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Nutrient content variation and mycotoxin occurrence of corn, rice bran, and soybean meal and complete feed for animal feeding by Nutreco.

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Feeding strategy depends on the quality of feed stuff to get precision nutrition. Corn, rice bran and soy bean meal are the most frequently feed stuff and give higher contribution in price and nutrition in the formula for poultry feed. Feed industry sector depends on the feed stuff stability. In the month of April to November 2013, Nutreco observed the quality over some feed stuffs and complete feeds. We focus on the nutrient content fluctuations and mycotoxin occurrences especially in tropical country like Indonesia. The result showed large variation on the nutrient quality of rice bran. Although corn and soybean meal have better stability in the nutrient content.

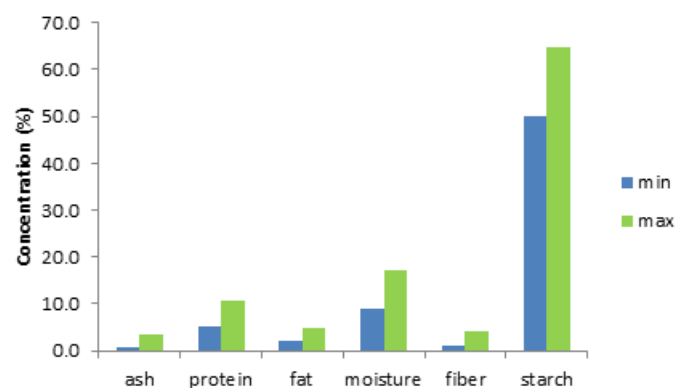
Corn starch as high energy source

There were 111 samples of corn collected and analyzed by NIRS in the Masterlab Asia at PT. Trouw Nutrition Indonesia. Starch content of corn is around 60.16% to 64.70%. Corn starch is the highest energy source for animal especially for poultry because it has highest starch content, therefore the metabolized energy from corn has important contribution in the poultry feed (Zhou *et al.* 2010). However, there are large variation of starch content between grain with different variety because of genetic factor and environment. The evaluation of corn showed low variation in the starch content (CV = 8.02%, Mean = 59.38%). Stability of the moisture in corn is good enough (CV = 13.19%, mean = 12.55%). Low moisture content and its variation are critical to tend up the corn quality and fungi growth.

Fluctuated nutrient content of rice bran

Results show high variation (n = 67) on the crude fiber of rice bran (CV = 71.43%, Mean = 9.22%).

Figure 1. Nutrient value (minimum and maximum) of Corn



High variation indicated quality inconsistency of rice bran. Great variation crude fiber among rice bran could lead to poor animal performance especially in poultry. Adulteration could happened for rice bran with rice husk, limestone and sand in Indonesia. Rice husk adulteration significantly increased rice bran crude fiber. It may also cause low digestibility and impact to animal performance. Rice bran quality

Table 1. Nutritional Value of Corn

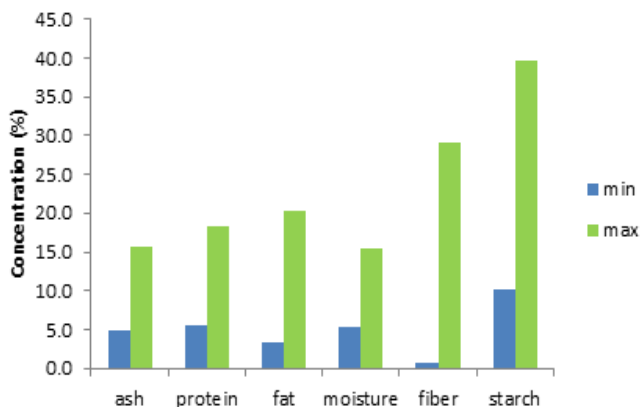
	Ash (%)	Protein (%)	Fat (%)	Moisture (%)	Fiber (%)	Starch (%)
Corn (n = 111)						
Mean ± sd	1.26 ± 0.24	7.64 ± 0.79	3.89 ± 0.49	12.55 ± 1.66	1.78 ± 0.32	59.38 ± 4.76
CV (%)	18.74	10.35	12.56	13.19	17.99	8.02
Modus	1.20	7.70	3.80	11.70	1.90	63.10

