

U.S. Dehulled Soybean Meal – Feeding Studies

Summary

A series of 27 feeding studies conducted over an eight year period in Asia, South America and Europe involving more than 234,000 broilers, layers and swine, has confirmed the economic value of U.S. dehulled soybean meal. These studies examined the performance of animals fed various lots of soybean meal originating from U.S., Argentina, Brazil, India, China, Thailand and Malaysia. All samples were obtained from the commercial trade using animals obtained and grown under local conditions. Using the same typical common feed ingredient prices in all of the studies, the U.S. dehulled soybean meal was worth U.S.\$33.60 more than non-dehulled soybean meal from India, Brazil, Argentina and China. U.S. dehulled soybean meal was worth U.S. \$8.74 more per mt than similar dehulled soybean meal produced in Argentina, Brazil, Paraguay and China. High efficiency soybean meal, produced in specialized soybean meal crushing plants in the U.S. and Malaysia, was found to have a U.S. \$6.76 advantage over commercially obtained U.S dehulled soybean meal (G.1).

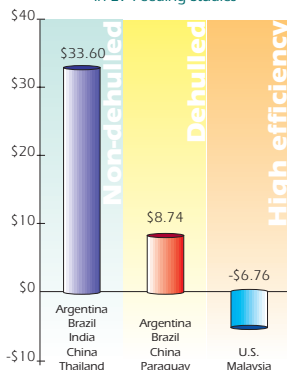
Details

The bar graph (G.2) depicts the results of the 27 individual feeding studies. The bars represent the average advantage or disadvantage of U.S. dehulled soybean meal on a USD per mt basis as compared to competitive meals from other origins using the ingredient prices (T.1) for all diets in all studies.

The graph shows rather large variation in quality of non-dehulled meal as compared to U.S. dehulled meal. On average, the results indicate an economic advantage of U.S. dehulled soybean meal over both non-dehulled and dehulled soybean meals obtained from Brazil, Argentina, Paraguay, India and China. New generation “high efficiency” soybean meals produced in quality optimized crushing plants in the U.S. and Malaysia were found to have an advantage over “commercial grade” U.S. dehulled meal.

All soybean meal samples (with the exception of the identity preserved high efficiency meals) were obtained from the commercial trade or stocks in use at commercial feed companies.

G.1: Average Economic Advantage of U.S. Dehulled Soybean Meal in 27 Feeding Studies



T.1: Ingredient Prices Used in Soybean Meal Feeding Studies

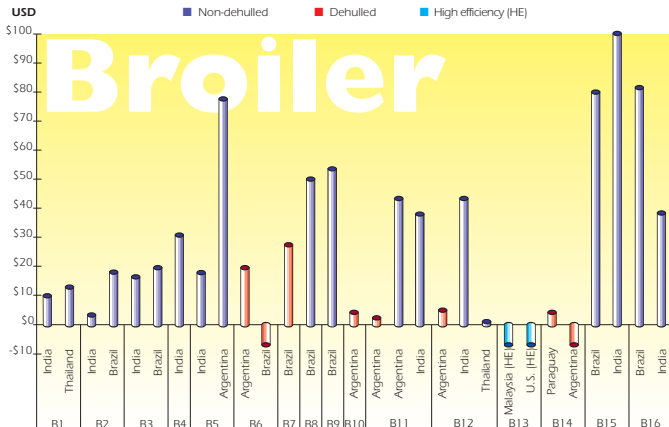
Ingredient	USD
SBM	240
FFSBM	260
Corn	140
Wheat	145
Cassava	80
Rapeseed meal	156
Gluten feed	146
Bakery	158
Fishmeal	550
Meat Meal	300
CGM	350
Fat/oil	400
Rice bran	136
Wheat pollard	136
DL-met	3500
L-Lys HCL	2857
Threonine	4500
Limestone	75
DCP	260
MDCP	300
Salt	75
VPmx	1500
MPmx	300
Choline	844
Drugs	1500
NaHCO3	200
Anti mold	2000
Alimet	3080
Whisky	800
Molasses	125
Enzyme	2500

Diets were formulated to meet locally derived nutrient specifications. Diets in some of the experiments contained small amounts of other protein/amino acid sources such as fishmeal, corn gluten meal, rapeseed meal, canola meal, DL-methionine, Alimet, L-lysine HCl and/or L-threonine in keeping with local practices.

