Managing Feed Quality and Effectiveness During Market Crises

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Challenges in the Market and Possible reactions

- **Definition of problem**
  - Commodity prices rising drastically – challenged harvests and supply
  - Freight availability especially containers
  - War in Ukraine destabilizing Wheat, SF and SFO

- **Alternative Ingredients**
  - What can be done
  - What ingredients are available

- **Can we lower feed cost through formula specifications?**
  - Chicken composition and potential
  - Feeding for best efficiency
  - Experimenting with nutrient supply

- **Can we lower feed cost by ingredient Information? (preview – YES)**
  - Accurate ingredient information lowers cost
  - Safety margins are reduced or redundant with frequent NIR Updates

Corn and Wheat Price Commentaries – Drives Alternatives

- Yellow Corn Prices stable 2017 – 2020
- Price breakout in 2020

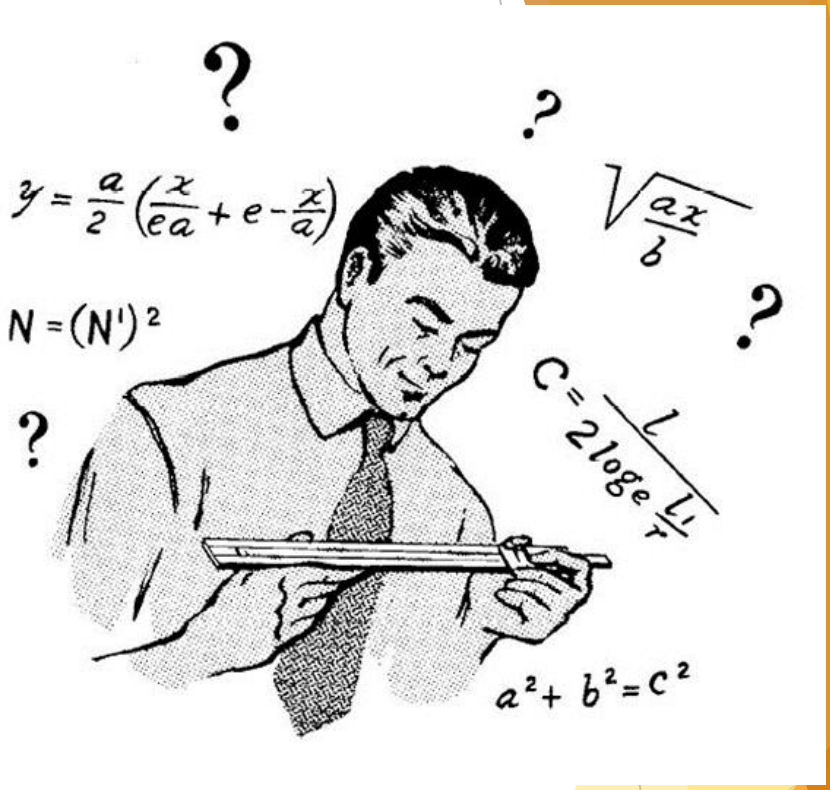
- Wheat prices similarly stable
- Price rises in 2020, not as steeply as corn
- Similar trend in prices. Commodities linked by common demand in animal feed sector

- SBM Prices stable 2017 – 2020 with a spike in 2018
- SBO and SBM have some independence as end user markets are different.
- Sharp rises in SBM and SBO as supplies of Soybeans become tighter in 2020
- SBO in 2022 responding to political mandate on biofuels and interruptions in palm oil supply
- SBO is driving the market currently, *SBM is by product of demand for oil. Oil revenue is currently 53% crush revenue*

Corn Prices - 59 Year Historical Chart | MacroTrends

Alternative Ingredients – Definition and Challenge

- **A weed is ……**
  - A plant in the wrong place
- **An alternative ingredient is …….**
  - A staple ingredient somewhere else
  - Normal in other regions
  - Defined by geography
  - Finite in supply
  - *A major temptation when prices rise*
- **Using alternative ingredients requires …….**
  - Thorough knowledge of the nutritional composition
  - Understanding anti-nutritional factors and limits to usage
  - Understanding the supply economics and regional differences
  - ***Test formulations to determine financial impact***
  - Preparation and Planning
    - Finding the right enzyme packages
    - Supplier testing
    - Engineering testing
    - Acceptance testing and confirmation of usability