Table 2. Nutritional Value of Rice Bran

	Ash (%)	Protein (%)	Fat (%)	Moisture (%)	Fiber (%)	Starch (%)
Rice Bran (n = 67)						
Mean ± sd	9.22 ± 2.50	12.23 ± 1.98	12.29 ± 3.40	10.96 ± 1.44	9.22 ± 6.59	28.36 ± 7.08
CV (%)	27.06	16.22	27.64	13.13	71.43	24.96
Modus	8.80	13.44	13.50	9.40	5.70	27.20

Analyzed in Masterlab Asia, PT. Trouw Nutrition Indonesia

Figure 2. Nutrient value (minimum and maximum) of Rice Bran



was depended by its fatty acid. Fatty acid could be determined from fat content. Crude fat variation of rice bran was relatively high (CV = 27.64%, mean = 12.29%). Reduction in nutrient quality of bran during storage resulted in decreased nutrient digestibility, which further reduced the increasing level of rice bran (Mujahid *et al.* 2003).

Linoleic acid is essential for animal. It's important to use rice bran as linoleic acid source in layer feed to optimized the egg size that was produced. Higher crude fat positively correlated to higher linoleic acid in rice bran. Sidhom *et al.* (1975) observed the development of Free Fatty Acid (FFA) in rice bran was much lower when the bran was stored at a cooler temperature. To prevent the oxidation of rice bran, we put antioxidant as a solution to avoid the rancidity.

Well stability of soybean meal (SBM)

SBM is good protein source for poultry feed because of its amino acid profile and high crude protein content (Serrano *et al.*, 2013). Protein quality of SBM is linked to both the reduction of anti-nutritional factor and

the optimization of protein (amino acid) digestibility. Inadequate heating fails to completely destroy the anti-nutritional factor, while excessive heating will reduce the availability of lysine via the Maillard reaction. Anti-nutrition substance can be eliminated by adding protease enzyme, therefore the amino acid digestibility can be improved. KOH solubility is a good index for determining over processing, but it is not sensitive index for monitoring under processing of soybean meal (Caprita *et al.*, 2010). Between 78 % and 85% for KOH are considered acceptable for well-processed soybean meal.

The anti-nutritional factors in soybean are often associated with the low acceptance of soybean products as they also inhibit protein digestibility. Results from 101 sample of soy bean meal showed low variation of crude protein (CV = 3.21%, mean = 45.48%) and low variation of protein soluble in KOH (CV = 8.57%, mean = 78.48). Low variation of soy bean meal indicated that the quality of soybean meal preferred to be consistent. Which mean the value of soybean meal protein soluble in KOH tend to be well acceptance to be us to feed the animal because it was not over or under processed.

Figure 3. Nutrient value (minimum and maximum) of soy bean meal

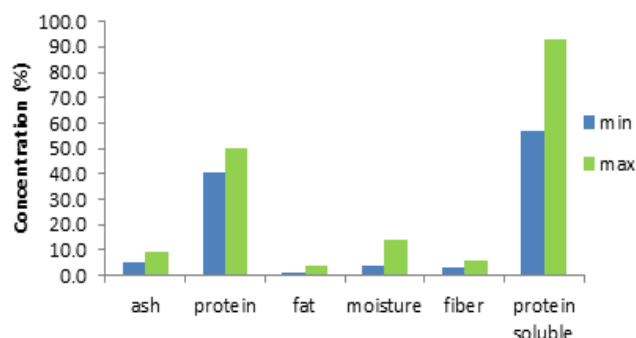


Table 3. Nutritional Value of Soybean Meal

	Ash (%)	Protein (%)	Fat (%)	Moisture (%)	Fiber (%)	Protein Soluble KOH (%)
Soybean Meal (n= 101)						
Mean ± sd	6.36 ± 0.71	45.48 ± 1.46	1.72 ± 0.44	10.87 ± 1.21	3.82 ± 0.55	78.48 ± 6.72
CV (%)	11.23	3.21	25.78	11.13	14.42	8.56
Modus	6.90	45.10	1.50	9.90	3.40	79.90