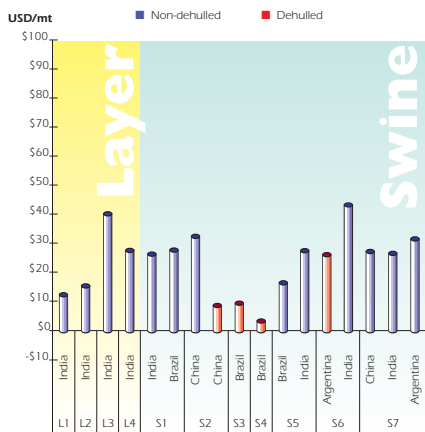
In some of the experiments, the test soybean meals were assumed to be exactly the same and formulations were exactly the same for each phase of feeding. In other experiments, the meals were assigned their laboratory analyzed nutrient values and formulated accordingly. In these studies, non-dehulled soybean meal was typically assumed to have between 100 to 200 kcal per kg less energy than dehulled meal. As a result, diets containing non-dehulled meal were fortified with additional soybean meal, amino acids and fat or oil.

The bulk cost of each feed formulation (starter, grower, finisher, etc) was calculated using ingredient prices and percentage inclusion of each ingredient for all studies. The feed cost consumed was then calculated by multiplying the feed price by the feed intake of each diet (starter, grower, finisher, etc).

G.2: Economic Advantage of U.S. Dehulled SBM in 27 Feeding Studies (1–16, Broilers)



G.2a: Economic Advantage of U.S. Dehulled SBM in 27 Feeding Studies (17 – 27, Layers & Swine)



These were then added up for each soybean meal source fed. The average feed cost was then divided by the average body weight or body weight gain to obtain feed cost per kilogram body weight. The price of the competitive soybean meal was then adjusted upward or downward until the price per kilogram body weight was exactly the same as the animals fed U.S. dehulled soybean meal. The "TABLE" and "TREND" functions in Microsoft EXCEL were used to facilitate these calculations.

With U.S. dehulled soybean meal set at U.S. \$240 per mt, the additional price (over \$240) of the competitive soybean meal required to give equal animal performance in terms of USD per kg body weight was calculated and depicted in the graph.

Conclusion

The analysis of these studies clearly indicate the economic benefit of U.S. dehulled soybean meal when compared to other sources of soybean meal, both non-dehulled and dehulled. As expected, variation does exist in commercially obtained samples of soybean meal. The results show that continued use of U.S. dehulled soybean meal makes economic sense even when priced higher than other soybean meal from other origins.

Details of each study are available from the American Soybean Association. A spreadsheet with all the study data is available. This will allow the user to enter in other raw material prices to determine the value spread of U.S. dehulled meal over other sources should ingredient prices be different than those listed in T.1.

Study and Soybean Meal Details

Study: B1. Comparison of soybean meal sources and replacement of fishmeal with full-fat soybean meal

Location and Date: Thailand, July 1995

Institute: Ajinomoto Bangkok Animal Research Facility

Animals: 2,880 mixed sex Arbor Acres broilers

Duration: 1 – 42 days

Diet type: Corn, soybean meal, fish meal, full fat soybean meal, D,L-methionine, L-lysine HCL, L-threonine

Soybean meal analysis: Ajinomoto Feed Laboratory, 88% dry matter basis

	U.S. dehulled	India	Thailand
Crude protein	47.91	46.8	47.9
Crude fiber	5.27	9.07	8.69
Crude fat	1.4	1.5	1.6
Ash	6.2	7.0	7.3
TME(n)	2311	1983	2270
Urease (delta pH)	.06	.09	.15
KOH-PS	83.2	62.0	88.7

