Technical Developments and Challenges in Poultry Nutrition beyond 2010

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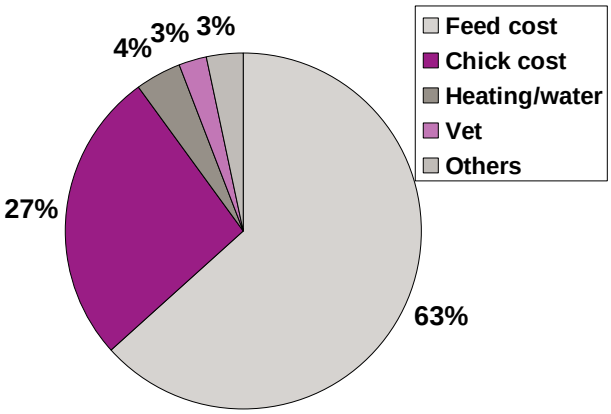
Recent developments important for animal production

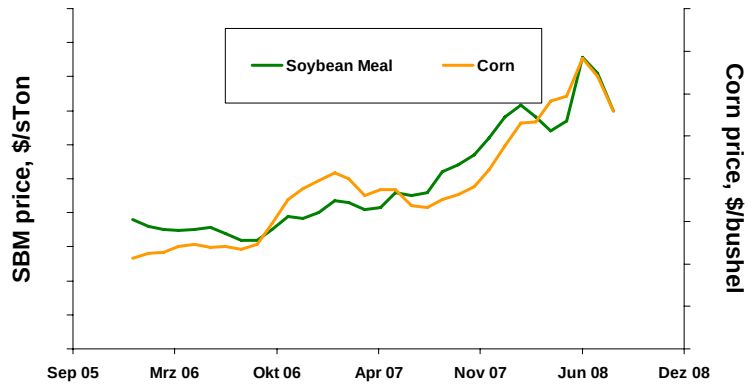
Rule of thumb

Major cost contributor to chicken production is feed cost…

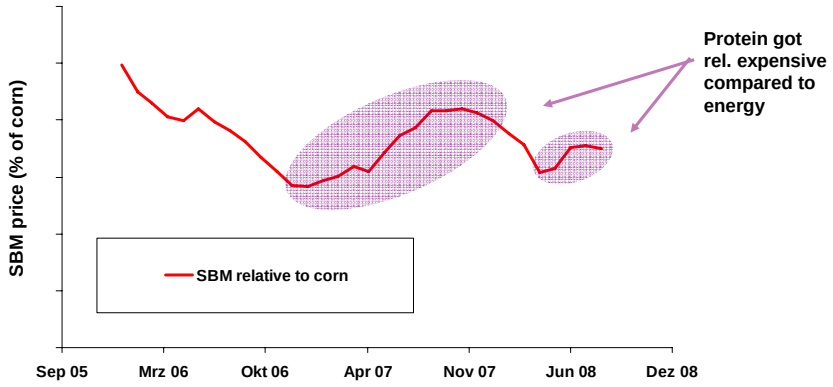


Raw material prices increased

… and increasing raw material cost increased feed cost



From beginning of 2007 protein got relative more expensive



Lemme et al. – Capetown – 26 Nov. 2008

Nutrition needs further to be

OPTIMISED

to keep or to improve profitability

From feed formulation‘s view

Raw materials

Specifications

What can be done?

Raw materials

- **Alternative ingredients / by-products**
  - **Standardisation of production**

Analytical results Corn DDGS wet chemistry – world wide

161 DDGS (corn) samples were analysed by wet chemistry in 2007 and 2008 (04.11.2008)

Nutrient, %	Mean %	Minimum	Maximum	CV, %
CP	27.85	11.75	50.99	17.74
Lys	0.55	0.23	1.25	23.87
Met	1.05	0.47	2.29	22.06
Met + Cys	0.79	0.33	1.47	22.37
Thr	1.02	0.43	1.86	17.31
Trp	0.22	0.16	0.37	15.11
Arg	1.19	0.68	1.97	16.46
Ile	1.01	0.36	1.99	21.55
Leu	3.23	0.97	6.80	26.26
Val	1.33	0.55	2.46	18.99
His	0.74	0.34	1.24	16.52
Phe	1.36	0.48	2.81	23.05

What can be done?

