

Analysis of Factors Affecting the Quality of Corn and the Supply Chain as An Animal Feed Ingredient in Karo District, North Sumatra

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| Joko Susilo^{1,*} | Ma'ruf Tafsin² | Elisa Julianti³ |

^{1,2,3} Faculty of Agriculture,
Univeritas Sumatera Utara,
Indonesia

*jokosusilo540@yahoo.com

ABSTRACT

This study aims determine the quality of corn, analyze the factors that influence corn quality and analyze differences in corn prices at the farmer and marketing level in Karo Regency. This research was carried out in Karo Regency in May - July 2023 with a total of 98 respondents. It used multiple linear analysis. The results of the research show that the quality of corn available to farmers and marketing meets SNI requirements as raw material for animal feed. The results of multiple regression analysis show that water content, supply chain and harvest season have a significant effect on corn quality in Karo Regency. The marketing margin for farmers is as high as IDR 523/kg, while at marketing level it is IDR 1,012/kg. The farmer share obtained at farmer level was 89.24%, while at marketing level it was 82.71%.

KEYWORDS

quality; aflatoxin; marketing margin; farmer share.

INTRODUCTION

Corn is a commodity needed by many industries. The use of corn for feed reaches 83 percent of the total corn requirement (Haryono, 2012). In addition, around 51% of feed raw materials for the food and animal feed industry come from corn (Purwono and Hartono, 2008). The high increase in demand for corn is the reason for early harvesting, resulting in a decrease in corn quality and below the manufacturer's corn quality standards because it has an impact on added value.

The development of the need and availability of corn in feed factories nationally has continued to fluctuate and increase over the last three years. Based on data from the Directorate General of Livestock And Animal Health Services, the availability of corn in feed factories for the North Sumatra region reached 313,000 tons in 2019 and increased to 467,000 tons in 2022. This is in line with the total volume of corn purchases by manufacturers which increased from 691,000 tons in 2019 to 789,000 in 2022. With the increasing need for the availability and volume of corn purchased, there will also be an increase in the quantity of animal feed factories, which will have an effect on increasing the demand for corn from farmers.

The quality of corn produced must meet industry quality standards which refer to the national standardization body. Based on SNI 01-4483 of 1998 regarding corn as a feed raw material, good quality corn has several quality requirements, including a maximum water content of 14%, a maximum fiber content of 3% and a maximum aflatoxin content of 50ppb. The high-water content in domestically produced corn is due to a poor storage system so that it does not meet the production requirements for animal feed raw materials.

Another factor that can influence the quality of corn in meeting industry standards is the mycotoxin content. Aflatoxins are a class of toxin compounds produced by molds from the

genera *Aspergillus*, *Fusarium* and *Penicillium* which have the potential to cause health problems in livestock. These molds are commonly found in food stored in storage rooms with high humidity conditions.

Karo Regency is a corn production center in North Sumatra with production of 757,927 tons/year (BPS, 2022). This makes Karo Regency the largest supplier of corn commodities to the livestock industry in North Sumatra Province. Farmers in Karo Regency harvest corn in 2 periods a year, the first period is June to August and the second period is December to February. According to the meteorological agency, there are differences in climate in these two periods, namely that from June to August there is a dry season, while from December to February it is the rainy season. According to Herlina & Prasetyorini (2019), climate temperature can affect the productivity and quality of corn commodities.

High demand makes it difficult for farmers to market it, so they need help from third parties to receive corn harvests from farmers which are then distributed to industries in need. This activity is known as the supply chain, namely the marketing process through several stages to consumers who need it. The longer the supply chain that is traversed, it will affect the quality and price of corn from farmers. For example, a supply chain that accommodates small scale will be different from a large-scale supply chain. For example, large-scale supply chain actors will carry out drying treatment to reduce the moisture content of corn taken from farmers. The drying carried out by supply chain actors has not been properly designed so it can cause a decrease in quality and damage. Based on this background, it is necessary to conduct research on the quality of corn and the supply chain at different harvest periods as a feed ingredient in Karo Regency.