Maintaining productivity with alternative ingredients requires us to work on the science and we have to do the maths for new materials

Layer Diets Australia *

Ingredient	Corn Soy	Aus 1	Aus 2	Aus 3	Aus 4	Aus 5
Yellow corn	58.39					
Wheat		53.15	49.75	50.77	52.51	48.06
Barley		10.00	13.50	6.50	5.00	10.00
Triticale				7.00	5.00	7.50
Wheat Pollard	5.00	4.00				
Soybean Meal	23.98	8.65	9.25	2.65	2.20	1.00
Meat Meal			2.00	5.00	5.75	4.40
Canola		12.00	9.00	10.00	10.00	10.00
Peas			4.30			
Lupins				7.00	7.50	8.00
Oil	1.00	1.05	1.46	0.50	1.65	0.60
Limestone	9.44	9.57	9.98	9.50	9.50	9.65
DCP	0.69	0.60				
L Lysine HCl		0.17	0.06	0.17	0.17	0.12
DL Methionine	0.19	0.15	0.13	0.16	0.15	0.11
Threonine		0.05			0.02	
Tryptophan				0.01		
Isoleucine		0.07	0.01	0.06	0.04	0.01
L Valine		0.01				

* Tony Edwards, ACE Consulting

- Wheat can completely replace corn
- Barley can be used in modest quantities
- Soybean meal can be replaced with other vegetable proteins
- Alternative ingredients can be used, but should be verified before purchase for technical feasibility.

Potential Cereal Substitutes

	Corn Argentina	Wheat 12.5%	Barley 10.5%	Barley 89.5% DM	Barley 11.5% CP	Sorghum
Crude Protein	7.20	12.53	10.49	10.85	11.50	9.32
AMEn Poultry	3,297.91	3,088.00	2,748.93	2,843.62	2,748.93	**3,248.00**
AMEn Broiler	3,297.91	3,088.00	2,748.93	2,843.62	2,755.00	3,248.00
AMEn Layer	3,297.91	3,088.00	2,748.93	2,843.62	2,755.00	3,248.00
Crude Fat	3.80	1.98	2.46	2.46	2.46	3.37
Crude Fibre	2.10	2.42	4.41	4.41	4.60	2.27
Ash	1.10	1.69	2.20	2.20	2.20	1.37
N Free Extract	72.80	69.38	68.44	69.58	67.24	70.67
Dry Matter	87.00	88.00	88.00	89.50	88.00	87.00
Moisture	13.00	12.00	12.00	10.50	12.00	13.00
Calcium	0.02	0.04	0.05	0.05	0.05	0.02
Total Phos	0.24	0.27	0.28	0.28	0.28	0.24
Phos Av Poultry %	20.00	33.00	30.00	30.00	30.00	30.00
Av Phos (Poultry)	0.05	0.09	0.08	0.08	0.08	0.07
Sodium	0.01	0.01	0.01	0.01	0.01	0.02
Chloride	0.09	0.08	0.06	0.06	0.06	0.05
Potassium	0.31	0.37	0.44	0.44	0.44	0.33
Milliequivalents	57.46	76.36	100.03	100.03	100.03	79.03
Digestible Lys Poultry	0.19	**0.29**	**0.32**	**0.33**	**0.35**	0.19
Digestible Met Poultry	0.15	0.17	0.16	0.16	0.17	0.14
Digestible M&C Poultry	0.30	**0.43**	**0.36**	**0.37**	**0.39**	0.28
Digestible Thr Poultry	0.23	**0.31**	**0.26**	**0.27**	**0.29**	0.25
Digestible Trp Poultry	0.06	0.13	0.09	0.09	0.10	0.10
Digestible Ile Poultry	0.25	0.39	0.31	0.32	0.34	0.32
Digestible Val Poultry	0.33	0.48	0.42	0.43	0.46	0.40
Digestible Arg Poultry	0.33	**0.52**	**0.42**	**0.43**	**0.46**	0.32