Study: B2. Performance comparison of soybean meal sources in broilers

Location and Date: Philippines, 1996

Institute: University of the Philippines at Los Baños

Animals: 560 Arbor Acres feather sexed male broilers

Duration: 1 – 42 days

Diet type: Corn, soybean meal, D,L-methionine, coconut oil

Soybean meal analysis: University of Missouri, 88% dry matter basis

	U.S. dehulled	India	Brazil
Crude protein	47.0	49.1	48.7
Crude fiber	2.19	4.68	4.44
Crude fat	.72	.87	1.37
Ash	6.10	7.34	5.60
Urease (delta pH)	.20	.30	.08
KOH-PS	79.7	81.1	74.3

Study: B3. Comparison of soybean meal sources in normal and low protein diets

Location and Date: Thailand, July, 1996

Institute: Ajinomoto Bangkok Animal Research Facility

Animals: 2,688 mixed sex Arbor Acres broilers

Duration: 1 – 42 days

Diet type: Corn, soybean meal, palm oil, D,L-methionine, L-lysine HCL, L-threonine

Soybean meal analysis: UPLB, as is basis

	U.S. dehulled	India	Brazil
Crude protein	47.1	46.1	45.1
Crude fiber	3.13	6.15	5.68
Crude fat	1.38	.50	1.04
Ash	6.41	8.00	7.77
Urease (delta pH)	.06	.12	.10
KOH-PS	78.1	83.2	77.2

Study: B4. Soybean meal comparison in diets of various nutrient density and enzymes

Location and Date: Philippines, May, 1996

Institute: Swift Foods Tanauan Batangas Broiler Research Facility

Animals: 4,480 Avian mixed sex broilers

Duration: 1 – 41 days

Diet type: Corn, soybean meal, fish meal, coconut oil, soy oil, wheat pollard, Aliment, L-lysine HCL

Soybean meal analysis: Swift Foods Laboratory, as is basis

	U.S. dehulled	India
Crude protein	48.0	47.0
Crude fiber	3.3	5.9
Lysine	3.05	2.91

Study: B5. Comparison of soybean meal sources using total or digestible amino acids

Location and Date: Indonesia, 1996

Institute: Research Institute for Animal Production

Animals: 1,500 Arbor Acres male broilers

Duration: 1 – 41 days

Diet type: Corn, soybean meal, rice bran, palm oil, corn gluten meal, D,L-methionine, L-lysine HCl

Soybean meal analysis: University of Missouri and Research Institute for Animal Production, Bogor, Indonesia*, 88% dry matter basis

	U.S. dehulled	India	Argentina
Crude protein	47.6	48.8	45.1
Crude fiber	2.89	4.67	4.46
Crude fat	1.67	.92	1.76
Ash	6.33	6.2	5.59
Lysine	2.93	2.94	2.43
Urease (delta pH)*	.04	.32	.10
KOH-PS*	90.4	77.9	79.0

Study: B6. Comparative growth and production performance of broilers in U.S., Argentine and Brazilian dehulled soybean meals

Location and Date: Philippines, 1998

Institute: University of the Philippines at Los Baños

Animals: 300 feather sexed male Arbor Acres broilers

Duration: 1 – 42 days

Diet type: Corn, soybean meal, coconut oil, D,L-methionine, L-lysine HCl

Soybean meal analysis: UPLB, as is basis

	U.S. dehulled	Argentina	Brazil
Crude protein	46.4	43.4	47.9
Crude fiber	3.07	4.39	2.47
Crude fat	2.39	2.37	1.81
Ash	5.90	6.30	6.20
Urease (delta pH)	.06	.06	.06
KOH-PS	85.7	84.7	79.7

