Raw Material Evaluation: How to extract value from it?

Sheila Heidi M. Ramos and Torben Gosvig Madsen, PhD

Introduction

Today's livestock industry is faced with a lot of challenges from volatile ingredient prices, raw material quality and availability issues, among others. With the intensification of the modern livestock operation, the main focus is how to optimize production efficiency. With continuous improvements of genetics, modern livestock breeds have an impressively high growth potential combined with efficient feed utilization when nutrient requirements are fulfilled. Thus, as livestock feeds have a great influence on the total livestock production efficiency and feed cost comprises in the range of 50-70% of the total production cost, feeding the livestock sufficient nutrient levels is very critical.

In many livestock operations purchasers have a tendency to put too much focus on raw material price *per se*. Raw material quality is then more often than not put aside especially during times of raw material shortage, increase in prices and if the live sales is lower than the cost of production. The risk is that nutrient content in raw materials becomes secondary when evaluating raw materials. However, that is very dangerous as it can have huge effects on the final feed quality and thereby production results. The content of crude protein (CP), amino acids, crude fiber, moisture, ash, protein/pepsin digestibility, etc. are some of the factors that are commonly looked into. The reason why it is so dangerous not to look at these factors is the variation in the content. That is also why raw material variation is such an important factor in determining the value of the feed raw materials.

According to St. Pierre and Weiss (2008) variation in raw materials can be classified into two types the fixed and the variable. Fixed variation includes genetics (hybrid, variety, etc.) and growing conditions (climate, drought, soil fertility, etc.) in addition to factors affected by manufacturing techniques. In general we can say that fixed variations are those that can be described and replicated and are between populations. On the other hand, random variation is considered within-population variation and can be due to errors in sampling or due to random errors in the lab. In general raw materials that are considered as co-products such as soybean meal (SBM) and corn gluten feed are less variable than raw materials that are considered to be by-products like meat and bone meal (MBM) and rice bran. However, distillers dried grains and solubles (DDGS) a co-product of ethanol production has been shown also to vary quite a lot in amino acid content. The focus of this article is therefore to show recent development in amino acids in MBM, rice bran and DDGS, all three commonly used raw materials in the region.

Amino acid analysis in raw materials

For almost 50 years, Evonik Degussa has been analyzing amino acid content in raw material samples for its customers worldwide. With the dedicated laboratory for amino acid analysis, Evonik Degussa has been able to create and constantly update its own amino acid database of commonly used feed raw materials. The data were obtained from either NIR analysis or wet chemical analysis of the focus raw materials. Based on this database, a raw material evaluation has been performed focusing on DDGS (corn base), meat and bone meal and rice bran samples received from customers in Southeast Asia, India, Pakistan and Bangladesh in the period from 2006 to the first half of 2009. The values were compared with AminoDat® values which were obtained from wet chemical analysis of raw materials compiled from 2002 up to 2006.The origins of the samples evaluated are as follows: the USA for DDGS; Australia, Europe, India, and USA for meat MBM; and Indonesia, India, and the Philippines for rice bran samples.

DDGS

Distillers dried grains and solubles or DDGS is a co-product in the dry milling ethanol industry. Majority of the DDGS that is corn based that is present in our region comes from USA. Some of the factors that are looked into when purchasing DDGS are color (which is indicative of its amino acid digestibility) and the mycotoxin content, among others. Through the years the use of DDGS in livestock feeds has gaining more acceptances in the region due to improvements in processing methods.

It appears in Table 1 that the CP and most amino acid content have been continuously changing with no particular trend from 2006 to mid 2009. In 2009, there was a drop in the total lysine and arginine content which could be an indication of heat damage in DDGS. Maillard reaction takes place when the free amino group of lysine or arginine reacts with a sugar molecule resulting in an amino acid complex that is no longer available for absorption by the animal. Overall, the highest variability was observed for lysine although it has improved comparing it with AminoDat values (9.15 vs 14.6%).

