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QUALITY EVALUATION ON POST-HARVEST CORN COMMODITIES PHYSICALLY, CHEMICALLY AND BIOLOGICALLY PRODUCED BY FARMERS IN GROBOGAN DISTRICT

EVALUASI KUALITAS KOMODITAS JAGUNG PASCA PANEN SECARA FISIK, KIMIA DAN BIOLOGIS PRODUKSI PETANI DI KABUPATEN GROBOGAN

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ABSTRACT

Handling post-harvest corn yield is the determinant of the quality of raw materials in feed manufacturing. The high quality standard of the acceptance of raw materials in the livestock industry makes it difficult for post-harvest corn yield produced by farmers to compete. The objective of this research is to evaluate the quality of corn yield physically, chemically and biologically by comparing the quality of post-harvest corn yield produced by farmers in Grobogan District with the corn yield of feed industry. Physical testing (broken seed and foreign material) was carried out using human senses, chemical testing (moisture content, protein, fiber, ash) was carried out using NIR Foss System and biological testing (aflatoxin) was carried out using TLC method. The data analysis was performed using Independent Sampel T-Test. The research findings showed that there were differences (P < 0.05) to the average quality of broken seed, foreign material, moisture content, fiber, ash and aflatoxy between the farmers and livestock industry. Meanwhile, there was no significant difference (P > 0.05) to the average value of quality of protein and fat content between the farmers and livestock industry. Post-harvest corn yield produced by farmers has not met the standard of the acceptance of raw materials in livestock industry. It is also necessary to improve the modern technology, facility and farmer assistance in handling post-harvest activities of the corn yield.

Keywords: Corn, Post-harvest, Quality

INTISARI

Penanganan pasca panen hasil jagung merupakan penentu kualitas bahan baku dalam pembuatan pakan. Standar kualitas penerimaan bahan baku yang tinggi pada industri peternakan membuat hasil jagung pasca panen yang dihasilkan petani sulit bersaing. Penelitian ini bertujuan untuk mengevaluasi kualitas hasil jagung secara fisik, kimia dan biologi dengan membandingkan kualitas hasil jagung pasca panen yang dihasilkan petani di Kabupaten Grobogan dengan hasil jagung industri pakan. Pengujian fisik (biji pecah dan benda asing) dilakukan dengan menggunakan indera manusia, pengujian kimia (kadar air, protein, serat, abu) dilakukan dengan menggunakan NIR Foss System dan pengujian biologis (aflatoksin) dilakukan dengan metode KLT. Analisis data dilakukan dengan menggunakan Independent Sampel T-Test. Hasil penelitian menunjukkan bahwa terdapat perbedaan (P < 0,05) rata-rata mutu benih pecah, bahan asing, kadar air, serat, abu dan aflatoksi antara petani dan industri peternakan. Sementara itu, tidak terdapat perbedaan yang nyata (P > 0,05) terhadap nilai rata-rata kualitas kadar protein dan lemak antara petani dan industri peternakan. Hasil panen jagung pasca panen yang dihasilkan oleh petani belum memenuhi standar penerimaan bahan baku di industri peternakan. Perlu juga meningkatkan teknologi modern, fasilitas dan pendampingan petani dalam penanganan kegiatan pasca panen hasil jagung.

Kata Kunci: Jagung, Pasca Panen, Kualitas

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INTRODUCTION

Every year, corn production of Indonesia has increased; from 2010 amounted to 18,327,636 tons until 2015 amounted to 19,612,435 tons (Purwasih, et al, 2017). Central Java Province is a quiet high production center of corn. With production of 3,212,391 tons in 2015, Grobogan District becomes the region with the highest corn production of 700,941 tons in 2016 (Badan Pusat Statistik, 2016).

Corn can be used and processed into food and animal feed. However, most corn production is more widely used as feed raw material (Revina, 2008). Corn distribution as raw material in the feed industry is increasing every year; in 2013 amounted to 6.5 million tons and in 2014 amounted to 7 million tons (GMPT, 2016). In addition, national feed consumption also increases every year; in 2015 amounted to 16.4 million tons and is expected to increase in 2016 by 17 million tons (Winarso, 2012).

Central Java has a lot of feed making industry, so the demand for local corn raw material is quite high. The largest corn supplier to the feed industry is Grobogan District. So far, the production of corn at the farmer level in Grobogan District is quite high. However, it is not directly proportional to the quality of corn produced. The low quality of the corn is due to poor handling of post-harvest activities conducted by the farmers (Erlangga *et al*, 2012). The high standard of corn acceptance in the feed industry makes it difficult for the corn yields at the farmer level to compete. As the result, the selling price of corn will decrease because of the corn condition does not meet the requirement (Novitasari, 2016).

