Research Paper

The Assessment of Corn Quality as Feed Ingredients Received at an Animal Feed Mill

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ABSTRACT: This study aims to determine the quality control in the procurement of corn feed ingredients in animal feed mill. The research data collection was carried out based on procurement in the form of sacks and bulk which were loaded in trucks with 76 samples each. The research stages were pre sampling, preparation, sampling, measurement of corn quality parameters. Parameters observed were moisture content, damaged kernels, mouldy kernels, broken kernels, and foreign matter. Data were analyzed by descriptive analysis, t-test: one sample, and t-test: with – without testing using Data Analysis Microsoft Excel Series 365. The results showed that there were 97.37% of corn in sacks that had a moisture content outside the quality of SNI (Indonesian National Standard), and the quality of damaged kernels, moldy kernels, broken kernels, and foreign matter in the category of SNI quality. Based on the moisture content, damaged kernels, moldy kernels, cracked kernels, and foreign matter, corn was obtained in bulk containers according to SNI quality. Corn in sacks showed a higher quality of water content and foreign matter ($p<0.05$) than corn in bulk containers, but based on the quality of damaged kernels, corn in bulk containers was higher ($p<0.05$) than corn in sacks.
KEYWORDS: corn quality, quality control, feed mill, animal feed

I. INTRODUCTION

Feed is an important factor in livestock development because about 60% of production cost is feed. The feed mill has an important role in the development of livestock. The success of the livestock sector is determined by the availability and quality of animal feed (Syamsu et al., 2015). The feed mill as an animal feed producer guarantees the quality of the ration according to the nutrient requirements of animal, animal health, and human health as consumers of livestock products. Feed raw materials used as inputs in the animal feed mill from various sources have very varied qualities. Variations in the quality of feed raw materials are caused by natural variations, processing, post-harvest, and adulteration of feed ingredients. One of the dominant feed ingredients used in feed mills is corn.

In Indonesia, the use of corn as an animal feed ingredient in rations, especially poultry, is a component of primary with a proportion of about 60%. Estimated more than 58% of corn needs in Indonesia is used for feed, about 30% for food, and the other side for industrial needs and kernels (Panikkai et al., 2017). Procurement of corn feed ingredients in a feed mill considers nutritional quality, continuity of availability, and price factors. Thus, quality control in the procurement of corn from suppliers must be carried out to ensure the quality of corn, so a strategy for purchasing feed raw materials is needed (Stark, 2012). Only quality raw materials can deliver the quality output product. Different types of raw materials are received every day in feed mills, such as corn. To sort out the quality feedstuff, some rapid tests and inspection methods are applied commonly, such as moisture, insect, particle size test, etc. (Islam et al., 2016; Tangendjaja et al., 2008).

The acceptance of feed raw materials in animal feed mills generally has its quality standards of acceptance that must be known by feed raw material suppliers. The quality standard of corn feed ingredients in Indonesia is based on the Indonesian National Standard SNI 4483:2013 (Table 1) for corn as a feed ingredient (Badan Standardisasi Nasional, 2013). The quality of corn in Indonesia as animal feed ingredients is grouped into two qualities, namely quality one and quality two. The parameters that are required for corn quality are

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moisture, crude protein, mycotoxin, percentage of damaged kernels, mold kernels, broken kernels, and foreign material in corn.

Table 1. Quality requirements of corn as animal feed (SNI 4483:2013)

No.	Parameter	Unit	Requirements	
			Quality I	Quality II
1	Moisture (max)	%	14	16
2	Crude protein (min)	%	8	7
3	Mycotoxins:			
	-Aflatoxin (max)	µg/kg	100	150
	-Ochratoxin (max)	µg/kg	20	No required
4	Damaged kernels (max)	%	3	5
5	Mold kernels (max)	%	2	5
6	Broken kernels (max)	%	2	4
7	Foreign material (max)	%	2	2

Thus, quality control in the procurement of corn feed ingredients in feed mills is a determining factor for the quality of feed to be produced. In general, feed mills have acceptable corn quality standards as feed ingredients. This study aims to determine the quality of corn received as feed ingredients in an animal feed mill.

