts as a source of pigmentation in the skin and eggshell (Laconi and Widiyastuti, 2010). However, the use of Leucaena has limitation, especially in fowl because it contains anti-nutritional substance, mimosine. To overcome the limitations, feeding leucaena leaf meal to poultry may use microorganisms through fermentation process. A biology treatment need to be applied such as fermented by *Bacillus laterosporus* (from isolate of *Tractus digestivus* of Pitalah Duck, Yessirita *et al*. (2010) and also *Trichoderma viride* (from isolate comersil), in order to reduce *mimosine*, crude fiber while increase of protein leveling order to reduce mimosine, crude fiber while increase of protein level. Fermentation also improves the digestibility (Winarno, 1980), adds flavor and aroma and increases the content of vitamins and minerals. Furthermore, Murugesan *et al*. (2005), represent that fermentation products have a preferred

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Table 1: Research ration composition

	Treatment ration (%)						
Ingredient	R0	R1	R2	R3	R4	R5	R6
Yellow corn	49.00	49.25	48.00	46.50	48.00	48.00	46.50
Rice bran	25.75	19.00	23.00	20.75	23.00	20.00	21.00
Soybean meal	10.00	8.00	6.00	2.50	6.25	2.50	2.50
Fish meal	11.00	9.25	9.00	6.50	8.00	5.25	6.00
LLM Without Fermentation (LLMWF)	0.00	10.00	0.00	0.00	0.00	0.00	0.00
LLMFBL	0.00	0.00	10.00	20.00	00.00	00.00	10.00
LLMFTV	0.00	0.00	00.00	00.00	10.00	20.00	10.00
Palm oil	2.00	2.25	2.00	2.00	2.00	2.00	2.00
$CaCO_3$	0.75	1.25	1.00	1.25	1.00	1.00	0.75
Mineral ducks	1.50	1.00	1.00	0.50	1.50	1.50	1.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Crude protein (%)	16.48	16.52	16.52	16.52	16.50	16.52	16.56
Crude fat (%)	5.53	5.37	5.37	5.22	5.37	5.22	5.25
Crude fibre (%)	5.42	6.03	5.96	6.56	5.97	6.49	6.59
Ca (%)	2.48	2.45	2.47	2.45	2.54	2.47	2.51
P (%)	0.79	0.74	0.76	0.71	0.79	0.71	0.70
ME* (%)	2842.12	2837.10	2851.35	2854.72	2838.51	2856.17	2845.22
Methionine* (%)	0.42	0.36	0.35	0.27	0.34	0.25	0.27
Lysin* (%)	0.99	0.82	0.78	0.56	0.75	0.51	0.54

Analysis from Animal Feed and Nutrition Laboratory Andalas University (2012), *Values based on NRC (1994)

flavor and has some vitamins (B1, B2 and B12) that are preferred when compared to the original material. In this case, mimosine was reduced by fermented *Bacillus laterosporus* and *Trichoderma viride* was compared without fermented.

MATERIALS AND METHODS

The research used one hundred and twenty six head Pitalah ducks, aged 5.5-6.0 months. They were kept in 21 individual battery cage units made from bamboo with a dimension 100 x 100 x 50 cm^3, each supplemented with individual drinking water and feed made from bamboo. The feed ingredients were consisted of corn, fishmeal, soybean, rice bran, palm oil and duck minerals, $CaCO_3$ and leucaena leaf meal fermented and without fermented (Table 1). The feed composition was formulated based on calculation from the list of feed material composition according to NRC (1994), ration was based on iso protein (16.5%) and iso energy (2850 kcal/kg) and analysis result from Animal Nutrition and Feed Laboratory Andalas University. Finally, mealed leaf of meal Leucaena leucochepala was used to analyze for mimosine contents (Matsumoto and Sherman, 1951).

The treatments of the research were consisted of seven kinds of feed composition, each treatment was repeated three times, each repetition was consisted of 6 ducks. Experiment was done *in vivo*, in Completely Randomized Block Design (Steel and Torrie, 1995). Data were analyzed using analysis of SAS program (1996). The feed trials were: RO (control), R1 (10% leucaena leaf meal without fermentation), R2 (10% leucaena leaf meal fermented by *Bacillus laterosporus)*, R3 (20% leucaena leaf meal fermented by *Bacillus laterosporus*), R4 (10% leucaena leaf meal fermented by *Trichoderma viride*), R5 (20% leucaena leaf meal fermented by *Trichoderma viride*), R6 (10% leucaena leaf meal fermented by *Bacillus laterosporus*+10% leucaena leaf meal fermented by *Trichoderma viride*). Leucaena leaf meal are leaves of lead tree (*Leucaena leucocephala*) that it were harvested, dried at 60°C for 24 h after that it were milled. Material for fermented products using a substrate consisting of a mixture of leucaena leaf meal added water (water content 80%). Then the substrate mixture is steamed for 30 minutes after the water boils, then let the temperature down to room temperature. After that the inoculation with the mold *Trichoderma viride* as much as 7% of the weight of the substrate with a thickness of 2 cm, then incubated for 7 days and for fermentation used bacterium of *Bacillus laterosporus* that leucaena leaf meal used as much as 6% of the weight substrate with thickness of 2 cm, then go into the incubator 37°C for 24 h. Fermentation product is dried and ground into flour which then becomes a product LLFTV (leucaena leaf meal fermentation with *Trichoderma viride*) and LLFBL (leucaena leaf meal fermentation with *Bacillus laterosporus*). The variables examined were: (1). Feed consumption; (2). Egg production; (3). Egg weight; (4). Egg mass and (5). Feed conversion. The composition of the duck diet is given in Table 1 and mimosine content in Leucaena Leaf meal as seen in Table 2.