Raw materials

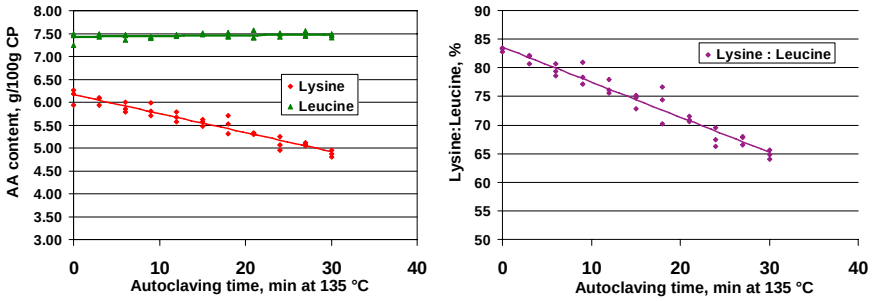
- Alternative ingredients / by-products
  - Standardisation of production
- Nutritive Value of Raw materials
  - Nutrient analysis (NIR technique, etc.)
  - Bioefficacy of nutrient sources
  - Energy system (Net energy)
  - Nutrient digestibility (SID)
  - Detection of heat damage

Example:
Heat Damaged Soybean products

Soybean meals (47% CP; 43% CP), full fat soy beans (37% CP)

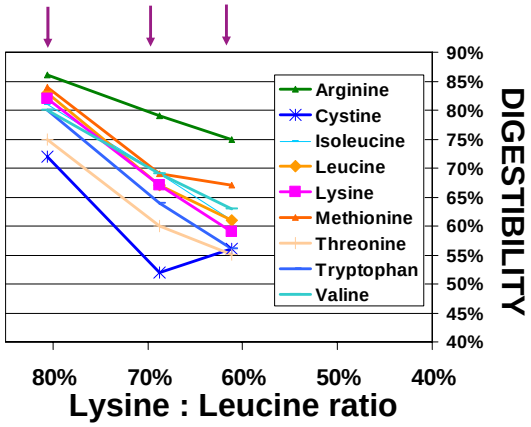
0, 3, 6, 9, … 24, 27, 30 min autoclaving at 135 °C

*Fontaine et al., 2007



Example:
Heat Damaged Soybean meal (HP)

0, 20, 40 min autoclaving at 135 °



What is it all about?

Managing risk

Reducing safety margins

What else?

Improve dietary specifications

Recommendations

Recommendations are often given in form of tables….

Broilers Recommended standardised ileal digestible amino acid levels for male broilers based on optimum dietary lysine content and the ideal protein concept

Species Broilers	ME (MJ/kg)	Ileal dig. Protein, % of diet*		Lys	Met	Met+Cys	Thr	Trp	Arg	Val	Ile
starter I 1.- 12. day**	12.7	21.0	% of diet	1.27	0.57	0.92	0.80	0.20	1.30	1.00	0.86
			Lys = 100		*45*	*72*	*63*	*16*	*103*	*79*	*68*
starter II 13.- 22. day	13.0	19.0	% of diet	1.09	0.48	0.81	0.70	0.18	1.13	0.87	0.75
			Lys = 100		*44*	*74*	*64*	*16*	*104*	*80*	*69*
grower 23.- 35. day	13.2	18.0	% of diet	1.00	0.44	0.76	0.65	0.16	1.05	0.80	0.71
			Lys = 100		*44*	*76*	*65*	*16*	*105*	*80*	*71*
finisher I 36.- 48. day	13.2	17.0	% of diet	0.95	0.41	0.74	0.63	0.16	1.01	0.77	0.68
			Lys = 100		*43*	*77*	*66*	*17*	*106*	*81*	*72*
finisher II > 49. days	13.4	16.0	% of diet	0.89	0.38	0.70	0.60	0.15	0.96	0.73	0.65
			Lys = 100		*43*	*79*	*67*	*17*	*108*	*81*	*73*