- Energy levels are generally lower than corn
- Sorghum is the closest match
- Higher protein levels in wheat and Barley
- Important to know the Dry Matter content – different origins can vary
- Energy of wheat and barley needs expert assistance to determine
- Study the non-starch polysaccharides and determine a suitable enzyme package when making changes

Selected Alternative Proteins

	SBM	**Field Peas**	**Faba beans**	Chick peas	Lentils	Lupin Seed Meal	**DH lupin seed**	Canola Meal	**Canola Hi Fat 1**
Crude Protein	45.50	22.20	27.60	22.10	23.50	32.00	**39.00**	36.70	31.00
AMEn Poultry	2,269	**2,606**	**2,662**	3,080	2,741	1,911	**2,279**	2,200	**2,650**
AMEn Broiler	2,109	2,543	2,662	3,030	2,679	1,911	2,279	2,200	2,650
Crude Fat	1.66	**12.00**	**12.00**	4.40	1.40	5.96	**7.54**	3.30	**13.00**
Crude Fibre	4.32	6.20	7.60	9.24	4.30	14.20	3.42	11.20	10.00
Ash	6.54	2.90	3.70	2.90	3.10	2.99	3.11	6.70	5.20
N Free Extract	29.98	47.20	38.10	50.36	67.70	34.85	36.93	32.10	30.80
Sucrose	**8.65**	1.40	1.50	1.00				-	-
Glucose	-	0.02	0.20	0.05		1.70	2.90	6.75	5.94
Starch	1.00	**40.63**	**38.50**	**44.18**	**45.70**	1.10	1.40	-	-
Dry Matter	88.00	90.50	89.00	89.00	89.00	90.00	90.00	88.00	90.00
Neutral Det Fibre	9.57	18.90	12.90	20.06	12.60	22.92	8.76	25.40	22.95
Acid Det Fibre	5.69	6.10	9.10	12.14	4.80	17.87	5.11	16.20	14.67
Calcium	0.34	0.08	0.14	0.12	0.13	0.23	0.13	0.65	0.51
Av Phos (Poultry)	0.26	0.18	0.19	0.11	0.10	0.12	0.15	0.35	0.36
Sodium	0.03	0.01	0.01	0.01	0.04	0.03	0.03	0.07	0.08
Chloride	0.05	0.02	0.01	0.12	0.06	0.15	0.15	0.01	0.10
Potassium	2.32	0.93	0.01	0.96	0.87	0.82	0.97	1.13	1.00

- Be cautious not to evaluate on protein base only
- Some of the proteins are ‘dual purpose’ contributing protein, starch and energy, not only protein.
- Field peas and Faba beans are good starch sources
- DH Lupins medium energy and 7.5% fat
- Hi Fat Canola – many types – important to know and test the type