RESEARCH METHODS

Research data collection was carried out from January 2023 to December 2023. The research was carried out in Karo Regency as a corn production center in North Sumatra and laboratory analysis at PT. Cargill Indonesia. There are three sub-districts with the highest corn production as research locations, namely: Tigabinanga, Mardinding and Laubaleng sub-districts which are considered to represent corn farmers in Karo Regency so they are considered to have a fairly clear supply chain.

The data used in the research are primary and secondary data. Primary data was obtained from the results of laboratory analysis and questionnaires with respondents: farmers, traders and all units involved in the supply chain. Secondary data was obtained from the Karo Regency Agricultural Service and agencies related to research, books, journals, articles, the internet and other literature that is related to the research topic.

The quality of corn analyzed includes: Water content, ash content, fat content, protein content, total carbohydrates, ADF (Acid Detergent Fiber) content, NDF (Neutral Detergent Fiber) content and aflatoxin content.

Data analysis method

The data analysis method uses multiple linear regression with a general formula, namely:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3$$

Information:

Y	: Corn Quality
a	: Constant
b ₁ , b ₂ , b ₃	: Regression coefficient values
X ₁	: Season
X ₂	: Source of supply
X ₃	: Water content

The values a and b can be calculated using the formula below:

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

The independent variables analyzed include: (i) Seasonal variables (X1) consisting of the rainy season which is observed from December to February and the dry season which is observed from June to August, (ii) Supply source variable (X2) which comes from farmers and wholesalers based on analysis of water content, ash content, protein content, fat content, total carbohydrates, ADF, NDF and aflatoxin content, (iii) Variable water content (X3) with water content above 17% coming from farmers and below 17% coming from traders.

Trading Margin

Data collection technique

Data collection is by interviews and recording which is carried out in accordance with a list of questions or questionnaires that have been prepared to look at the supply chain.

Method of Determining Respondents

Respondents from the research were corn farmers in three sub-districts with high, medium and low corn production, namely Tiga binanga, Tiga nderket and Naman Teran and combined with data information from related agencies. The research method used is a survey method with respondent units that produce corn. The determination of the research area was carried out according to the objectives and randomly (purposive random).

Determining the Number of Respondents

Farmer

The method for attracting respondents used was as follows: In the first stage, 3 villages were selected from each sub-district by determining which villages had high, medium and low levels of corn farmers. The sampling technique used is purposive sampling, namely a technique for determining samples based on specific characteristics that are suitable and in accordance with the objectives of the research so that these farmers can be used as samples (respondents).

The number of farmers in the three districts is 628 farmers. Based on data on the number of farmers, a method for determining the number of samples was carried out using the Slovin method, namely:

$$n = \frac{N}{1 + (\alpha^2)}$$

$$= \frac{628}{1 + (628 * [(0.1)]^2)}$$

$$= 86.263$$

$$= 86 \text{ respondents}$$

The following samples were used in this research:

Table 1. Table of number of respondents and Corn Samples

No	Subdistrict	Production	Number of Farmers	Number of respondents and corn samples	Status
1	Tiga binanga	202.375	512	70	High production
2	Tiga nderket	45.776	114	15	Medium production
3	Naman Teran	21	2	1	Low production
Total			628	86	

Traders or Marketing Institutions

Traders are people involved in distributing corn produced by farmers to final consumers. Intermediary traders are determined using the tracing method, namely by tracing all the traders involved and who take the corn produced by producers to the research area, starting from agents, intermediary traders, wholesalers, processing/milling factories and retailers. The number of samples taken was 12 traders or marketing institutions based on observation results.