Table 1. Crude protein and amino acid content in DDGS based on corn (AminoLab®)

Data	Description	CP	LYS	MET	CYS	M+C	THR	TRP	ARG	ILE	LEU	VAL
2006 n = 19	**mean**	28.91	0.82	0.56	0.53	1.09	1.09	0.21	1.22	1.08	3.54	1.40
	CV	20.33	16.25	24.12	23.10	23.72	19.55	7.98	10.23	23.94	29.44	20.34
	min	24.77	0.67	0.46	0.43	0.89	0.93	0.19	1.10	0.90	2.88	1.18
	max	41.57	1.10	0.83	0.80	1.62	1.51	0.26	1.50	1.62	5.79	1.98
2007 n = 42	**mean**	27.99	0.84	0.55	0.53	1.07	1.07	0.22	1.22	1.05	3.28	1.37
	CV	10.30	7.37	11.87	10.46	11.02	9.81	7.50	5.80	13.66	17.18	10.67
	min	24.52	0.72	0.46	0.45	0.92	0.90	0.20	1.10	0.88	2.83	1.18
	max	38.90	1.02	0.81	0.75	1.55	1.44	0.27	1.42	1.62	5.52	1.94
2008 n = 482	**mean**	27.16	0.85	0.51	0.49	1.01	1.05	0.23	1.20	1.03	3.08	1.36
	CV	5.20	6.24	5.79	5.40	5.46	4.96	6.17	4.60	6.23	6.61	5.97
	min	23.19	0.59	0.44	0.41	0.85	0.83	0.16	0.89	0.83	2.71	1.12
	max	38.91	0.98	0.74	0.69	1.44	1.39	0.26	1.45	1.67	5.26	2.05
2009 n = 1385	**mean**	26.02	0.79	0.50	0.48	0.98	0.98	0.22	1.18	0.96	3.00	1.28
	CV	4.93	9.07	6.59	5.54	5.87	5.10	4.87	6.06	5.60	6.05	5.22
	min	22.65	0.46	0.41	0.38	0.81	0.87	0.18	0.85	0.83	2.56	1.11
	max	38.80	0.94	0.92	0.80	1.68	1.44	0.25	1.54	1.52	5.48	1.92
06 to 09 n = 1928	**mean**	26.37	0.80	0.51	0.49	0.99	1.00	0.22	1.19	0.98	3.03	1.30
	CV	6.05	9.15	7.24	6.46	6.82	6.39	5.69	5.87	7.41	7.81	6.68
	min	22.65	0.46	0.41	0.38	0.81	0.83	0.16	0.85	0.83	2.56	1.11
	max	41.57	1.10	0.92	0.80	1.68	1.51	0.27	1.54	1.67	5.79	2.05
AminoDat n = 409	**mean**	26.30	0.74	0.51	0.48	0.98	0.99	0.21	1.15	0.97	3.05	1.27
	CV	5.00	14.60	7.50	6.50	6.40	6.10	13.40	8.80	6.30	6.90	6.10
	min	22.38	0.35	0.32	0.35	0.76	0.80	0.16	0.68	0.78	2.19	1.07
	max	30.81	0.99	0.66	0.64	1.27	1.18	0.49	1.38	1.18	3.98	1.50

Meat and Bone meal

Meat & bone meal (MBM) is a product from the rendering of the unmarketable animal tissue, primarily the bones and offal from slaughtered livestock, the carcasses of dead stock, and meat products that have exceeded their ‘sell-by’ dates. The use of this raw material provides a good source of protein and amino acids for animal feeds. Aside from their nutritional contribution on crude protein and amino acids issues such as Salmonella, BSE, rancidity and presence of biogenic amines among others are being evaluated when using this product.

Most of the MBM samples originated from USA and Australia with some samples from Europe and India. A continuous decline in crude protein and amino acid content can be observed as we compare values from 2006 to first half of 2009 (Table 2). A high variation was observed in crude protein as well as in most of the amino acids (CV > 10%).

Table 2. Crude protein and amino acid content in Meat and bone meal (AminoLab®)