Study: B7. Soybean meal comparison with and without feed enzymes

Location and Date: Philippines, 1999

Institute: Central Luzon State University

Animals: 12,000 mixed sex Avian 34 broilers

Duration: 1 – 37 days

Diet type: Corn, wheat, soybean meal, fishmeal, soybean oil, D,L-methionine

Soybean meal analysis: CLSU, 88% dry matter basis

	U.S. dehulled	Brazil
Crude protein	47.7	46.0
Crude fiber	3.63	3.72
Crude fat	.94	2.76
Ash	6.59	5.86
Urease (delta pH)	.09	.05
KOH-PS	79.8	82.6

Study: B8. Comparison of U.S. dehulled and Brazilian non-dehulled soybean meals

Location and Date: Hungary, April, 1999

Institute: Pannon University, Tuskes Major Poultry Farm

Animals: 15,819 mixed sex broilers

Duration: 1 – 49 days

Diet type: Corn, soybean meal, wheat shorts, fishmeal, fat powder, L-lysine HCl, D,L methionine

Soybean meal analysis: Pannon University, 88% dry matter basis

	U.S. dehulled	Brazil
Crude protein	48.3	45.4
Crude fiber	2.9	6.1
Crude fat	1.4	1.4
Lysine	2.85	2.58
Urease (delta pH)	.06	.08
KOH-PS	82.1	74.9

Study: B9. Comparison of U.S. dehulled and Brazilian non-dehulled soybean meals

Location and Date: Hungary, April, 1999

Institute: Pannon University

Animals: 440 Ross 308 male broilers

Duration: 1 – 42 days

Diet type: Wheat, corn, soybean meal, meat and bone meal, fat powder, L-lysine HCl, D,L-methionine

Soybean meal analysis: Pannon University, 88% dry matter basis

	U.S. dehulled	Brazil
Crude protein	48.3	45.4
Crude fiber	2.9	6.1
Crude fat	1.4	1.4
Lysine	2.85	2.58
Urease (delta pH)	.06	.08
KOH-PS	82.1	74.9

Study: B10. Evaluation of U.S. and Argentine dehulled soybean meal at different nutrient densities in broilers

Location and Date: Malaysia, December, 2000

Institute: Gold Coin Research Farm, Ayer Manis, Johore, Malaysia

Animals: 3,360 mixed-sex Cobb 500 broilers

Duration: 1 – 49 days

Diet type: Corn, corn gluten meal, meat and bone meal, soybean meal, palm oil, L-lysine HCl, D,L-methionine, L-threonine

Soybean meal analysis: University of Missouri, 88% dry matter basis

	U.S. dehulled	Argentine dehulled
Crude protein	49.2	47.6
Crude fiber	1.28	1.98
Crude fat	2.46	2.65
Ash	6.08	6.29
Urease (delta pH)	0.02	0.02
KOH-PS	77.8	76.4
Protein dispersibility index	28.7	28.0

Study: B11. Soybean meal comparison in broilers

Location and Date: Vietnam, December, 2000

Institute: Institute for Agricultural Science, South Vietnam, Vifaco Poultry Farm

Animals: 1,500 mixed sex Hubbard broilers

Duration: 1 – 44 days

Diet type: Corn, soybean meal, fishmeal, soybean oil, L-lysine HCl, D,L-methionine, L-threonine

Soybean meal analysis: University of Missouri, 88% dry matter basis

	U.S. dehulled	Arg dehulled	Arg NDH	India NDH
Crude protein	47.1	47.4	44.2	44.2
Crude fiber	2.93	2.23	4.58	4.59
Crude fat	1.75	2.26	1.88	1.87
Ash	6.63	6.56	6.26	5.33
Urease (delta pH)	.04	0	0	.01
KOH-PS	73.0	75.4	69.8	68.8
Lysine	2.56	2.82	2.48	2.46
Available lysine	2.35	2.64	2.30	2.25

Study: B12. Soybean meal comparison

Location and Date: Thailand, September, 2002

Institute: Betagro Animal Research Farm

Animals: 3,700 Arbor Acres FSY mixed sex

Duration: 1 – 35 days

Diet type: Corn, soybean meal, full fat soy, palm oil, D,L-methionine, L-lysine HCl

