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Relationship between pellet durability index and hardness of pellet with various binder for broiler finisher phase

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Abstract. Feed quality is not only in terms of nutrition but also from physical quality. Good physical quality will increase feed consumption and improve the performance of broilers finisher phase. One feed that is usually given is pellets. This research aims to determine the effect of using molasses, tapioca flour and bentonite binder on relationship between pellet durability index and hardness of pellet for broiler finisher phase. The experimental design used was a completely randomized design with 4 treatments and 4 replications. The treatments were feed of broiler finisher phase with the addition of binder, as follows: P0 (without binder); P1 (molasses 2%); P2 (tapioca flour 2%) and P3 (bentonite 2%). To determine the relationship between pellet durability index (Y) and hardness (X) using simple linear regression analysis. The research results showed that the pellet durability index is strongly influenced by the level of pellet hardness where the higher hardness value will increase pellet durability index, with a correlation of 79.80%.

1. Introduction

Good feed in terms of quality and quantity an important to determine broiler productivity and efficiency of maintenance of broilers. Feed quality is not only in terms of nutrition but also from physical quality. Good physical quality will increase feed consumption and improve the performance of broilers finisher phase. One of feed that is usually given is pellet.

Pellets are a form of feed that can be used as feed for broilers. Pellets are compacted feed, compacted through a mechanical process. Pellets can be in the form of cylinders of different diameters, lengths and degrees of strength [1]. The problem with using pelleted feed is that it is easily damaged at the time of transportation and storage because of the structure that is less strong and easily crushed. The way to solve this problem is to use binder when making pellet so that the resulting pellets will be better. Binder is a material that functions for bind components in pelleted feed so that the structure remains compact and strong. material natural binders have been used as binder for various feeds, including tapioca flour, cassava flour, molasses, and seaweed [2].

The binder from tapioca flour and molasses contains starch which is an ingredient forming binder. Starch will form a gel which is very helpful in the manufacturing process feed to become harder and not easily crushed [3]. The adhesion force between solid particles and molasses can bind the particles and harden after cooling process [4]. Pellet form of animal feed compilers can use a mixture of tapioca flour about 2% up 5%, especially for bind materials which can serve as an effective binder [5].

The binder functions to bind the components of the feed in the pellets the structure remains compact. The binder commonly used in animal feed factories is binder synthetics such as bentonite and lignosulfonate [6]. Addition 5% tapioca flour in the pellet produced the best physical quality with



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specific density is 549 kg/m³ and compact specific density is 746 kg/m³ [7]. Use of 2% bentonite binder produces a percentage of pellet durability of 95% [8]. This research aims to determine the effect of using molasses, tapioca flour and bentonite binder on relationship between pellet durability index and hardness of pellet for broiler finisher phase.

2. Method

This research was conducted from June to July 2020 at the Feed Technology and Industry Laboratory Faculty of Animal Science, Universitas Hasanuddin, Makassar and PT. Japfa Comfeed Indonesia, Tbk. Makassar. The experimental design used was a completely randomized design with 4 treatments and 4 replications. The treatments were feed of broiler finisher phase with the addition of binder, as follows: P0 (without binder); P1 (molasses 2%); P2 (tapioca flour 2%) and P3 (bentonite 2%). The study was carried out with the stages of preparing feed, feed formulation, mixing feed, adding binder, adding water, pelleting process, cooling and drying, sampling and measuring research parameters.

The broilers finisher phase feed is prepared based on the standard requirements of the broiler finisher phase in accordance with SNI 8173.3: 2015. The composition of the feed is a concentrate of broilers finisher phase in mash (50%) produced by PT. Charoend Pokphand Indonesia, corn (35%) obtained from CV. Barbas Agro Celebes and rice bran (15%) obtained from rice mill in Sidrap regency. The quality of the feeds used is as shown in table 1.

Table 1. Analysis of nutritional content of feeds used in pellet making.