Data	Description	CP	LYS	MET	CYS	M+C	THR	TRP	ARG	ILE	LEU	VAL
2006 n = 25	mean	50.20	2.38	0.65	0.42	1.06	1.49	0.26	3.47	1.30	2.82	2.02
	CV	4.37	9.15	11.03	20.31	11.95	10.21	20.74	4.33	10.73	12.68	11.29
	min	45.82	1.96	0.45	0.27	0.70	1.09	0.15	3.12	0.91	2.17	1.61
	max	55.54	2.83	0.80	0.63	1.26	1.79	0.40	3.68	1.67	3.83	2.59
2007 n = 118	mean	49.29	2.42	0.64	0.41	1.05	1.48	0.31	3.29	1.30	2.83	2.04
	CV	7.45	17.57	20.04	32.91	23.13	18.05	25.61	10.97	20.00	19.20	18.35
	min	40.57	0.82	0.23	0.08	0.34	0.57	0.04	1.60	0.47	0.99	0.73
	max	60.79	3.43	1.12	0.84	1.79	2.28	0.52	4.01	2.14	4.05	2.80
2008 n = 667	mean	48.93	2.36	0.65	0.42	1.07	1.49	0.29	3.27	1.33	2.82	2.05
	CV	5.92	10.35	14.70	21.92	16.52	12.33	22.30	6.30	15.89	12.25	11.41
	min	41.51	1.39	0.32	0.07	0.43	0.86	0.04	2.70	0.73	1.50	1.19
	max	59.80	3.36	1.31	1.06	2.37	2.07	0.49	5.26	1.94	3.82	2.81
2009 n = 680	mean	48.56	2.30	0.61	0.39	1.00	1.43	0.28	3.22	1.26	2.73	2.02
	CV	6.37	12.65	19.17	24.87	19.41	15.19	29.09	7.62	18.50	15.31	13.86
	min	36.49	0.84	0.20	0.06	0.26	0.45	0.04	1.75	0.40	0.79	0.61
	max	60.91	3.02	1.10	0.91	1.73	2.06	0.48	4.00	1.99	3.97	2.83
06 to 09 n = 1490	mean	48.81	2.34	0.63	0.41	1.04	1.46	0.29	3.25	1.30	2.78	2.03
	CV	6.26	12.21	17.37	24.45	18.60	14.26	25.87	7.44	17.51	14.40	13.21
	min	36.49	0.82	0.20	0.06	0.26	0.45	0.04	1.60	0.40	0.79	0.61
	max	60.91	3.43	1.31	1.06	2.37	2.28	0.52	5.26	2.14	4.05	2.83
AminoDat n = 377	mean	48.09	2.34	0.64	0.44	1.08	1.51	0.28	3.31	1.32	2.81	1.97
	CV	15.90	25.80	33.90	50.40	34.80	28.20	48.70	14.80	32.00	27.60	26.20
	min	32.19	1.24	0.29	0.11	0.43	0.76	0.07	2.25	0.58	1.37	0.99
	max	67.49	3.81	1.30	1.21	2.25	2.67	0.67	4.88	2.48	4.82	3.35

Rice bran

Rice bran (RB) also referred to as rice polish or rice pollard in some countries is made up of aleurone and the pericarp portion of the rice grain with some endosperm produced during rice milling to produce polished rice. Approximately 8.5% of the weight of the rice paddy consists of rice bran (Tangendjaja and Farrell, 2002). The problems observed with this raw material are rancidity and possible contamination with hulls. On the average the crude protein content of rice bran ranges from 10 to 14%. However based on the samples that were analysed the crude protein content range varies depending whether it is full fat (FFRB) or extracted or de-oiled rice bran (DORB) with contents ranging from 6.97 to 15.88 and 10.59 to 18.58%, respectively (Table 3 and 4). Higher variability for crude protein and amino acids was observed for DORB. This variability can be attributed to the amount of hulls in the product.

Table 3. Crude protein and amino acid content in Full fat and extracted rice bran (AminoLab®)