Marketing Margin

The formula is used:

$$M_p = P_r - P_f \text{ or } M_p = B_p + K_p$$

Information:

- M_p: Marketing margin (Rp/kg)
- P_r: Price at consumer level (Rp/kg)
- P_f: Price at producer level (Rp/kg)
- B_p: Marketing Costs (Rp/kg)
- K_p: Marketing Profit (Rp/kg)

Farmer share

Farmer share is formulated as follows:

$$F_s = P_f / P_r \times 100\%$$

Information:

- F_s = Farmer's share
- P_f = Price at producer/farmer level (Rp/kg)
- P_r = Price at consumer level (Rp/kg)

RESULTS AND DISCUSSION

Descriptive Corn Quality

Table 2. Corn Quality Based on Supplier and Harvest Season

Harvest season	n	Supply Chain	n	Corn Quality						
				Abu	cADF	cNDF	CP	cStarch	Fat	KA
1	98	Farmer	86	1,18	2,16	8,19	8,69	70,13	3,90	25,30
		Trader	12	1,19	2,16	8,12	8,54	72,18	3,79	12,45
Average				1,19	2,16	8,16	8,62	71,15	3,84	18,88
2	98	Farmer	86	1,18	2,11	8,16	8,28	70,11	3,62	24,81
		Trader	12	1,30	2,05	8,24	8,58	71,35	3,84	13,26
Average				1,24	2,08	8,20	8,43	70,73	3,73	19,03

Corn Quality Regression Results

The results of the regression analysis of corn quality such as Aflatoxin, Ash (ash content), cADF, cNDF, CP (protein), cStarch, Fat with harvest season factors (X1), Water content (X2), and supply chain (X3) are presented in Table 3.

Table 3. Results of Corn Quality Regression Analysis

Corn quality (Y)	Constant	Harvest season (X1)	Water content (X2)	Supply Chain (X3)	R Square
Aflatoksin (ppb)	29,5962	-9,1696	-0,4826	3,9129	0,616
Ash (%)	0,7799	0,0152	0,0113	0,1004	0,11
cADF (%)	2,3279	-0,0549	-0,0028	-0,0332	0,021
cNDF (%)	8,5186	-0,019	-0,01	-0,0586	0,002
CP (%)	9,0674	-0,3532	-0,0026	0,0196	0,208
cStarch (%)	69,3898	-0,1151	0,0029	0,8383	0,147
Fat (%)	5,0663	-0,2493	-0,0309	-0,1578	0,087

Marketing Margin

Marketing margin is the difference between prices at the consumer level and prices at the producer level

Table 4. Average Marger Share dan Farmer share

Supply Chain	Average			
	Selling price	Factory Price	Marketing margin	Farmer share
Farmer	4,345,05	4,868,80	523,747	89,243
Trader	4,841,666667	5,854,166667	1,012,5	82,7184579

In table 3 it can be seen that at the farmer supply chain level the selling price is IDR 4,335/kg with a factory price of around IDR 4,868/kg to the factory, while the selling price from traders to the factory is around IDR 4,841/kg with a factory price of IDR 5,854/kg. The marketing margin obtained by farmers using the selling price and factory price is IDR 523.7/kg, while the marketing margin obtained by traders using the selling price and factory price is IDR 1,012/kg. There is a difference in factory prices obtained by farmers and traders due to differences in corn quality, namely the water content (sture) in corn, the lower the water content contained in corn sold to the factory, the higher the price and the higher the water content contained in corn, the cheaper the price. factories obtained by farmers and/or traders. The price margin obtained at the trader level is higher than that of farmers, but it is not entirely high due to a decrease in the amount of corn bought and sold due to drying to reduce the water content of the corn.

Farmer Share

Farmer share analysis is carried out to determine the share of the price received by farmers from the price at the consumer level expressed as a percentage (%). In table 8 it can be seen that the farmer share obtained by farmers is 89.243% while for traders it is 82.7%. The difference in farmer share obtained is closely related to the comparison between the selling price and the factory price obtained. The greater farmer's share value reflects an increasingly efficient supply chain. However, a high farmer's share does not necessarily indicate that marketing is running efficiently. The lowest farmer's share is for traders because this supply chain is the chain that has the most intermediaries.

CONCLUSION

1. The quality of corn in Karo Regency meets SNI requirements to be used as raw material for animal feed
2. Factors that influence the quality of corn in Karo Regency are water content, supply chain and harvest season.

3. Farmers' marketing margin is 523/kg while traders' marketing margin is Rp. 1,012/kg with farmer share for farmers around 89.243% and traders 82.718%

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