NSP Content of major cereals

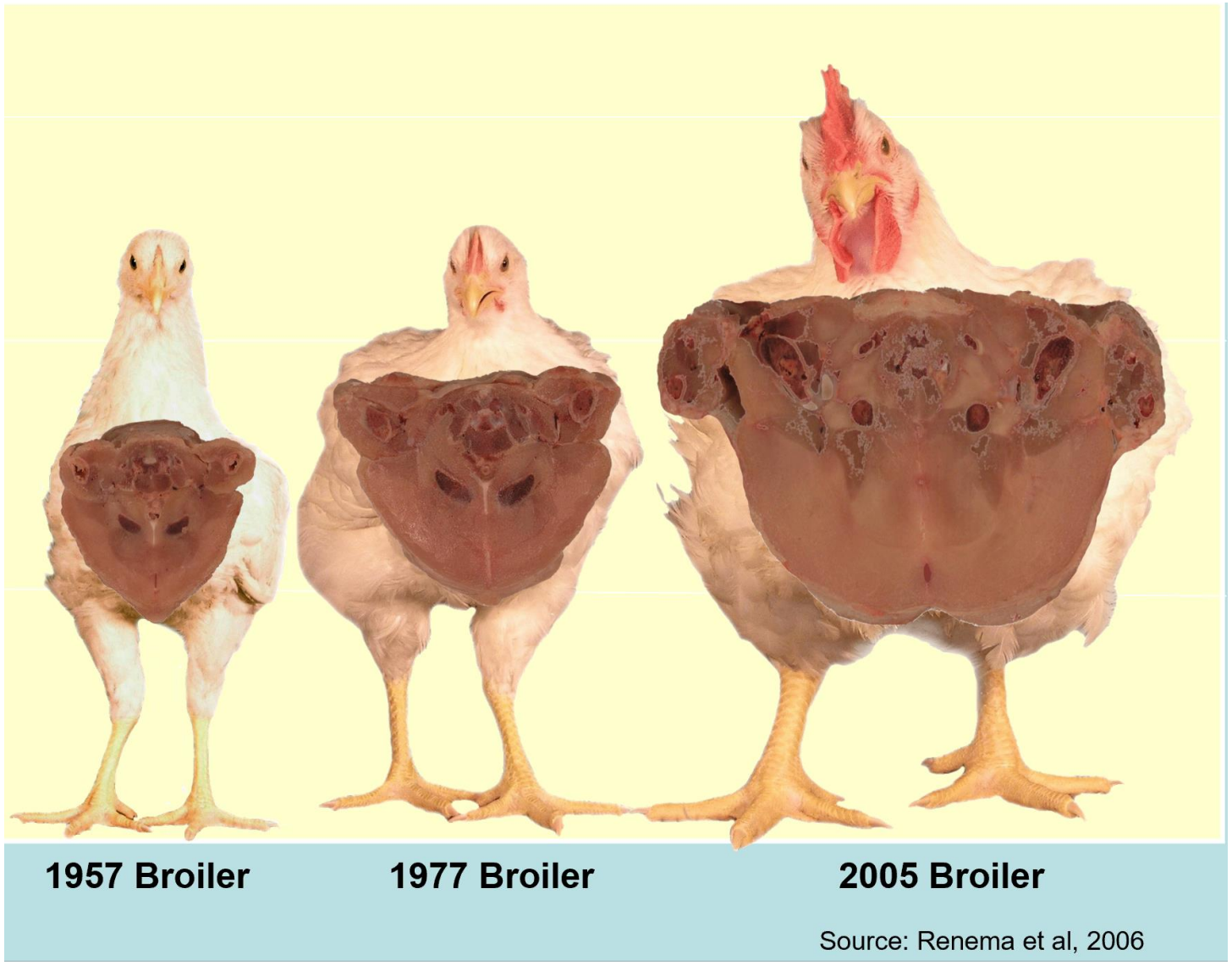
		ARABINOXYLAN	B-GLUCAN	CELLULOSE	OTHER NSP[2]	LIGNIN	TOTAL FIBRE
CORN	Soluble	0.1					0.1
	Insoluble	5.1		2.0	0.8	1.1	9.0
	Total	5.2		2.0	0.8	1.1	9.1
WHEAT	Soluble	1.8	0.4		0.2		2.4
	Insoluble	6.3	0.4	2.0	0.3	1.8	10.8
	Total	8.1	0.8	2.0	0.5	1.8	13.2
SORGHUM	Soluble	0.1	0.1				0.2
	Insoluble	2.0	0.1	2.2	0.25	1.1	5.65
	Total	2.1	0.2	2.2	0.25	1.1	5.85
BARLEY	Soluble	0.8	3.6		0.1		4.5
	Insoluble	7.1	0.7	3.9	0.5	3.2	15.4
	Total	7.9	4.3	3.9	0.6	3.2	19.9

- Wheat has higher Arabinoxylan
- Barley high in beta-glucanase
- Barley high in fibre – limits usage to partial substitution in poultry
- Sorghum low in soluble fibre

NSP Enzymes are commonly used, but efficacy must be verified
Phytase in 90% of diets
Double phytase dosing is becoming more common to improve nutrient utilisation
Super- dosing phytase is suggested, but may not be cost effective

1 From Choct (2006) and Bach Knudsen (2014)
2 Mannans + Galactans + Uronic Acid

Genetic advances and potential - Broilers



- Carcass composition has changed dramatically by genetic selection
- Improved genetics require re-engineered feeds
- Titration required to find correct protein level