Full Fat Rice Bran												
Origin	**Description**	**CP**	**LYS**	**MET**	**CYS**	**M+C**	**THR**	**TRP**	**ARG**	**ILE**	**LEU**	**VAL**
2006 n = 11	**mean**	11.59	0.52	0.24	0.25	0.48	0.44	0.16	0.88	0.41	0.81	0.63
	CV	10.33	13.94	12.57	13.91	13.40	11.50	9.12	8.73	10.83	10.32	0.07
	min	9.00	0.33	0.18	0.18	0.36	0.32	0.13	0.78	0.34	0.68	0.49
	max	12.82	0.59	0.27	0.28	0.54	0.50	0.17	1.01	0.46	0.91	0.72
2007 n= 23	**mean**	12.14	0.56	0.24	0.26	0.50	0.45	0.16	0.94	0.42	0.85	0.65
	CV	10.78	10.59	11.47	11.01	11.04	9.91	5.74	11.64	10.32	10.57	0.07
	min	6.97	0.32	0.14	0.15	0.30	0.28	0.14	0.52	0.25	0.50	0.39
	max	13.67	0.61	0.27	0.29	0.56	0.50	0.17	1.05	0.46	0.95	0.72
2008 n = 258	**mean**	12.35	0.58	0.25	0.27	0.52	0.47	0.16	0.96	0.43	0.87	0.67
	CV	6.34	7.03	6.81	6.77	6.61	6.44	6.39	7.57	6.35	6.08	0.04
	min	7.87	0.34	0.15	0.17	0.34	0.31	0.09	0.52	0.28	0.57	0.42
	max	15.88	0.69	0.32	0.32	0.63	0.60	0.20	1.19	0.55	1.12	0.87
2009 n = 250	**mean**	12.52	0.59	0.25	0.27	0.52	0.48	0.16	0.97	0.44	0.89	0.68
	CV	6.72	8.07	6.86	8.67	7.62	6.83	7.13	8.83	6.41	6.42	0.05
	min	8.67	0.38	0.17	0.19	0.37	0.34	0.10	0.60	0.30	0.61	0.45
	max	14.78	0.72	0.29	0.32	0.61	0.57	0.19	1.19	0.51	1.06	0.81
06 to 09 n = 541	**mean**	12.41	0.58	0.25	0.27	0.52	0.47	0.16	0.96	0.43	0.88	0.68
	CV	6.91	8.02	7.21	8.11	7.50	7.07	6.76	8.46	6.78	6.69	0.05
	min	6.97	0.32	0.14	0.15	0.30	0.28	0.09	0.52	0.25	0.50	0.39
	max	15.88	0.72	0.32	0.32	0.63	0.60	0.20	1.19	0.55	1.12	0.87
AminoDat n = 136	**mean**	13.06	0.60	0.26	0.27	0.53	0.50	0.17	1.03	0.46	0.94	0.72
	CV	14.80	16.20	16.40	15.60	15.60	16.10	15.70	16.90	15.90	16.20	16.30
	min	7.18	0.34	0.13	0.14	0.27	0.28	0.09	0.52	0.25	0.51	0.38
	max	16.74	0.79	0.34	0.34	0.66	0.63	0.21	1.38	0.59	1.34	0.93

Based on the data presented in Tables 1 to 4 it is evident that the amino acid content differs a lot in these three raw materials. Some samples of DDGS and MBM with the maximum observed content of total lysine were more than two times higher or more than the content in the samples with the lowest lysine level. With such noted huge variability how can we make sure that when we formulate enough safety margins is being factored-in in order to meet the formulation specifications.

Table 4. Crude protein and amino acid content in extracted rice bran (AminoLab®)

Extracted Rice Bran												
Origin	**Description**	**CP**	**LYS**	**MET**	**CYS**	**M+C**	**THR**	**TRP**	**ARG**	**ILE**	**LEU**	**VAL**
2006 n = 7	**mean**	14.85	0.70	0.28	0.28	0.56	0.60	0.19	1.11	0.53	1.08	0.84
	CV	3.95	3.58	3.93	11.24	6.78	2.72	6.98	4.21	4.40	4.22	0.03
	min	14.02	0.65	0.27	0.25	0.53	0.58	0.17	1.06	0.50	1.02	0.81
	max	15.66	0.73	0.30	0.32	0.62	0.62	0.20	1.17	0.56	1.14	0.88
2007 n= 23	**mean**	16.01	0.73	0.31	0.31	0.62	0.62	0.20	1.23	0.57	1.15	0.89
	CV	7.13	7.93	7.10	10.10	8.28	5.91	7.73	8.10	6.34	6.61	0.06
	min	13.25	0.62	0.27	0.24	0.51	0.56	0.16	1.03	0.50	1.01	0.77
	max	17.63	0.83	0.36	0.35	0.70	0.69	0.22	1.42	0.63	1.32	0.99
2008 n = 42	**mean**	15.82	0.73	0.30	0.31	0.61	0.60	0.20	1.20	0.55	1.12	0.87
	CV	7.98	9.20	8.83	9.31	8.68	8.37	7.54	8.99	8.47	8.26	0.07
	min	11.44	0.51	0.21	0.21	0.43	0.43	0.14	0.86	0.39	0.80	0.64
	max	17.87	0.83	0.35	0.35	0.71	0.68	0.22	1.39	0.63	1.26	1.00
2009 n = 159	**mean**	16.38	0.76	0.32	0.32	0.65	0.64	0.20	1.24	0.58	1.18	0.92
	CV	7.94	9.09	9.47	8.36	8.69	8.44	7.40	9.55	9.28	9.18	0.08
	min	10.59	0.50	0.20	0.19	0.39	0.42	0.16	0.78	0.38	0.77	0.59
	max	18.59	0.88	0.39	0.37	0.75	0.75	0.24	1.51	0.70	1.42	1.08
06 to 09 n = 231	**mean**	16.19	0.75	0.32	0.32	0.64	0.63	0.20	1.23	0.57	1.16	0.91
	CV	8.02	9.18	9.45	9.28	9.12	8.36	7.54	9.42	9.09	8.99	0.08
	min	10.59	0.50	0.20	0.19	0.39	0.42	0.14	0.78	0.38	0.77	0.59
	max	18.59	0.88	0.39	0.37	0.75	0.75	0.24	1.51	0.70	1.42	1.08
AminoDat n = 41	**mean**	16.99	0.75	0.33	0.33	0.66	0.65	0.21	1.30	0.60	1.21	0.95
	CV	6.10	7.50	8.30	7.90	7.30	6.60	8.10	8.80	8.80	7.80	8.90
	min	15.10	0.63	0.28	0.29	0.57	0.56	0.18	1.10	0.49	1.02	0.78
	max	19.04	0.88	0.39	0.40	0.75	0.73	0.26	1.53	0.70	1.39	1.09