II.   MATERIAL AND METHODS

The research was conducted at PT. Japfa Comfeed Indonesia Tbk, Makassar, Indonesia. Research data was collected based on the supply of corn received by the feed mill. Corn supplies are received in the form of sacks (CS) and bulk (CB). The supply of corn in sacks is the supplier using sacks that are transported in the back of a truck. Corn supply in bulk is corn transported in tailgates or without sacks. The number of corn suppliers as samples in this study were 152 corn suppliers with 76 corn suppliers for CS and CB respectively.

The research was carried out in stages, namely pre-sampling, preparation, sampling, and measuring corn quality parameters. Pre sampling is the activity of taking corn from truckloads that enter the feed mill. The pre-sampling technique for CS is to take the corn from the top and bottom of the sack. The CB pre-sampling technique is to use an automatic sampler that takes 15 points. Preparation is a preparatory activity before sampling. The preparation is done by stirring the corn in the sample container so that it is evenly mixed, and then the corn is divided into four parts. Sampling is the activity of taking 100 grams of corn that has been prepared.

The parameters observed in this study were the measurement of moisture content using a moisture tester. The percentage of damaged kernels, mold kernels, broken kernels, and foreign material is calculated based on SNI 4483:2013.

2.1.Moisture Content

Moisture content is the amount of water contained in feed ingredients. The measurement of the moisture content of corn is carried out using a moisture tester.

2.2.Damaged Kernels

Damaged of corn kernels are a whole or broken corn kernels that are damaged due to mechanical, biological, physical and enzymatic influences (Figure 2.a). Corn kernels were separated visually using tweezers and a magnifying glass. The calculation of the percentage of damaged kernels is the weight of damaged kernels in the sample divided by the total weight of the sample multiplied by 100 per cent.

2.3.Mold Kernels

Mold kernels is a corn kernels that is attacked by fungus, which has changed colour from its original colour (Figure 2.b). The separation of mold kernels is done by separating the mold corn visually using a UV lamp and tweezers. The calculation of the percentage of mold kernels is the weight of mold kernels in the sample divided by the total weight of the sample multiplied by 100 per cent.

2.4.Broken Kernels

Broken kernels are corn kernels that are broken during the processing process which have a minimum size of 0.6 parts of whole corn (Figure 2.c). Separation of broken kernels by visually using tweezers and a magnifying glass. The calculation of the percentage of broken kernels is the weight of broken kernels in the sample divided by the total weight of the sample multiplied by 100 per cent.

2.5.Foreign Material

Foreign material is should not be present in feed raw materials or objects other than corn (Figure 2.d). The separation of foreign objects is done by separating foreign objects visually using tweezers and a magnifying glass. The calculation of the percentage of foreign material is the weight of foreign material in the sample divided by the total weight of the sample multiplied by 100 per cent.

Figure 2. Visualization of corn broken kernels, mold kernels, damaged kernels, and foreign material

The data obtained were analyzed using descriptive analysis, t-test: one sample to compare the average value of quality parameters with Indonesian National Standard (SNI) for corn as a feed ingredient. Testing the differences in the quality of CS and CB will be analyzed by t-test: with – without testing. Data analysis was calculated using Data Analysis of Microsoft Excel (Berk and Caray, 2010)

III. RESULT AND DISCUSSION

The quality of corn feed raw materials in procurement at feed mills is based on CS and CB as shown in Table 2. Table 2 shows that the moisture content of corn feed ingredients received in the form of sacks (CS) is 97.37% of the corn supply sample that does not according to SNI quality or quality III with an average moisture content of 26.13% (Figure 2). Based on other quality parameters, the corn received by the feed mill has followed the quality of SNI (quality I), namely 100% damaged kernels, 88.16% mold kernels, 89.47% broken kernels, 100% foreign material from the corn supply sample.

On the other hand, the moisture content of corn feed ingredients received in bulk (CB) showed that only 14.47% of the corn supply samples did not according to SNI quality, the average moisture content was 17.8% (Figure 3). Based on other quality parameters, the corn received by the feed mill has followed the quality of SNI 1, namely 100% damaged kernels, 93.42% mold kernels, 76.32% broken kernels, 100% foreign material from the corn supply sample.

Thus, it can be explained that the feed material received by feed mills in the form of sacks (CS) generally has a high moisture content compared to the supply of corn in bulk (CB). The results of interviews with corn suppliers obtained information that corn supplied with sacks generally has not been dried after harvest. In contrast to corn which is supplied to feed mills in bulk, it has been dried, so that the moisture content is generally in accordance with SNI quality (quality I and II).