… which do not consider production conditions

Recommendations

In few cases, tables give values adjusted to certain production conditions

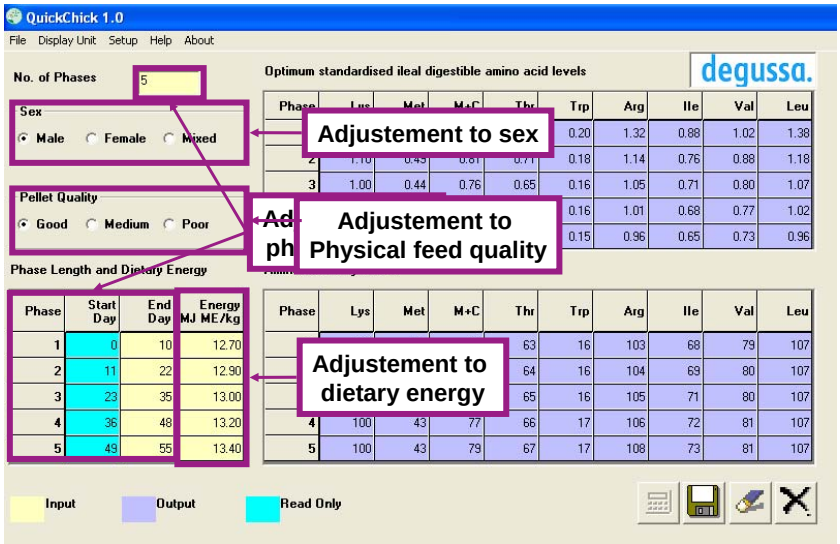
different feeding programs (Aviagen, 2007)

sex / performance level (Rostagno, 2005)

production goals – gain / white meat (Cobb, 2004)

…

QuickChick
Adjustments to production factors



Adjust dietary specifications

to
production goal?

Optimal AA levels in growing broilers

Criterium	Lys, total % of diet n=9	Met+Cys, total % of diet n=5	Thr, total % of diet n=4
Weight gain	1.10	0.93	0.66
Feed per gain	1.17	1.05	0.68
Breast meat yield	1.21	0.99	0.70

Pack et al., 2003

Question

Have we considered all important criteria so far?

Economically optimal amino acid levels in broiler diets

A. Lemme[1] – J. Fickler[1] – C. Kemp[2] – C. Fisher[2] – O. Akinde[1]

[1] Evonik – Degussa, Health & Nutrition, Hanau, Germany

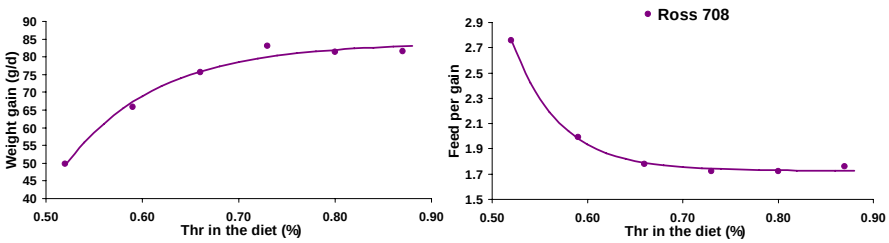
[2] Aviagen Ltd., Newbridge, Scotland

Different definitions are used

Feed cost/kg body weight

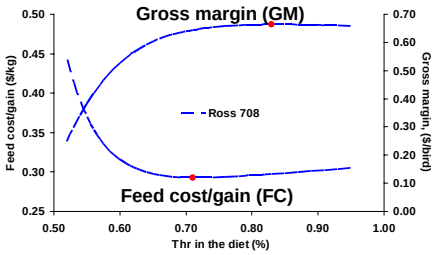
Gross margin (Income over feed cost)

Example: Thr dose-response trial (Kidd et al., 2004)