A better estimate for amino acids can be done based on the crude protein content where a constant ration between CP content and individual amino acids are expected. Further evaluation of these raw materials revealed that there was poor correlation (figure 1) between crude protein level and the amino acid content (expressed as percent of CP). This implies that it is difficult to predict amino acid levels precisely in these raw materials based on table values or regression equations based on crude protein. It also shows that changes in the nutrient profile of these raw materials do not seem to follow a specific trend.

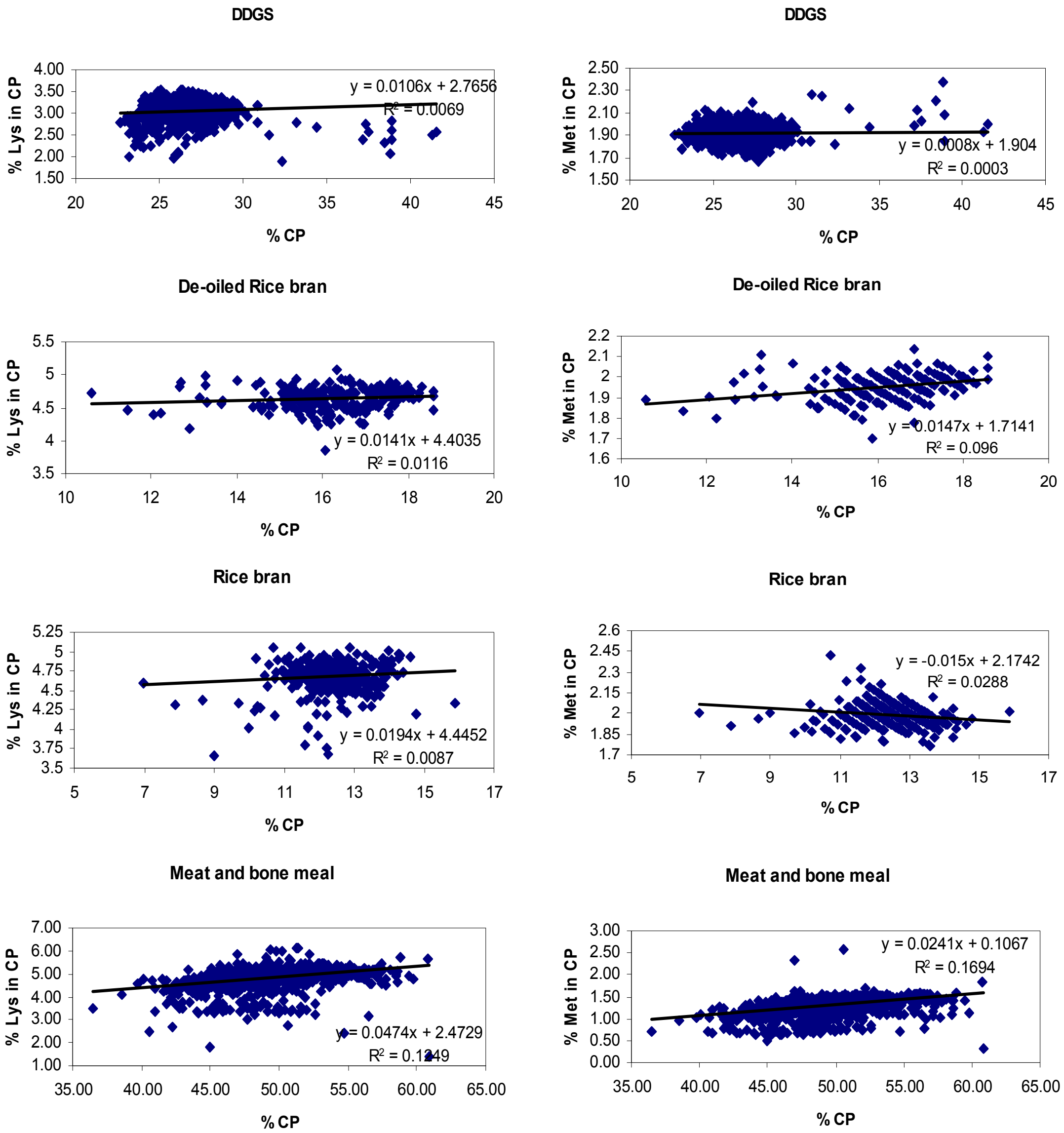

Figure 1. Lysine and Methionine content (%CP) in DDGS, De-oiled Ricebran, Rice bran and Meat and bone meal in response to crude protein level (AminoLab®, 2006-2009)

Based on the above data, it can be concluded that it is difficult to rely on table values and regression estimates in determining the nutrient content in DDGS, MBM and RB. The probability of either an over or under estimation of amino acid levels will always be present. The optimal solution to optimize the nutrient content in raw materials is through a systematic and continuous analysis of all incoming raw materials if possible. Wet chemical analysis of amino acids is expensive but with the advent of the NIR technology and the use of Evonik Degussa's AminoNIR calibrations, analyzing all incoming raw materials is now feasible.

Evaluating analytical data

In any feed milling operation raw materials are analyzed to make sure of the quality of the raw materials that are being purchased. Most of the feed mills have the capability to do simple quality tests on raw materials i.e. proximate analysis (moisture, crude protein, crude fat, crude fiber, ash, etc.). The common practice is that the results of their analysis are compared with existing book or table values of such raw materials (ie. NRC, CVB, AminoDat®) in order to verify the 'quality" or authenticity of the sample. Crude protein and dry matter values are sometimes further used to calculate the amino acid content of a specific raw material whenever regression equations are available. Optimally all this information is then used by nutritionists in adjusting their feed formulation matrix and by purchasers in deciding which raw materials to purchase. However, this is not always the case. Although to increase the accuracy of a feed ration, raw materials with moderate and high variability in composition must be analyzed routinely and the data gathered must be used correctly. The following are some suggestions on how to make use of analytical data to further evaluate raw materials.