Nutritional content (%)	The ingredients of the feed		
	Broiler concentrate finisher phase	Corn	Rice bran
Water	10.32	10.72	10.79
Crude protein	37.66	8.78	7.34
Crude Fiber	6.04	3.31	8.23
Crude Fat	4.14	5.35	10.6
Ash	17.42	1.85	6.47

The mixed feeds were added with binder according to the treatment. Binder on mix manually and the addition of water is done by spraying water using pressure sprayer into the feed which has been given the binder manually. Addition of levels water based on the condition of the initial moisture content of the material up to the level of 30-35% measured using grain moisture tester. The pelleting process uses a farm feed pelleter. The pellets produced then cooling with room temperature and drying under the sunlight until the water content of the pellets is at the level of water content of 10-12%.

Sampling for parameter measurement using the quartering method based on SNI 13-6717-2002. The parameter observed was the relationship between pellet durability index (Y) and hardness (X). The data obtained were processed using simple linear regression analysis data Microsoft Office excel series 365.

3. Results and discussion

Based on the results of research on the relationship between pellet durability index and hardness of broiler finisher phase pellet index was obtained by simple linear regression statistical data at table 2. Results of simple linear regression analysis of the relationship between pellet durability and hardness of broiler finisher phase pellet index obtained the coefficient of determination of 0.636. This matter shows that the relationship between pellet durability index and hardness is 63.6% and the degree of closeness linear relationship between pellet durability index with hardness of 79.8%. The simple linear regression shows that the relationship between pellet durability and hardness of broiler finisher phase pellet were significantly different (P <0.05). Pellet durability index is influenced by the effectiveness of the sticky power of the binder. The stickiness is closely related to the gelatinization process of the starch of the binder. The starch content in the material affects the pelleting process, the more starch is converted by heat helps improve the bonding process of the particles in the pellet thereby increasing the resistance of

the pellet. The resistance of pellets is influenced by a lot of starch which is converted by hot steam into an adhesive so that it can help the bonding process of the particles in the pellet. Pellets that are strong, sturdy and do not break easily help the handling and transportation process to keep them intact.

Table 2. Regression statistics results relationship between pellet durability index and hardness.

Regression		
Multiple R		0.79
R Square		0.64
Adjusted R Square		0.61
Standard Error		0.55
Regression (Significance)		0.00
Variabel	Coefficients	p-value
Constanta (a)	92.26	0.00
Hardness (x)	0.91	0.001139

The results of calculating the simple regression coefficients in table 2 show that the coefficient of constant values is 92.26 and the coefficient of the independent variable (X) is 0.91, therefore, obtained a regression equation is $Y = 92.26 + 0.91X$ (figure 1).

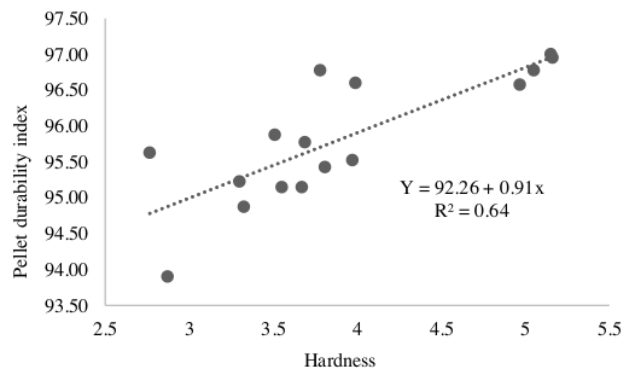


Figure 1. Relationship between pellet durability index and hardness.

The hardness variable coefficient (x) is positive (0.91) in the regression coefficient independent variable (hardness) illustrates that the direction of the relationship between the independent variables (hardness) with the dependent variable (pellet durability index) is unidirectional, where each increase is one unit the hardness variable which is 1 kg, will cause an increase in the pellet durability index of 0.91%. The addition of binder especially bentonite, results in a strong bond between the particles of the pellet making up so that the material is not filled with air cavities during the pressing process. Pellets with little air cavity produce a compact pellet texture and will withstand the pressing process. The measurement of hardness can be influenced by several factors, including variations in the length of different pellets, differences in pressure received and the presence of cracks in the pellets [9]. The hardness value has variations due to several things, namely variations in pellet length, longer pellets usually require greater splitting than short pellets, cracks in the pellets and in some cases due to compression received by the material during the pellet-making process [10].

4. Conclusion

Based on the research results, it can be concluded that the pellet durability index is greatly influenced by level of pellet hardness, the higher the value of hardness pellets will increase pellets durability index, with correlation of 79.80%.

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