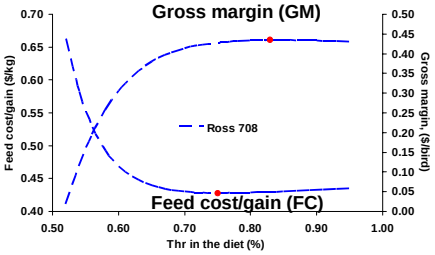
y (Gain) = 49.4 + 34.4 x (1 - $e^{-10.47 \times (Thr - 0.52)}$) **y (FCR) = 2.761 - 1.035 x (1 - $e^{-19.98 \times (Thr - 0.52)}$)**

Economically optimal amino acid levels



Opt. Thr level, %	FC	GM
Ross 708	0.71	0.83

Scenario 1: Basal feed cost = 0.24 €/kg
L-Thr price = 3.00 €/kg
Revenues = 0.68 €/kg LW



Opt. Thr level, %	FC	GM
Ross 708	0.75	0.83

Scenario 2: Basal feed cost = 0.16 €/kg
L-Thr price = 4.00 €/kg
Revenues = 0.68 €/kg LW

Lemme et al., 2004, World Poultry Congress, Turkey: pp4

Different definitions are used

Gross margin / Income over feed cost

Should be preferred because it consideres not only the effects on feed conversion but also on growth

Strain comparison – Responses to BP Ross 308 vs. Ross 708

Birds: 1800 male (41.9 g) and 1800 female (41.7 g) Ross 308 broilers
1800 male (41.9 g) and 1800 female (42.1 g) Ross 708 broilers

Period: 1-49 days of age

Housing: 80 floor pens with 90 birds each, 4 pens per treatment

Diets: wheat-soybean meal based
starter (1-10d), grower (11-28d), finisher (29-49d)

Treatments: five graded levels of balanced protein

- 76, 82, 90, 99, 111 % of recommendation for females
- 82, 90, 99, 111, 123 % of recommendations for males

Parameters: Body weight, feed conversion, breast meat yield, (7 birds/pen)
Profitability

Strain comparison – Responses to BP Ross 308 vs. Ross 708

Treatment	Strain	Sex	Balanced protein level % of recommendation	Birds per treatment
1	Ross 308	Male	82	360
2	Ross 308	Male	90	360
3	Ross 308	Male	99	360
4	Ross 308	Male	111	360
5	Ross 308	Male	123	360
6	Ross 308	Female	76	360
7	Ross 308	Female	82	360
8	Ross 308	Female	90	360
9	Ross 308	Female	99	360
10	Ross 308	Female	111	360
11	Ross 708	Male	82	360
12	Ross 708	Male	90	360
13	Ross 708	Male	99	360
14	Ross 708	Male	111	360
15	Ross 708	Male	123	360
16	Ross 708	Female	76	360
17	Ross 708	Female	82	360
18	Ross 708	Female	90	360
19	Ross 708	Female	99	360
20	Ross 708	Female	111	360

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Basal diets - ingredients

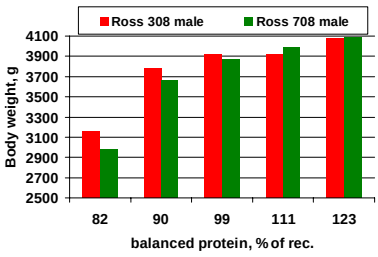
	Starter (1-10d)		Grower (11-28d)		Finisher (29-49d)	
Balanced protein	**76 %**	**123 %**	**76 %**	**123 %**	**76 %**	**123 %**
Ingredients, %						
Wheat	72.37	45.24	76.04	50.58	78.74	55.89
Soybean meal	20.42	41.32	16.34	35.50	13.30	30.66
Fish meal	1.50	7.50	0.00	6.00	0.00	5.00
Oil/Fat	1.74	3.38	3.49	5.34	3.99	5.77
L-Lys HCl	0.12	0.06	0.19	0.06	0.18	0.06
DL-Met	0.17	0.41	0.17	0.37	0.15	0.34
L-Thr	0.04	0.09	0.07	0.09	0.07	0.09
Minerals, salt	3.20	1.56	3.27	1.64	3.14	1.77
Choline, Enzymes, Premix	0.43	0.43	0.43	0.43	0.43	0.43
Total	100	100	100	100	100	100