Soybean meal analysis: University of Missouri, Betagro*, 88% dry matter basis

	U.S. dehulled	Argentina	Thailand	India
Crude protein	48.7	47.7	49.0	47.5
Crude fiber*	3.87	4.30	6.52	6.09
Crude fat	1.23	1.11	1.17	1.14
Ash	6.22	6.81	6.25	7.42
Urease (delta pH)	.04	0	.07	0
KOH-PS	87.2	79.6	86.8	84.4
Protein dispersibility index	16.8	14.4	16.5	20.4
Lysine	2.94	2.81	2.97	2.79
Available lysine	2.72	2.57	2.78	2.59

Study: B13. Evaluation of high efficiency soybean meal from U.S. and Malaysia

Location and Date: Indonesia, December, 2002

Institute: Wonokoyo Jaya Company, Surabaya Indonesia

Animals: 80,000 mixed sex Hubbard broilers

Duration: 1 – 34 days

Diet type: Corn, soybean meal, wheat pollard, rapeseed meal, meat and bone meal, palm oil, L-lysine HCl, Alimet

Soybean meal analysis: University of Missouri, Wonokoyo Lab, 88% dry matter basis

	U.S. dehulled	U.S. (HE)	Malaysia (HE)
Crude protein	47.8	49.3	45.8
Crude fiber*	4.66	4.09	3.66
Crude fat	1.52	1.71	1.67
Ash	6.31	6.34	6.09
Urease (delta pH)	.01	.01	0
KOH-PS	86.7	86.5	86.0
Protein dispersibility index	18.8	19.9	19.1
Lysine	3.02	2.97	2.87
Available lysine	2.89	2.78	2.73

Study: B14. Soybean meal comparison under commercial conditions in Peru

Location and Date: Peru, April, 2002

Institute: Macas Farm, Gramobier SAC, 40 km east of Lima Peru

Animals: 78,825 Cobb 500 (males and females fed separately)

Diet type: Corn, soybean meal, fish meal, full fat soy, soy oil, D,L-methionine, L-lysine HCl

Soybean meal analysis: Laboratory International Analytical Services, 88% dry matter basis

	U.S. dehulled	Paraguay	Argentina
Crude protein	48.9	51.5	48.1
Crude fat	1.35	1.14	1.23
Crude fiber	3.02	3.85	2.79
Urease (delta pH)	0.01	0.01	0.03
KOH-PS	78.8	79.0	76.1

Studies: B15 and B16. Evaluation of feeding values of U.S. dehulled and non-dehulled soybean meals from South America and India based on PDI and bioassay with broilers

Location and Date: Korea, 2002

Institute: Korea University, Seoul

Animals: 720 Ross mixed sex for each study

Diet type: Corn, soybean meal, wheat, corn gluten meal, rapeseed meal, wheat bran, soybean oil, D,L-methionine, L-lysine HCL, vitamins and minerals

Soybean meal analysis: Korea University, as is basis

	U.S. dehulled	Brazil	India
Moisture	10.7	12.3	9.9
Crude protein	47.6	44.8	44.3
Crude fiber	3.9	5.3	5.6
Crude fat	1.5	2.4	2.1
Ash	6.2	6.0	8.1
Lysine	3.01	2.82	2.62
Available lysine	2.65	2.58	2.43
Methionine	.70	.64	.62
Cystine	.74	.68	.63
Urease	.10	.03	.08
KOH-PS	80.6	74.8	74.3
PDI	22.2	20.2	17.5
PER	3.68	3.33	3.32
dig lysine	96.1	92.5	93.8
dig met	96.0	88.9	94.2
dig cystine	90.6	87.5	90.2
AME mcal/kg	2.6	2.5	2.4