Variation calls for safety margins

The high variation found in DDGS, MBM and Rice bran will affect the value, as the variation together with the price and the nutrient content are the main factors determining the real value of raw materials. Variation affects the safety margin that is used to ensure that the purchased raw material actually contains the expected nutrient of interest. A one standard deviation (stdev) safety margin statistically indicates that at least 83% of the batch can be expected to contain at least this level of nutrient in question. In the market it is commonly observed that at least ½ a standard deviation is subtracted to the mean value of the nutrient content. Table 5 shows a big difference in nutrient content when comparing mean values and values including 1 standard deviation safety margin for the raw materials with high variation.

Table 5. CP and amino acid content with and without safety margins (-1 stdev) in DDGS, MBM, FFRB.

Nutrients	DDGS		MBM		FFRB	
	mean	**mean -1stdev**	**mean**	**mean -1stdev**	**mean**	**mean -1stdev**
CP	26.37	*24.78*	48.81	*45.75*	12.41	*11.55*
Met	0.51	*0.47*	0.63	*0.52*	0.25	*0.23*
Cys	0.49	*0.45*	0.41	*0.31*	0.27	*0.24*
M+C	0.99	*0.92*	1.04	*0.84*	0.52	*0.48*
Lys	0.80	*0.73*	2.34	*2.06*	0.58	*0.53*
Thr	1.00	*0.94*	1.46	*1.25*	0.47	*0.44*
Trp	0.22	*0.21*	0.29	*0.21*	0.16	*0.15*

Another example of why it is relevant to consider variation (stdev or CV) in purchasing decisions is when comparing 2 raw material suppliers of DDGS with an average CP content of 26%. Supplier A has a CV of 3% at USD300/mt and supplier B has a CV of 8% at USD290/mt. If the purchase decision is based on the raw material cost alone without factoring in the variation then we would go for supplier B with the rationale of saving 10 USD/MT of DDGS. However, if the variation is factored in with one stdev the CP values would be 25.2% and 23.9% for supplier A and B, respectively. Then when calculating the cost per unit of nutrient the cost of CP for supplier A would be USD 11.90 (USD300/ 25.2% CP) and for supplier B it would be USD 12.12 (USD290/ 23.9%CP). Based on these calculations purchasing the more expensive DDGS from supplier A can be justified by its low variation and thereby a lower cost per unit of CP.