Finding the right protein/amino acid level

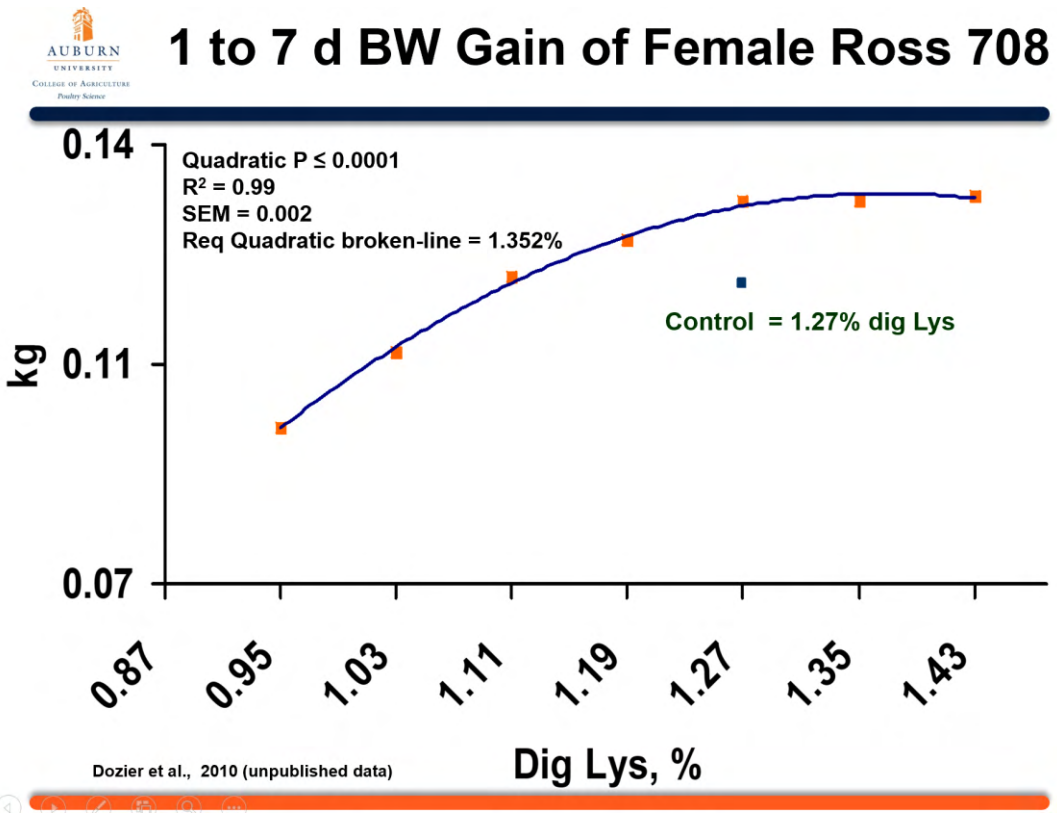


Table 1: Nutrition Specifications for As-Hatched Broilers - Target Live Weight ≤2.0 kg (≤4.4 lb).

		Starter	Grower	Finisher
Age Fed	days	0 - 10	11 - 24	25 - market
Energy per kg	kcal	2975	3050	3100
	MJ	12.4	12.8	13.0
Energy per lb	kcal	1349	1383	1406
DIGESTIBLE AMINO ACIDS[1]				
Lysine	%	**1.32**	**1.18**	**1.08**
Methionine + Cyst(e)ine	%	1.00	0.92	0.86
Methionine	%	0.55	0.51	0.48
Threonine	%	0.88	0.79	0.72
Valine	%	1.00	0.91	0.84
Isoleucine	%	0.88	0.80	0.75
Arginine	%	1.40	1.27	1.17
Tryptophan	%	0.21	0.19	0.17
Leucine	%	1.45	1.30	1.19
Crude Protein[2]	%	**23.0**	**21.5**	**19.5**

- As Digestible lysine (and other Dig AA) increases, ADG increases
- Diminishing returns begin at 1.25%
- Optimum is 1.35%
- Much higher than 1996 levels or breed standards

- Feeding standards need to be challenged
- Consider single feed to 30 days (Indonesia)
- Energy is less of an issue than 10 years ago
- Crude protein reduction important for cost and health
- Fully utilise full range of synthetic amino acids