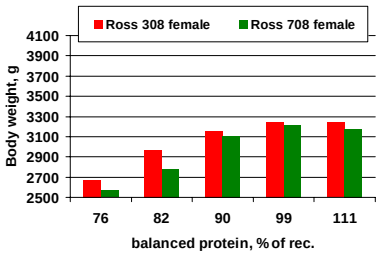
Basal diets – energy and nutrients Example Starter diets

	Starter (1-10d)			Grower (11-28d)		Finisher (29-49d)	
Balanced protein	**76 %**		**123 %**		**76 %**	**123 %**	**76 %**	**123 %**
Energy, MJ AME/kg and nutrients, %								
Energy	12.6		12.6					
Ether extract	3.99		6.16					
Protein	18.9		28.9	**Target**				
Dig. Lys	0.97	**100**	1.56	**100**				
Dig. Met+Cys	0.71	**74**	1.16	**74**				
Dig. Thr	0.63	**65**	1.02	**65**				
Dig. Arg	1.12	**116**	1.82	**103**				
Dig. Ile	0.68	**67**	1.09	**66**				
Dig. Val	0.66	**75**	1.07	**74**				
Ca	1.00		1.00					
av. P	0.48		0.48					

Body weights at day 49

- Birds strongly responded to increasing balanced protein levels
- Strain differences were observed particularly at low amino acid supply
- Final weight of males was considerably higher than in females

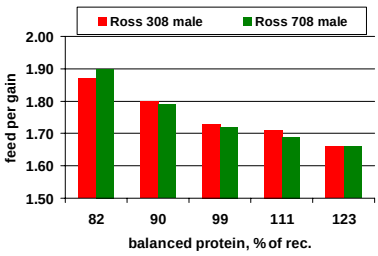


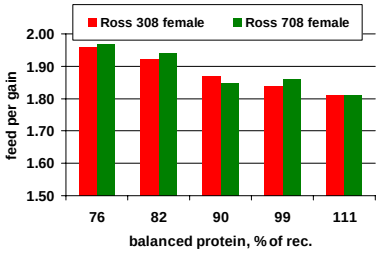


male **female**

Feed conversion ratio at day 49

- Responses to balanced protein on FCR appeared almost to be linear
- FCR was better in males

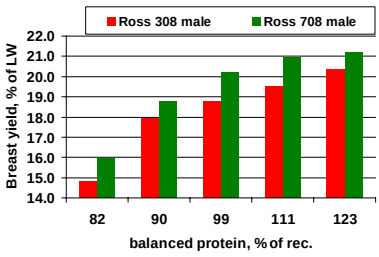




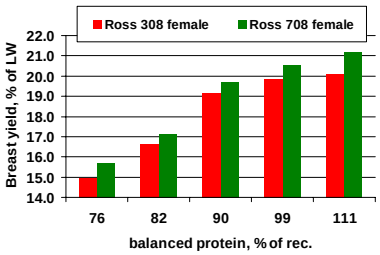
male **female**

Breast meat yield at day 49

- Ross 708 broilers had significantly higher breast meat yield
- Response to amino acids was similar in both strains
- No difference between sexes



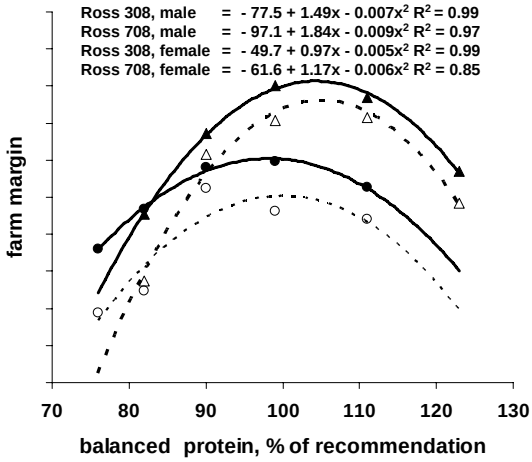
male



female

Economics, farm margin, 2 kg based on live weight

Ross 308, male = - 77.5 + 1.49x - 0.007x^2 R^2 = 0.99
Ross 708, male = - 97.1 + 1.84x - 0.009x^2 R^2 = 0.97
Ross 308, female = - 49.7 + 0.97x - 0.005x^2 R^2 = 0.99
Ross 708, female = - 61.6 + 1.17x - 0.006x^2 R^2 = 0.85



male (triangles) and female (dots)
Ross 308 (solid line) and Ross 708 broilers (dotted line)