Improper post-harvest handling by the farmers will result in poorly produced corn quality (Suprem et al, 2013). The low quality of post-harvest corn will affect the nutritional and physical content of the corn itself (Bakoye et al, 2017). According to Fitriati et al (2015) and Kereth et al (2013) Improvement in the handling of post-harvest activities is aimed at improving the quality of commodities in order to be competitive. It is necessary to have a quality evaluation on corn commodity by comparing the quality of post-harvest corn produced by the farmers with the standard of the acceptance of feed industry. Thus, it can be analyzed whether there is a difference in terms of the quality value of corn produced.

The objective of this research is to evaluate the quality of corn yield physically, chemically and biologically by comparing the quality of corn yield of post-harvest farmers in Grobogan District with corn acceptance standard of feed industry.

METHOD

Setting and Time of Research Sampling: The research setting was in Grobogan Regency, Indonesia with corn sampling in 3 sub-districts which were the highest corn production center consisting of Pulokulon, Geyer and Toroh. Corn sampling was also conducted in the feed industry of PT. Charoen Pokhpand Indonesia. The research and sampling were conducted from January to February 2018.

Corn Sample: The corn samples were as many as 15 samples consisting of 5 samples from each sub-district that had been determined with random sampling system. Each sample weighed 100gr/sample. The sampling in the feed industry was also as many as 15 samples using random sampling system on each arrival of corn raw materials. The testing was performed using physical, chemical and biological quality parameters (Sugiyono, 2001).

Physical Test: Physical quality test was performed using broken seed and foreign material parameter. This test aimed to determine the quality of whole corn physically

using the senses and then each test was repeated as many as 3 times. The method used was screen sieve that was carried out in sequence; mesh 4.75mm, 2.0mm and pan. Corn weighing 100 gr was weighed. The corn was weighed and then placed on a 4.75mm mesh sieve screen and sifted. The yields left in the 2.0mm mesh were separated as the percentage of broken seed and foreign material grains. The yields that pass from 2.0mm mesh were combined with the tump as the percentage of foreign material. Then the identification result was weighed and the percentage was calculated based on the weight (Barrozo et al, 2011), (Williams et al, 2017) and (Wahyuningsih et al, 2016).

Chemical Test: Chemical quality test was performed using water, protein, fat, fiber and ash parameters. This test aimed to determine the level of nutrients in corn by using the rapid method with NIR Foos System tool. The working principle is to use infrared light to know the proximate level of the material. Firstly, the corn samples were milled to become powder. After that, the sample was homogenized by being shaken inside the plastic wrap. The homogeneous sample was then inserted into a quarter cup of 10 grams. Then scanning was performed on corn samples using NIR Foss System tool with 3 times repetition (Delgado et al, 2015), (Maarschalkerweerd, 2015), (Garcia et al, 2016) and (Riovanto et al, 2009).

Biological Test: Biological test was performed using aflatoxin parameters. The aim of this test was to know contamination of toxins caused by the Aspergillus Flavus fungus. The method used for testing aflatoxin was TLC (Thin Layer Chromatography) method. It was a substrate separation method using a thin layer of 0.1-0.3 mm absorbent solids. The sub-dripped layer was then dipped into the solvent. The substrate was dissolved in the solvent and crawled upward along the thin layer. The soluble depended on the substrate solubility of the mobile phase and the substrate interaction on the absorbent (Aini, 2012) and (Rubak, 2011). The formula for calculating aflatoxin by TLC method is as follows:

$$\text{Aflatoxin B1 (ppb)} = \frac{\text{standard } \mu L \times 0.5\ \mu L / ml \times \text{sample dilution} \times 1000}{\mu L \text{ spot sample} \times W \text{ (constants)}}$$

$$W \text{ (constants)} = \frac{\text{Volume of pipes (ml)} \times \text{sample weight (gr)}}{\text{Volume extracting solvent (ml)}}$$

Independent Sample T-Test: The data, obtained from the sample test from the corn yields of the farmers and feed industry, were then processed through the analysis of independent sample T-test using software SPSS version 17. The function of independent sample T-Test is to know whether there was difference of mean from two unpaired samples, to determine whether they were significant or not, and to see through their probability values. The level requirements, whether there is a difference or not, can be seen from the following conclusions:

- If the Sig.value (2 tailed) < 0.05, then there is a significant difference between corn quality of the farmers and feed industry.
- If the Sig.value (2 tailed) > 0.05, then there is no significant difference between corn quality of the farmers and feed industry.

Independent samples T-Test can be performed if the resulting data has a normal and homogeneous distribution. Normality test data was performed using Shapiro Wilk test which aimed to find out whether the research data had a normal distribution or not. Because, in parametric statistics, the normal distribution of data is a must and is an absolute requirement that must be met to conduct an independent sample T-Test (Ojiako et al, 2017) and (Firdaus and Farid, 2008).