The moisture content of corn produced by farmers generally has a high moisture content so that it cannot be stored for a long time and does not comply with the quality requirements of feed mills with a maximum corn moisture content of 16%. Post-harvest handling such as drying determines the quality of the corn produced. Even though production is high, post-harvest handling is not appropriate, causing low corn quality so that it affects the selling price (Adiputra, 2020). Price factors, availability dan consistency of supplies be of utmost importance to ensure raw materials of adequate quality (´Smiglak-Krajewska, 2020).

Table 2. The quality of corn feed raw materials in received at feed mills

| Corn Supply Type	Parameter	Quality According to SNI		Quality Not According to SNI
		Quality I	Quality II	Quality III
CS Corn-Sacks	Moisture			
	Percentage of Samples	0%	2.63%	97.37%
	Number of Samples	0	2	74
	Damaged kernels			
	Percentage of Samples	100.00%	0.00%	0.00%
	Number of Samples	76	0	0
	Mold karnels			
	Percentage of Samples	88.16%	10.53%	1.32%
	Number of Samples	67	8	1
	Broken kernels			
	Percentage of Samples	89.47%	10.53%	0.00%
	Number of Samples	68	8	0
	Foreign material			
	Percentage of Samples	100.00%	0.00%	0.00%
	Number of Samples	76	0	0
CB Corn-Bulk	Moisture			
	Percentage of Samples	56.58%	28.95%	14.47%
	Number of Samples	43	22	11
	Damaged kernels			
	Percentage of Samples	100.00%	0.00%	0.00%
	Number of Samples	76	0	0
	Mold kernels			
	Percentage of Samples	93.42%	6.58%	0.00%
	Number of Samples	71	5	0
	Broken kernels			
	Percentage of Samples	76.32%	23.68%	0.00%
	Number of Samples	58	18	0
	Foreign material			
	Percentage of Samples	100.00%	0.00%	0.00%
	Number of Samples	76	0	0
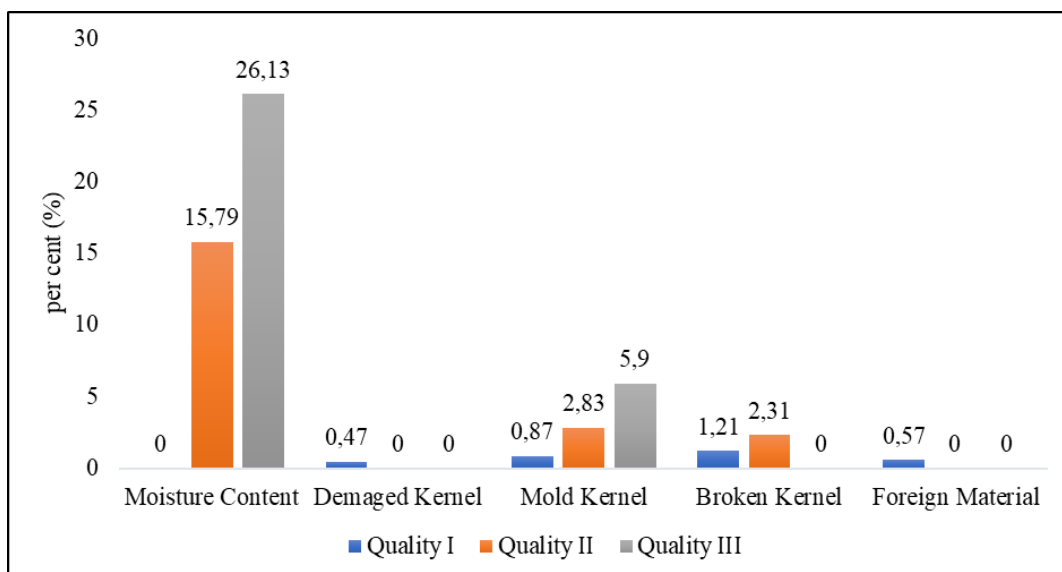
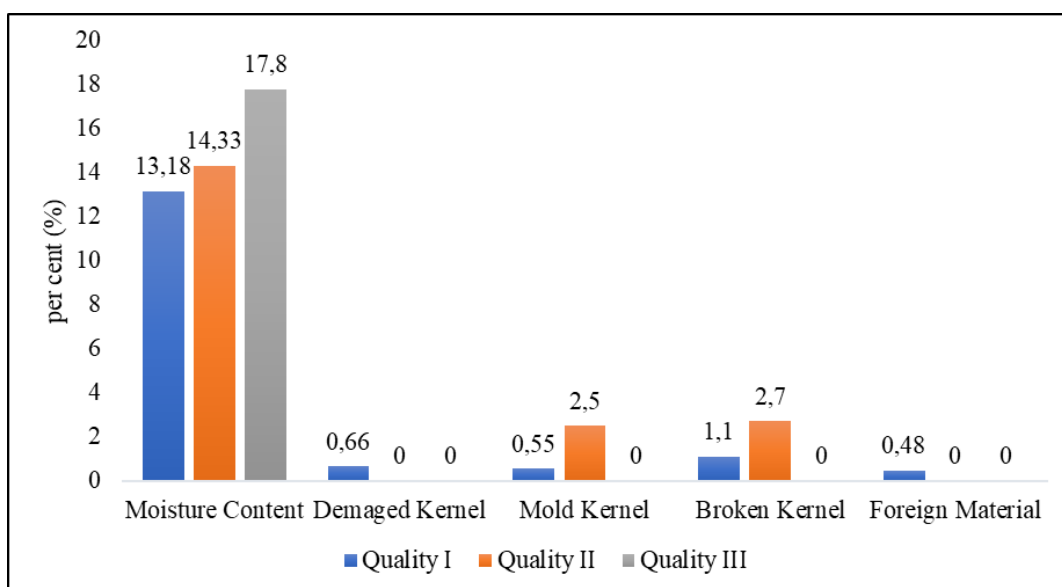**Figure 2.** The average quality of corn feed ingredients supplied using sacks (CS)