Minimise Excess Protein – Lessons From Layers

Parameters	Crude protein (g/kg)		
	140.0	155.0	170.0
Feed (g/day)	116.0	115.4	113.9
Lysine (mg/day)	940.9	936.0	924.1
Production (%)	77.22	76.02	75.24
Egg weight (g)	66.63	66.82	66.67
Egg output (g/day)	51.45	50.82	50.18
Yolk (%)	24.94	24.39	24.19
Manure crude protein (g/kg)	338.8	385.4	464.9

Excess crude protein:

- Increases cost
- Increases nitrogen excretion
- Increases pollution and disease risk

Know your ingredients well

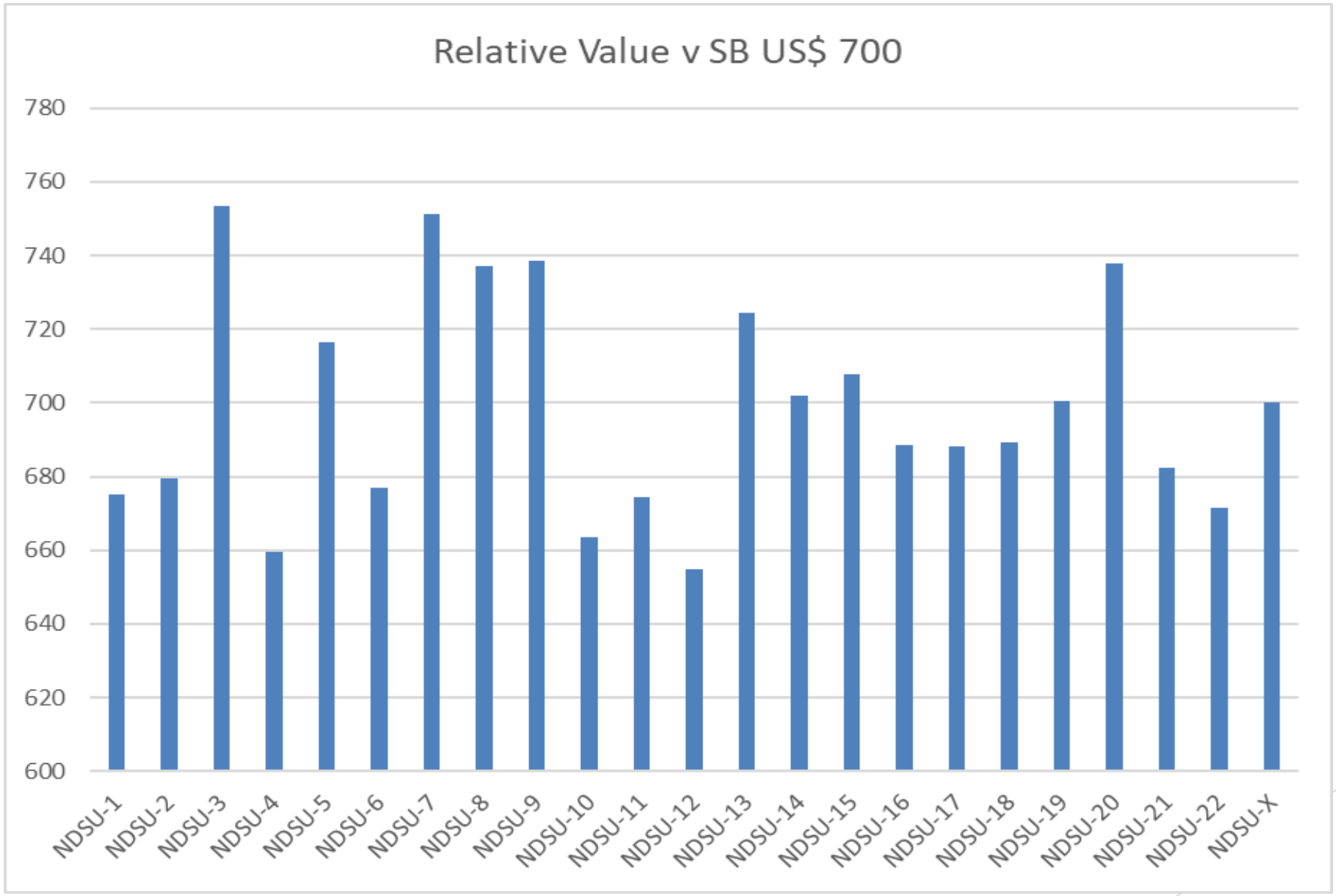
- E.g. DDGS is a cost effective ingredient
- Can be used at 10-15% in broiler and layer diets respectively
- DDGS is variable and selecting the right one is critical