Feed formulation comparison (Shadow price calculation)

Taking the safety margin calculations one step further with least cost formulation and shadow price calculations, it shows that for DDGS at the current price of USD280/mt regardless of nutrient composition will surely be used in the formulation (Table 6). Whereas for MBM at the current price of USD600/mt and FF rice bran at USD 210/kg, qualities with minimum nutrient content will be kicked out of the formulation since the shadow price for it is at USD529/mt and

USD 205/mt, respectively. Shadow price calculation provides price indications for when the raw materials of different nutrient content starts to be attractive in the diet as well as the magnitude of change in the inclusion rates in the formulation.

Table 6. Example of a broiler starter least cost formulation and shadow price calculations for DDGS, MBM and FF rice bran using mean, min, max amino acid profile.

Ingredient	Price	Composition	Nutrient content	
	USD/MT	g/kg	Nutrient	g/kg
Corn	270	512	Crude protein	24
Soybean meal	520	381	ME (Kcal/kg)	3000
Palm oil	810	30.4	Crude fat	5.80
Dl-Methionine	5,000	2.90	Crude fiber	27
L-Lysine HCl	2,300	1.40	Ash	69
L-Threonine	3,200	0.40		
Premix + others	-	72.2	TFD Lys	12.70
			TFD Met	6.15
Total	411	1000	TFD Met + Cys	9.20
			TFD Thr	8.00
Shadow price calculation (US$/MT)			TFD Arg	14.25
DDGS mean	386	177	TFD Ile	8.90
DDGS min	369	179	TFD Leu	17.81
DDGS max	430	58	TFD Val	9.60
MBM mean	612	79		
MBM min	529	79	Calcium	10.00
MBM max	700	42	Phosphorus, av.	5.10
FF Rice bran mean	222	153	Sodium	1.50
FF Rice bran min	205	154	Chloride	2.57
FF Rice bran max	231	152		

**ingredient prices as of Dec. 2009*

Feed formulation comparison (Actual vs. Old values)

To evaluate the value of having more precise amino acid data for the raw materials, i.e. the analytical results, a set of formulations based on book values and on actual analysis were performed based on the nutrient specifications on Table 7. For almost all of the raw materials the analysed nutrient content (CP and amino acids) were higher compared with table values except for the CP of DDGS. Formulating the same diet using AminoDat® values to represent old values came out to be more expensive by USD0.53/MT. Assuming a feed miller to be producing 100,000 mt of broiler starter feeds per year would translate to USD53,000.00 savings per year by using more accurate raw material nutrient matrix in the feed formulation. Feed formulation results showed that formulating based on book values increases the chance that feed diets either do not meet the specifications or exceeds the nutrient specifications. In addition, feed formulation using actual analytical data or more recent nutrient values can be more economical. Thus, the examples shows that when purchasing raw materials, decisions should not only be based on price per kilogram, or price per unit of a single nutrient like for example crude protein. Instead, value should be determined based on actual analysis of nutrient content combined with shadow price evaluation done with least cost feed formulation.

Table 7. Crude protein and amino acid content with a safety margin (-1standard deviation) in DDGS, MBM and FF Rice bran based on AminoDat® or present survey (new).

Nutrients	DDGS			MBM			Full fat Rice bran		
	AminoDat	new data	Δ	AminoDat	new data	Δ	AminoDat	new data	Δ
CP	24.99	*24.78*	-0.20	40.45	*45.75*	5.30	11.23	*11.55*	0.32
Met	0.47	*0.47*	0.00	0.42	*0.52*	0.10	0.22	*0.23*	0.01
Cys	0.45	*0.45*	0.00	0.22	*0.31*	0.09	0.22	*0.24*	0.02
M+C	0.92	*0.92*	0.00	0.70	*0.84*	0.14	0.45	*0.48*	0.03
Lys	0.63	*0.73*	0.10	1.73	*2.06*	0.33	0.50	*0.53*	0.03
Thr	0.93	*0.94*	0.01	1.08	*1.25*	0.17	0.42	*0.44*	0.02
Trp	0.18	*0.21*	0.03	0.14	*0.21*	0.07	0.14	*0.15*	0.01

Evaluation of raw material based on origin

In evaluating raw materials based on the country of origin for example MBM (figure 2), it can be observed that for crude protein and amino acid content, the highest variability was observed in MBM samples from India. Samples coming from Australia, the USA and the AminoDat® values had comparable crude protein and amino acid content. By getting such information based on historical data future purchased can be decided on this basis. Or additional caution can be taken when using raw materials from such origin. A similar analysis can also be performed based on a specific supplier or a particular processing method for raw materials.