RESULTS AND DISCUSSION

The results of the variety analysis shows that the addition of leucaena leaf meal fermentation products *Bacillus laterosporus* and *Trichoderma viride* and their mixtures or without fermentation and control ration gives different significant effect ($p<0.01$) toward consumption,

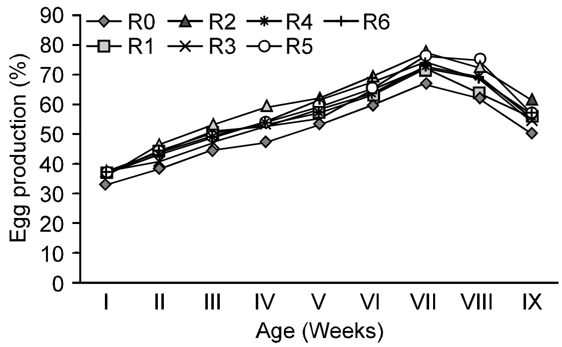

Fig. 1: Production of eggs Pitalah Ducks are getting ration of control, lamtoro leaf meal without fermented and that fermented with *Bacillus laterosporus* and *Trichoderma viride* and a mixture of both, during 2 months of the research

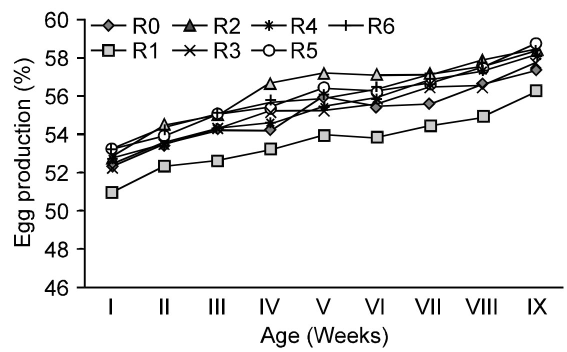

Fig. 2: Weight of eggs Pitalah Ducks are getting ration of control, lamtoro leaf meal without fermented and that fermented with *Bacillus laterosporus* and *Trichoderma viride* and a mixture of both, during 2 months of the research

weight and egg mass ration treatment. However, it has significantly influence ($p<0.05$) on the production and conversion ration treatment, as seen in Table 3.

Effect on feed consumption: Feed consumption indicates the presence of different levels of efficiency of nutrient absorption in the body. This difference is predicted not only because of the rate of decline varied mimosin but also the presence of other antinutritional in leucaena like mimosine, tannin and phenol compounds. As stated by Tangendjaja (1983), despite mimosin level, high level of tannin and total phenol can affect protein digestibility in monogastric livestock. Consumption of protein ration R1, R2 and R4 are each get 10% of electricity is different is not real, this is due to the energy content of the ration iso-energy 2800 kcal/kg and iso-nitrogenous 16%, according to Bell and Weaver (2002) and Amrullah (2003) the energy content of the ration is the main factors affecting consumption and livestock rations will stop eating when the requirements have

Table 2: Mimosine content in leucaena leaf meal (*leucaena leucocephala*)

Treatments	Mimosine	RMC (%)
Without fermented	2.62	00.00
Fermented by *Bacillus laterosporus*	0.92	64.89
Cermentede by *Trichoderma viride*	0.59	77.48

Note: Analysis from Microbiology Laboratory IPB, Bogor (2012). RMC: Reduction of mimosine contents

been met energy (Scott *et al*., 1982), added by (Nahashon, 2007) that contains a balance of nutrients, especially protein and energy metabolism affects the amount of the consumption ration.