Analyzed in Masterlab Asia, PT. Trouw Nutrition Indonesia

Table 4. Mycotoxin in corn

Corn					
	Number of samples	Mean ± sd (µg/kg)	Maximum (µg/kg)	Median (µg/kg)	Standard Maximum Number (µg/kg) *
Aflatoxin	91	27.2 ± 39.84	154	5.5	20
T-2 Toxin	47	28.2 ± 28.20	248.1	16.4	400
DON	12	0.6 ± 0.19	0.9	0.5	
Ocratoxin	26	6.9 ± 4.17	15.6	6.8	100
Zearalenon	49	76.4 ± 121.01	428.5	21.9	
Fumonisin	10	1.2 ± 1.37	4.4	0.6	2000
Ocratoxin	26	6.9 ± 4.17	15.6	6.8	100
Zearalenon	49	76.4 ± 121.01	428.5	21.9	

* Source: <http://www.food.gov.uk/policy-advice/mycotoxins/animalfeed/>

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Mycotoxin in corn

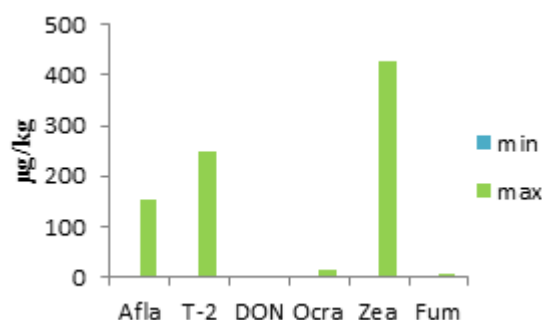
Formation of mycotoxin can occur in almost all feedstuff under appropriate environment or storage conditions through the animal feed distribution. The major problem related with mycotoxin from contaminated animal feed is not acute disease episodes but low level toxin ingestion which may cause an array of metabolic disturbances resulting in poor animal productivity (Bryden, 2012).

Mycotoxin was positive on the corn and feed samples. Between those samples the number of mycotoxin is higher on the complete feed than corn. Mycotoxin was analyzed by ELISA method. Aflatoxin, T-2 Toxin, and zearalenone showed the highest number (µg/kg). The average number of aflatoxin in corn and feed was 27.2 µg/kg, with maximum number 154 µg/kg. T-2 toxin concentration was 28.2 µg/kg and Zearalenone concentration was 76.4 µg/kg. Generally, the lower mycotoxin in corn is a result from low moisture of corn with average 12.55%, therefore this is a good condition for storing and uncontaminated by fungi.

Growth depression is an indicator of mycotoxicosis impacts which is resulted by the reduction of feed intake, unbalanced nutrient utilization and reduced immune function. It was estimated that with each mg/kg increase of aflatoxin in the diet, the growth rate would be depressed by 16% for pigs and 5% for broilers (Dersjant-Li *et al.*, 2003). Mycotoxin that produced by fungi contaminated feed and affected on the animal productivity and losses on crop.

Mycotoxicosis may cause economic losses. In this case, anti-mold is important to be added in the feed stuff and feed (Fylax) and mycotoxin binder product range (Toxo) to absorb mycotoxin whether it is in the feed or in the feedstuff. To prevent fungi growth, storage grain management is important and silo need to be maintained well. Mycotoxin that occurs in high concentration will cause major losses in health

Figure 4. Mycotoxin in corn



and performance of animals. However, mycotoxin are usually at a lower level that could resulted in interaction with other stressor to cause subclinical losses in performance, increased in incidence of diseases and reduced reproductive performance. To the animal producer, these subclinical losses are of greater importance than losses by acute effects.