Study: L1. Soybean meal comparison in a commercial Indonesian layer farm

Location and Date: Indonesia, 1997

Institute: Rebobat Layer Farm, Tangerang, Indonesia

Animals: 19,200 Lohmann Brown

Duration: 24 – 48 weeks of age

Diet type: Corn, soybean meal, ricebran, D,L-methionine, L-lysine HCl

Soybean meal analysis: (Research Institute for Animal Production, as is basis)

	U.S. dehulled	India
Crude protein	45.8	46.0
Crude fiber	2.90	4.80
Ash	6.00	7.20
KOH-PS	84.1	66.7

Study: L2. Soybean meal comparison on a total and digestible amino acid basis

Location and Date: Thailand, 1997

Institute: Ajinomoto Bangkok Animal Research Facility

Animals: 1152 Isa Brown

Duration: 19-39 weeks of age

Diet type: Corn, soybean meal, ricebran, palm oil, D,L-methionine

Soybean meal analysis: Ajinomoto Laboratories, 88% dry matter basis

	U.S. dehulled	India
Crude protein	47.8	45.7
Crude fat	1.61	1.32
Crude fiber	3.10	4.87
Ash	7.24	7.36
Urease (delta pH)	.26	.45

Study: L3. Soybean meal comparison on a total and digestible amino acid basis

Location and Date: Indonesia, 1997

Institute: Research Institute for Animal Production

Animals: 512 Lohmann Brown

Duration: 20 – 40 weeks of age

Diet type: Corn, soybean meal, rice bran, D,L-methionine, L-lysine HCl

Soybean meal analysis: Research Institute for Animal Production, as is basis

	U.S. dehulled	India
Crude protein	45.8	46.0
Crude fiber	3.20	5.00
Ash	7.23	7.60
KOH-PS	84.1	66.7

Study: L4. U.S. dehulled vs Indian on total or digestible basis

Location and Date: Philippines, December, 2000

Institute: Central Luzon State University

Animals: 960 Hisex

Duration: 15 – 42 weeks of age

Diet type: Corn, soybean meal, molasses, rice bran, coconut oil, D,L-methionine, L-lysine HCl

Soybean meal analysis: CLSU, 88% dry matter basis

	U.S. dehulled	India
Crude protein	45.4	41.7
Crude fat	1.84	0.77
Crude fiber	3.20	5.85
Ash	6.13	7.64
KOH-PS	85.92	ND
Urease (delta pH)	0.06	ND

Study S1. Comparing three soybean meal sources in diets for pigs from 15 to 95 kg

Location and Date: Bangkok, Thailand, 1996

Institute: Bangkok Animal Research Facility, Ajinomoto

Animals: 96 crossbred (LR X LW X DR) 15 kg sex separate

Duration: 15 – 95 kg (180 days)

Diet type: Corn, soybean meal, palm oil, L-lysine HCL, L-threonine

Soybean meal analysis: Ajinomoto, OMIC*, 88% dry matter basis

	U.S. dehulled	India	Brazil
Crude protein	46.4	45.2	44.2
Crude fat	1.36	.48	1.02
Crude fiber*	3.08	6.02	5.55
Ash	6.32	7.48	7.60
Urease (delta pH)	0.06	.012	.010

Study: S2. Soybean meal comparison in Shandong

Location and Date: Shandong, China 1996

Institute: Shandong Meat and Export Corporation Commercial Farm

Animals: 1, 134 (LW X LR X DR) mixed equal sex

Duration: 5 to 70 kg (102 days)

Diet type: Corn, soybean meal, soy oil.

Soybean meal analysis: Shandong Meat and Export Lab, 88% dry matter basis

	China NDH	China dehulled	U.S. dehulled
Crude protein	44.5	49.3	47.0
Crude fiber	5.6	2.8	3.7
Ash	6.2	5.4	6.2
Urease (delta pH)	.07	.14	.02
KOH-PS	80	88	88
Lysine	2.66	3.14	2.98

Study: S3. Performance of weaning and growing pigs fed rations with U.S. and Brazilian dehulled soybean meal and two levels of energy