Effect of egg production: Duck egg production ability is influenced by genetic and environmental factors and rations. Genetic factor significantly influences the production of eggs. Local Pitalah duck is not included in any superior Indonesian duck compared by Tegal or Mojosari duck. Its egg production is categorized so low which is only 180-200 grain/bird/year and is still low when compared to Tegal ducks and Mojosari 260-300 grains/bird/year (Prasetyo *et al*., 2003). Moreover, environmental factors also greatly affect the productivity of ducks. This is due to that ducks which are common in the cool temperature and then kept in hot environment will reduce their feed intake and affect the production of eggs. Other factor that greatly affects the production of eggs is ration. The reduction of mimosine on fermentation product treatment with *Bacillus laterosporus* 0.92% and *Trichoderma viride* is 0.59% compare to 2.62% before fermentation, does no show significant increase of egg production. The decrease of mimosin in the fermentation products is followed by an increase in DHP that suppresses iodine consumption so that it disrupts thyroxin hormone metabolism which in turn suppresses the growth and further affect egg production (Widiyastuti, 2001). If the ration contains energy and protein in a limited number, these birds compensate to reduce egg size and number of eggs produced, or extend the interval of laying eggs (Brand *et al*., 2003). Mean egg production of this research for 9 weeks test is 56.53-59.35% with the highest peak in week VII of 76.98% (R2). This is still in duck egg production limits recommended by Suswono (2011) on Pitalah ducks as biodiversity (nutfah plasm) of West Sumatera and local ducks family, the average egg production is 57.29-76.12%. More detail can be seen in Fig. 1.

Effect of egg weight, mass egg and feed conversion: The weight of eggs is influenced by the consumption of protein (Amrullah, 2003; Ivy and Glaves, 1996 and Rasyaf, 1991). Meanwhile, according to Keshavarz (2003) that an increase or decrease in consumption, especially the consumption of protein ration will affect the weight of the eggs produced. In this research seen

Table 3: The average value of effect on performance of laying Pitalah ducks for 2 months

	Treatment						
Performance	R0	R1	R2	R3	R4	R5	R6
Feed consumption (g/bird/week)	826.07[bc]	891.96[a]	897.47[a]	849.31[b]	884.94[a]	847.14[b]	796.67[c]
Egg production (%)	56.40[c]	58.49[ab]	59.66[a]	57.65[abc]	59.00[a]	56.85[bc]	56.75[bc]
Egg weight (g/grain)	55.22[b]	53.67[c]	56.23[a]	55.32[b]	55.23[b]	56.11[ab]	56.06[ab]
Egg mass (g/bird/week)	217.99[c]	219.73[bc]	234.86[a]	223.28[bc]	228.10[ab]	223.32[bc]	222.68[bc]
Feed conversion	3.79[bc]	4.06[a]	3.82[b]	3.81[bc]	3.88[ab]	3.79[bc]	3.58[c]

Description: Superscript different on the same lines show the effect of a significantly different ($p<0.05$) between treatment

an increase in egg production at 77% at week 7 and weight of the eggs contained 58.78% at week 9 as shown in Fig. 2.

Production of egg mass is influenced by the weight of duck egg and the quantity of duck egg production per day. Production of egg mass is a way of stating the production of eggs in the form of weights which is derived from multiplying the number of eggs by weight of each period (Hidayat, 2007). According to Bell and Weaver (2002), the output calculation of the daily egg mass in laying hens is by multiplying Hen day egg production with average egg weight in grams. In this research on Pitalah ducks, the highest of the average egg production is 59.66% and egg mass production of 33.55 g/bird/day is higher but with a lower egg weight 56.23 grams/grain compared with research of Prasetyo *et al.* (2003) in ducks resulted from the crossing of Alabio and Mojosari duck with the rate of egg production by 20.2% and egg weight average of 58.5 grams/grain resulted egg masses production of 11.82g/bird/day.

Average conversion ratio of this study is 3.82 lower than the research conducted by Prasetyo *et al.* (2003), that is the average value of conversion ratio from crosses of Mojosari with Alabio duck of 4.10. According to Amrullah (2003) the factors that affect the conversion of ration is the ration consumption, the energy content of the ration, egg production, size of the livestock, the fulfillment of anti-nutritional substances in the ration, the temperature of the environment and health of the livestock. Rasyaf (1991) added that conversion ration can be used as an overview of the production coefficients. The smaller the value of the conversion, the more efficient the using of ration conversion and vice versa.

Conclusion: Based on these results it can be concluded that the use of leucaena leaf fermented by *Trichoderma viride* or *Bacillus laterosporus* (LLMFTV and LLFBL) or a mixture of both can be used as much as 20% in Pitalah duck rations. R2 ration treatments can increase feed consumption, egg production, egg weight, eggs mass and feed conversion compared by control ration. Obtained under these conditions feed consumption 897.47 g/head/week, egg production (Duck day production) 59.66%, egg weight 56.23 g/grain, egg mass 234.86 g/bird/week and feed Conversion of the best obtained 3.58 (treatment R6), where everything is better than the control ration.

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