NAME	Base Diet	DDGS NRC 1994	DDGS Sample 1	DDGS Sample 2	DDGS Sample 3
Crude Protein		27.40	32.18	29.01	28.64
Crude Fat		9.00	7.74	6.01	7.63
Crude Fibre		9.10	6.23	6.90	6.90
Ash		4.20	3.38	5.60	3.79
Dry Matter		90.00	89.13	91.44	90.16
Shadow price	445.00	452.25	480.70	465.45	463.68
Difference		7.25	35.70	20.05	18.68
Diet Cost USD/MT	458.38	457.65	454.81	456.33	456.51
Difference	-	-0.73	-3.57	-2.05	-1.87
Corn Price Ratio	1.24	1.26	1.34	1.29	1.29

Relative Values of Soybeans in Poultry

		1	2	3	4	5	6	7	8	9	10
Beans DM		NDSU-1	NDSU-2	NDSU-3	NDSU-4	NDSU-5	NDSU-6	NDSU-7	NDSU-8	NDSU-9	NDSU-10
Protein DM	%	38.3	35.8	39.0	38.0	37.8	37.4	39.2	39.5	41.2	36.2
Oil DM	%	20.8	23.3	23.4	20.7	23.3	21.5	23.9	22.3	21.8	22.1
Fibre DM	%	5.7	5.9	5.2	5.5	5.3	5.7	5.0	5.1	4.9	5.5
Moisture	%	8.0	7.2	7.3	8.7	7.8	7.7	8.3	7.8	9.4	6.8
DM	%	92.00	92.80	92.70	91.30	92.20	92.30	91.70	92.20	90.60	93.20
Beans Content AF											
Protein	mg/Kg	352.4	332.2	361.5	346.9	348.5	345.2	359.5	364.2	373.3	337.4
Oil	mg/Kg	191.4	216.2	216.9	189.0	214.8	198.4	219.2	205.6	197.5	206.0
Fibre	mg/Kg	52.4	54.8	48.2	50.2	48.9	52.6	45.9	47.0	44.4	51.3
Moisture	mg/Kg	80.0	72.0	73.0	87.0	78.0	77.0	83.0	78.0	94.0	68.0
		1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0
		NDSU-1	NDSU-2	NDSU-3	NDSU-4	NDSU-5	NDSU-6	NDSU-7	NDSU-8	NDSU-9	NDSU-10
Rel value		675.23	679.51	753.53	659.36	716.39	677.02	751.29	736.97	738.66	663.4714
		96%	97%	108%	94%	102%	97%	107%	105%	106%	95%

Variation in Soybean nutritional-economic value



Key points on Reactions to High Prices

- **Nutrition Support- Still important to find the point of optimal efficiency**
  - Energy appears to be less of a driver
  - Formulate for lowest crude protein possible to reduce Ammonia
  - Avoid ingredients with low digestibility
  - Maximise use of enzymes
- **Know your ingredients well. Use NIR frequently to update the ingredient matrix**

- **Ventilation - Objective is to remove water daily**
  - Less water = less NH3 release: Less NH3 = less respiratory disease
  - Temperature control follows water removal. Maintain min airspeed for health
- **Remember the birds are more valuable!**

- **Feed Additives – become more valuable to maximise nutritional efficiency**
  - Always verify efficacy in all classes of additive
  - Antioxidant, Anti mould, antiseptics, phytogenics etc

- **Manufacture – we need to know what we don't know**
  - More work needed on grinding and pellet quality
  - Can ingredients be fermented? Work suggests that protein can be enhanced and fibre removed