Location and Date: San Pedro, Laguna, Philippines 1998

Institute: Holiday Hills Stock and Breeding Farm

Animals: 288 (LW X LR X DR) commercial weaners mixed equal sex

Duration: 18 to 90 kg (152 days)

Diet type: Corn, soybean meal, powdered fat, wheat bran

Soybean meal analysis: Woodson Tenent Laboratories, Inc 88% dry matter basis

	U.S. dehulled	Brazil dehulled
Crude protein	48.2	48.6
Crude fat	1.58	1.57
Crude fiber	3.90	3.13
Ash	6.19	6.33
Urease (delta pH)	.03	.03
KOH-PS	82.4	85.8
Protein dispersibility index	10.4	9.0

Study: S4. ASA swine feeding demonstration: U.S. vs Brazilian dehulled soybean meal

Location and Date: Cabuyao, Laguna, Philippines 1999

Institute: INFARMCO Commercial Breeding Farm

Animals: 128 (LW X LD) F1 weaners 7 female: 1 male

Duration: 20 – 90 kg (120 days)

Diet type: Corn, wheat, soybean meal, wheat pollard, fishmeal, coconut oil

Soybean meal analysis: Lipa Quality Control Laboratories, Philippines, 88% dry matter basis

	U.S. dehulled	Brazil dehulled
Crude protein	45.5	45.3
Crude fat	1.94	1.20
Crude fiber	3.68	2.51
Ash	6.03	6.07
Urease (delta pH)	.08	.16
KOH-PS	85.1	85.9

Study: S5. Trials for U.S. dehulled soybean meal applied to genetically improved pig's diet compared to South American and Indian soybean meal in Korea

Location and Date: Taegu, Korea, 2001

Institute: Jung Institute and Best Pig Swine

Animals: 320 (LW X LD x DR) weaners equal sex per pen

Duration: 30 to 80 kg (160 days)

Diet type: Corn, ricebran, wheat, tapioca, bakery, tallow, lysine, methionine, molasses

Soybean meal analysis: Science Lab Center Ltd Korea, 88% dry matter basis

	U.S. dehulled	Brazilian NDH	Indian NDH
Crude protein	47.1	45.2	45.0
Crude fat	1.29	1.26	1.23
Crude fiber	4.68	6.32	7.08
Ash	6.32	6.20	6.96
Urease (delta pH)	.14	.13	.13
KOH-PS	88.7	85.2	88.3
Lysine	3.09	2.79	2.87

Study: S6. The effect of different soybean meal sources in pig diets in Vietnam

Location and Date: Cu Cui Vietnam, 2002

Institute: Thai My Swine Farm and Agricultural Institute of South Vietnam

Animals: 360 (Yorkshire X Landrace X Duroc) castrates:gilts 1:1

Duration: 20 to 100 kg (150 days)

Diet type: Corn, soybean meal, ricebran, soy oil

Soybean meal analysis: IAS Vietnam, Soon Soon Oil Mills, Malaysia*, 88% dry matter basis

	U.S. dehulled	Argentine dehulled	Indian NDH
Crude protein	46.4	45.7	42.7
Crude fat	1.98	1.98	2.00
Crude fiber	3.96	3.92	6.00
Ash	6.6	6.1	7.0
Urease (delta pH)*	.08	.03	.19
KOH-PS*	90.8	77.0	87.8
Lysine	2.79	2.70	2.34

Study: S7. Soybean meal comparison in a commercial farm on Hainan

Location and Date: Hainan, China, 1998

Institute: Hainan Island Commercial Swine Farm

Animals: 576 Dekalb pigs castrates:gilts 1:1

Duration: 20 to 100 kg (120 days)

Diet type: Corn, soybean meal, cassava, palm oil

Soybean meal analysis: 88% dry matter basis

	U.S. dehulled	Chinese NDH	Indian NDH	Argentine NDH
Crude protein	47.7	44.1	43.1	47.1
Crude fiber	3.06	6.49	6.81	7.81
Urease (delta pH)*	.07	.04	.07	.07
KOH-PS*	84	83	72	74