Conclusion

Feedstuff quality and nutrients content are varying (never be such a constant value). Thus to keep the Stability of the feedstuff quality need an understanding on the pattern of variation. SBM and corn are at much less extent variation or relatively consistent compare to rice bran. Big variation of nutrient content, especially those in fiber, is also an indication of adulteration.

The common occurrence of mycotoxin contamination in corn and feed are aflatoxin, T-2 toxin, and Zearalenone. Feed tend to be higher in occurrence of mycotoxin than it is in the corn, this is due to the accumulation of mycotoxin contamination from various feed stuff. Although some data indicated only such a low level of mycotoxin contamination at feedstuuf or feed, it is well proven that some mycotoxins co-presence or contamination in combination can synergistically showing their more detrimental effect to animal, as compare to the single contamination of a mycotoxin at higher level.

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Kesimpulan

- Strategi pemberian pakan sangat bergantung pada kualitas bahan pakan untuk mendapatkan nutrisi yang presisi. Jagung, dedak dan bungkil kedelai merupakan bahan pakan yang paling sering digunakan dan memiliki kontribusi nutrisi serta biaya yang signifikan dalam formulasi pakan unggas. Sektor industri pakan bergantung pada stabilitas suplai dan kualitas bahan pakan. Selama bulan April hingga November 2013, Trouw Nutrition Indonesia mengamati kualitas bahan pakan dan pakan komplit. Kami fokus pada fluktuasi kandungan nutrisi dan kejadian keberadaan mycotoxin terutama pada negara tropis seperti Indonesia. Hasil analisa menunjukkan variasi yang besar pada kualitas nutrisi dedak padi. Sedangkan, jagung dan bungkil kedelai memiliki stabilitas kandungan nutrisi yang lebih stabil.
- Jagung memiliki kandungan nutrisi yang cenderung stabil, dengan kadar air sekitar 12.55%, protein 7.64%, dan pati 59.38%. Kandungan pati jagung yang tinggi membuatnya dipakai sebagai sumber energy terbesar dalam pakan unggas.
- Analisa mikotoksin pada jagung dilakukan dengan metode ELISA. Jenis Aflatoxin dan Zearalenon menunjukkan hasil yang cukup tinggi yaitu 154 dan 428 ppb ($\mu\text{g}/\text{kg}$) melebihi standar Aflatoxin menurut SNI (50 ppb) dan European Government (20 ppb). Penurunan pertumbuhan akibat berkurangnya konsumsi pakan, penggunaan nutrisi yang tak seimbang dan menurunnya fungsi imun merupakan indikasi mikotoksikosis (penyakit akibat mikotoksin).
- Kualitas nutrisi dedak padi sangatlah beragam. Variasi yang besar mengindikasikan pemalsuan untuk bahan pakan jenis ini masih tinggi, pemalsuan dengan sekam padi, limestone and pasir in Indonesia. Serat kasar dengan koefisien variasi 71.41% menunjukkan fluktuasi kualitas sepanjang tahun. Hal ini berimbas buruk pada pencernaan ternak sedangkan dedak padi banyak digunakan karena kandungan asam linoleatnya cukup baik sehingga akan menurunkan fungsinya.
- Bungkil kedelai memiliki stabilitas nutrisi yang konsisten terutama proteinnya yaitu sekitar 45.48%. Kualitas protein berhubungan dengan anti nutrisi yang rendah serta pencernaan asam amino yang optimal. Protein larut dalam KOH bungkil kedelai sekitar 78.48%, level tersebut baik untuk diberikan kepada ternak karena pencernaan proteinnya masih cukup tinggi.

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