Figure 3. The average quality of corn feed ingredients supplied by bulk (CB)

The results of the t-test analysis (Table 3) showed that the moisture content, damaged karnel, foreign material from CS were significantly different ($p<0.05$) compared to CB. Based on moisture content and foreign matter, CS was higher than CB ($P<0.05$) with an average moisture content of 25.6% vs. 15.39%) and foreign material was 0.57% vs. 0.48%. There was no significant difference between CS and CB in terms of the quality of mold kernel (1.15% vs 1.09%), and broken kernel (1.33% vs 1.49%).

Based on the research results, it is known that feed mills receive corn from suppliers with high moisture content that is not in accordance with SNI corn quality requirements, which is a maximum of 16%. The feed mill has corn drying facilities so that corn received even with a high moisture content will be dried before being used in feed production. In addition, the availability of corn fluctuating levels are influenced by the harvest of corn, so corn as a feed mill store stock feed ingredients to ensure the production of feed not having problems.

Table 3. Comparison of the quality of corn received in sacks (CS) and bulk (CB) at the feed mill

No	Parameter	Corn Supply Type		t-value	Sig.
		CS	CB		
1.	Water Content			16.71	p<0.05
	Average (%)	25.86 [a]	15.39 [b]		
	Standard Deviation	3.40	4.28		
2.	Damaged kernels			2.45	p<0.05
	Average (%)	0.47 [a]	0.66 [b]		
	Standard Deviation	4.20	0.44		
3.	Mold kernels			0.46	*no significant*
	Average (%)	1.15 [a]	1.09 [a]		
	Standard Deviation	0.96	0.64		
4.	Broken kernels			1.59	*no significant*
	Average (%)	1.33 [a]	1.49 [a]		
	Standard Deviation	0.53	0.72		
5.	Foreign material			2.02	p<0.05
	Average (%)	0.57 [a]	0.48 [b]		
	Standard Deviation	0.3	0.23		

Different superscripts in the same line showed significantly different (p<0.05)

IV. CONCLUSION

This study concluded that as much as 97.37% of corn received by the feed mill in sacks had a higher moisture content than bulk corn, so it did not meet the quality requirements of SNI. However, the feed mill still accepts the corn because it will be dried to reduce the water content until it meets the SNI quality requirements, namely quality I and quality II. Based on, other corn quality requirements namely damaged kernels, mold kernels, broken kernels, and foreign material meet the SNI requirements for both corn supplied using sacks or in bulk.

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