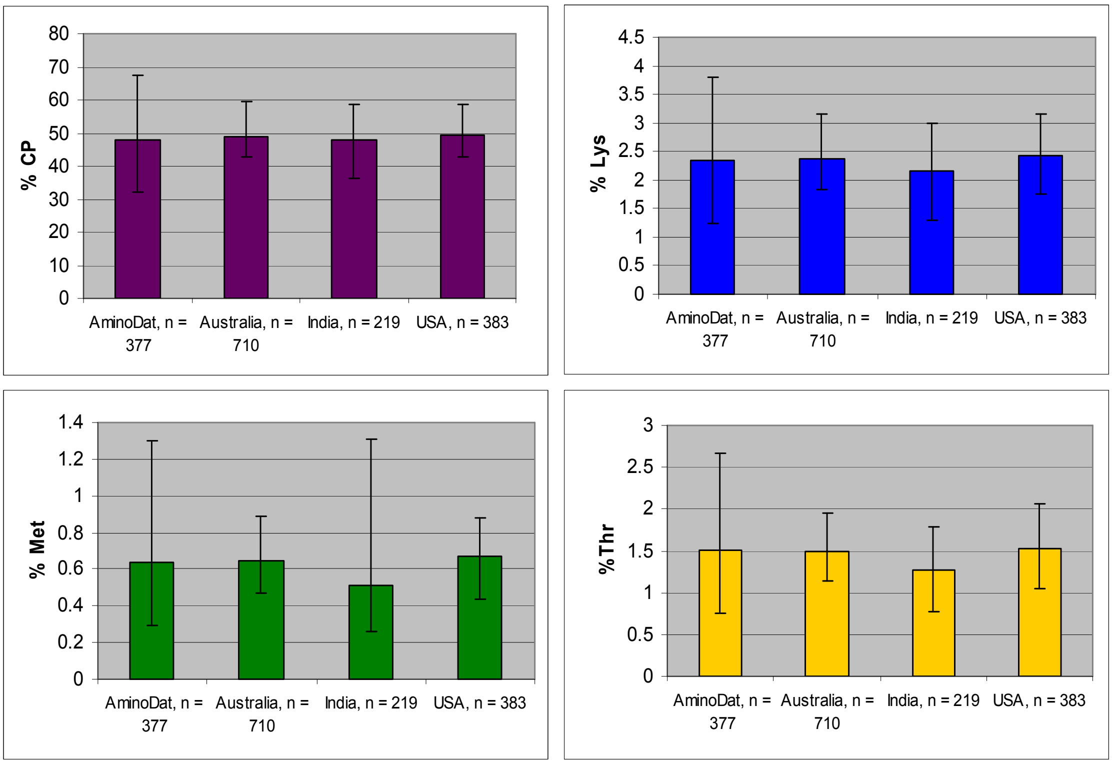

Figure 2. Comparison of Crude protein and amino acid content in MBM samples (AminoLab®)

Conclusion

The main hurdle in this whole process of raw material evaluation is getting the information across to those who can take action. Management of the data produced from analysis of these feed and raw material samples has always been a challenge. The transfer of analytical data information to nutrition and purchasing department from laboratories or quality control department and often among many sites of a customer is commonly observed. Further more statistical evaluations such as coefficient of variation and standard deviation calculations should be performed as it will give information about the magnitude of safety margins needed and thereby add to a more informed purchasing decision. More thorough evaluations of the raw material supplier, origin and seasonal trends, among others can also be performed with substantial amount of accumulated analytical data. All this information from raw material evaluation can aid in inventory control and resource management. We therefore conclude that constant monitoring and analysis of amino acids in raw materials is important to optimize profitability through more consistent feed quality and reduced production cost.

References

St. Pierre,N. and W. P. Weiss. 2008 Understanding feed analysis variation and minimizing its impact. AminoNews™. 10:1. pp. 7-16.

Tangendjaja, B. and D. Farrell. 2002. Rice bran, watch for variability. Asian Poultry Magazine. Jan/Feb 2002. p. 14-16.