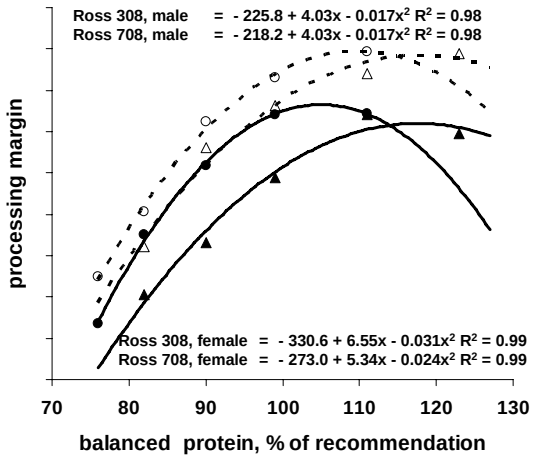
Optimum BP levels – Peak

Male
Ross 308: 106% BP
Ross 708: 102 % BP

Female
Ross 308: 97 % BP
Ross 708: 98 % BP

Current recommendation optimal

Economics, processing margin, 2 kg based on BMY



male (triangles) and female (dots)
Ross 308 (solid line) and Ross 708 broilers (dotted line)

Optimum BP levels –
95% asympt. response

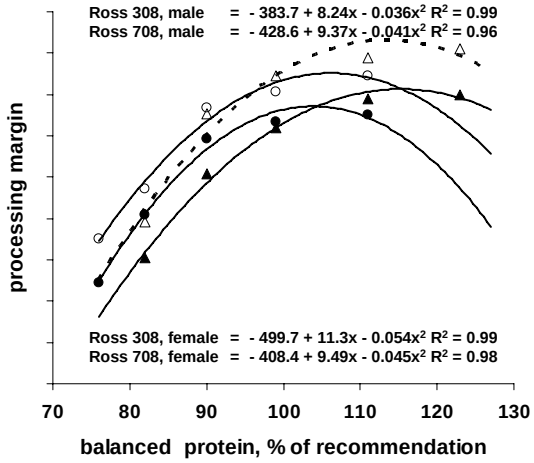
Male
Ross 308: 118 % BP
Ross 708: 119 % BP

Female
Ross 308: 106 % BP
Ross 708: 111 % BP

For maximising processing margin about 20 %(male) or 10 % higher BP levels (females) than currently recommended would be needed.

Margin of Ross 708 broilers higher because of higher breast yied.

Economics, processing margin, 3 kg Based on BMY



male (triangles) and female (dots)
Ross 308 (solid line) and Ross 708 broilers (dotted line)

Optimum BP levels –
95% asympt. response

Male
Ross 308: 115 % BP
Ross 708: 113 % BP

Female
Ross 308: 104 % BP
Ross 708: 106 % BP

For maximising processing margin about 5 - 15% higher BP levels than currently recommended would be needed.

Margin of Ross 708 broilers higher because of higher breast yield.

Conclusions

Increasing dietary balanced protein levels improved weight gain, feed conversion, breast meat yield, abdominal fat

Compared to female broilers male broilers showed

- higher final weight
- lower FCR and abd. fat
- similar breast meat yield

Compared to Ross 308 broilers those of Ross 708 had

- higher breast meat yield and thus higher profitability in terms of processing margin
- No difference in terms of optimum dietary balanced protein level

Economic evaluation showed

- Target weight affects optimum BP levels
- higher dietary BP needed for maximising processing margin

Technical Developments and Challenges

in

Poultry Nutrition beyond 2010?

Managing variation in raw materials

Using the economically optimal nutrient levels

Any questions?