RESULTS AND DISCUSSION

Evaluation of Physical Corn Quality: The average of corn yield of the farmers was 9.53 ± 0.91, while the average of corn yield of feed industry was 4.33 ± 1.04. There was a difference between the results of broken seed from the corn yield of the farmers and feed industry (P <0.05). The standard specification of corn raw material in broken seed of feed industry is 6, whereas the result of broken seed average of the farmers was 9.53. The high broken seed at the farmer level was caused by the traditional drying of corn, so the potential for corn breaking became bigger. The result of broken seed of the corn was more than 7, the corn was categorized as the corn with poor physical quality (Krejzova et al, 2017).

From the test result using the parameter of foreign material, the average of post-harvest yield of the farmers was 9.266 ± 1.03, while the average of foreign material of the feed industry was 4.13 ± 1.40. Based on the significance value (P <0.05), there was a difference in the average result of foreign materials of the farmers and feed industry. Corn specification standards on the parameters of foreign materials at PT. Charoen Pokhpand Indonesia maximum is 6. The high result of foreign materials from the post-harvest corn of the farmers was caused by several factors including: the unclean process spot of corn drying and the inaccuracy of the farmers in sorting corn during the packing process into sacks (Alasaad et al, 2016).

Evaluation of Chemical Corn Quality: The average result of corn water content from the farmers was 28.61 ± 0.65, while the average result of corn water content from the feed industry was 10.87 ± 0.55. Based on the significance results (P < 0.05), there was an average difference between the results of corn water content of the farmers and feed industry. Standard specification of acceptance of corn raw materials for water content parameters in PT. Charoen Pokhpand Indonesia maximum is 17%. Factors that affect the high levels of corn water content was because the farmers still relied on traditional drying process using the sun and corn storage process that had not been good due to high corn moisture (Yulianto et al, 2013).

Based on chemical test of corn quality with protein content parameter, the average result of protein content from the corn yield of the farmers was 8.45 ± 0.25, while the average result of protein content from the corn yield of feed industry was 8.46 ± 2.20. Based on the significance results (P > 0.05), there was no difference in protein content between the corn yield of the farmers and feed industry. High levels of protein do not affect the standard process of raw material acceptance in the feed industry. To be processed, the minimum required protein content is 7.5% (Harris, et al, 2018).

Based on the chemical analysis of corn quality with fat content parameter, the average result of fat content from the corn yield of the farmers was 4.19 ± 0.42, while the average result of fat content from the corn yield of feed industry was 4.43 ± 2.25. Based on the significance results (P > 0.05), there was no difference in fat content between the corn yield of the farmers and feed industry. The standard requirement of minimum fat content of corn is 3%. The higher the level of fat in corn, then it will affect the process of fat oxidation during the handling of corn yield if it is not properly handled (Della Rosa et al, 2018).

Based on the chemical analysis of corn quality with fiber content parameter, the average result of fiber content from the corn yield of the farmers was 1.90 ± 0.25, while the average result of fiber content from the corn yield of feed industry was 2.23 ± 0.25. Based on the significance results (P < 0.05), there was a difference in fiber content between the corn

yield of the farmers and feed industry. The standard requirement of minimum fiber content of corn is 3%. Average level of corn fiber at the level of farmers and feed industry does not undergo much change; within the range of 2-3% (Zurak et al, 2018).

Based on the chemical analysis of corn quality with ash content parameter, the average result of ash content from the corn yield of the farmers was 1.02 ± 0.07, while the average result of ash content from the corn yield of feed industry was 1.12 ± 1.15. There was a significant difference ($P < 0.05$) in ash content between the corn yield of the farmers and feed industry. The standard requirement of minimum ash content of corn is 2%. The value of ash content does not affect the quality of corn (Santoso and Hariadi, 2009).

Evaluation of Biological Corn Quality: Based on the biological testing result of the corn quality using aflatoxin parameter, the average result of aflatoxin content from the corn yield of the farmers was 109.67 ± 15.25, while the average result of aflatoxin content from the corn yield of feed industry was 71.67 ± 14.35. There was a significant difference ($P < 0.05$) in aflatoxin content between the corn yield of the farmers and feed industry. The high aflatoxin of the farmer's corn yield was due to poor facility condition in drying and storage. Other parameter that affected the incidence of aflatoxin was the effect of temperature and humidity (Sumantri et al, 2012). Early drying process and inappropriate drying medium will increase aflatoxin level. The ideal temperature and humidity for fungal growth has the potential to cause aflatoxin, i.e. at 25-28°C and at least 60% moisture. The higher moisture results the higher aflatoxin level. The aflatoxin tolerance limit for corn yield is 50 ppb and for feed is 100 ppb (Fitriati et al 2015).

CONCLUSION AND RECOMMENDATION

The conclusion of this research was that there were differences in the average results of broken seed, foreign materials, water content, ash content, fiber content and aflatoxin content between the corn yield of the farmers and feed industry. In addition, protein content and fat content had no mean difference in the average results between the corn yield of the farmers and feed industry.

Post-harvest handling process at farmer level Grobogan Regency, Indonesia needs improvement, upgrade and renewal in technology, facilities and post harvest handling so that the corn yields have the competitiveness value.

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