



88 years

Universidade Federal de Viçosa

USE OF PROTEASES: THE BRAZILIAN EXPERIENCE

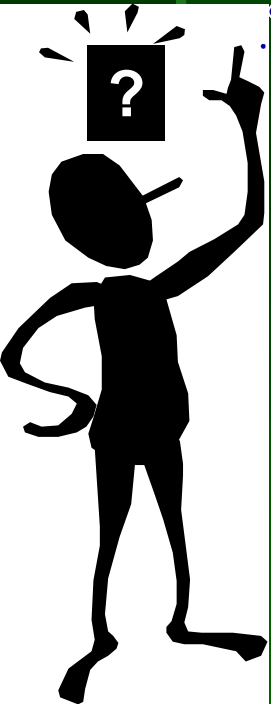
**Rodrigo Messias¹, Sandra Salguero¹, José O. Sorbara²,
Luiz F. Albino¹, Horacio S. Rostagno¹**

**1. Department of Animal Science
Federal University of Viçosa. Brazil**

**2. Enzymes Manager - DSM
São Paulo - Brazil**

USE OF PROTEASES: THE BRAZILIAN EXPERIENCE

PROTEASES



- Introduction.
- Full Fat Soybean, Soybean Meal, Corn-Soy Diet
- Ileal Amino Acids Experiments
- Metabolizable Energy Experiments
- Proact Contribution: Amino Acids, Metab. Energy
- Proact Utilization in Broiler Diets
- Final Considerations



Experiment 1 & 2



Effect of Proact on ileal amino acids digestibility of full fat soybean (Expt 1), soybean meal (Expt 2) and a corn-soybean diet (Expt 1 & 2) for broilers.



Proact and ileal amino acids digestibility of full fat soybean, soybean meal and a corn-soybean diet for broiler chickens.

EXPERIMENT 1

Without	With Proact
PFD	PFD
PFD + FF SB	PFD + FF SB
Corn-Soy Diet 1	Corn-Soy Diet 1

EXPERIMENT 2

Without	With Proact
PFD	PFD
PFD + SBM	PFD + SBM
Corn-Soy Diet 2	Corn-Soy Diet 2

**PFD: Protein Free Diet. FF SB: Full Fat Soybean. SBM: Soybean Meal
Proact: 200 g/ton**

Experimental Diets – Without & With ProAct

Ingredients (%) / Diets	Experiment 1		Experiment 2	
	PFD	FFSB	PFD	SBM
Starch	81.01	51.01	81.02	51.02
Full Fat Soybean (FFSB)	-	30	-	-
Soybean Meal (SBM)	-	-	-	30
Sugar	5.0	5.0	5.0	5.0
Soybean Oil	5.0	5.0	5.0	5.0
Corn Cobs	4.0	4.0	4.0	4.0
Minerals & Vitamins Px	3.99	3.99	3.98	3.98
AIA (Celite)	1.0	1.0	1.0	1.0
Proact	- / +	- / +	- / +	- / +
Total	100	100	100	100
Calculated Crude Protein	0	11.1	0	13.5

PFD: Protein Free Diet. FFSB: Full Fat Soybean. SBM: Soybean Meal
 Proact: 200 g/ton

Experimental Diets – Without & With ProAct

	Experiment 1	Experiment 2
Ingredients (%) / Diets	Corn-Soy 1	Corn-Soy 2
Corn	57.16	55.43
Soybean Meal	36.00	36.60
Soybean Oil	2.00	3.19
L-Lysine HCl	0.11	0.16
DL-Methionine	0.23	0.28
L-Threonine	0.04	0.04
Minerals & Vitamins Px	3.46	3.31
AIA (Celite)	1.0	1.0
Proact	- / +	- / +
Total	100	100
Calculated Crude Protein	21.0	21.3

Proact: 200 g/ton

Experiment 1 – Analyzed Composition of Full Fat Soybean and the Corn-Soy Diet 1 (% as fed basis)

Amino Acid (%)	Full Fat Soybean	Corn-Soy Diet 1
Lysine	2.111	1.196
Methionine	0.547	0.695
Met + Cys	0.945	1.003
Threonine	1.492	0.933
Arginine	2.932	1.373
Valine	1.510	0.906
Isoleucine	1.572	0.871
Crude Protein	36.02	21.98

FFSB: Fat: 19 %; Urease: 0.04; Protein Solubility in KOH: 77.9%

Experiment 2 – Analyzed Composition of Soybean Meal and the Corn-Soy Diet 2 (% as fed basis)

Amino Acid (%)	Soybean Meal	Corn-Soy Diet 2
Lysine	2.572	1.320
Methionine	0.523	0.540
Met + Cys	1.100	0.832
Threonine	1.850	0.865
Arginine	3.408	1.577
Valine	2.153	1.043
Isoleucine	1.675	0.807
Crude Protein	46.700	22.047

SBM: Fat: 1.13 %; Urease: 0.09; Protein Solubility in KOH: 82.02%

Proact and ileal amino acids digestibility of full fat soybean, soybean meal and a corn-soybean diet for broiler chickens.



- **Metabolism Cages.**
- **Broilers:** 252 Cobb 500 males
- **Experimental Period:** Expt 1: 12- 22 days; Expt 2 14-23 days
- **Ileal Digesta Collection:** Day 22/23 (terminal ileum)



Proact and ileal amino acids digestibility of full fat soybean, soybean meal and a corn-soybean diet for broiler chickens.

Results

Experiments 1 & 2

Experiment 1 - Full Fat Soybean: Amino Acids Standardized Ileal Dig. Coefficients for Broilers

Amino Acid	Standardized Ileal Dig. Coef		
	Without	Proact	Index
Lysine	86.4	89.0**	103.0
Methionine	89.4	92.4**	103.4
Met + Cys	79.9	86.7**	108.5
Threonine	78.4	83.9**	107.0
Arginine	88.2	92.1**	104.4
Valine	83.8	85.5 ns	102.0
Isoleucine	84.6	86.9 ns	102.7
Crude Protein	87.1	90.3**	103.7
	84.7	88.4	104.3

Index: Without = 100; ANOVA: ns P>0.05; * P<0.05; ** P<0.01.

Experiment 2 – Soybean Meal: Amino Acids SID Coefficients for Broilers

Amino Acid	SID Coef.		
	Without	Proact	Index
Lysine	84.2	90.0**	106.9
Methionine	88.8	93.1**	104.8
Met + Cys	83.6	88.0**	105.3
Threonine	79.0	87.9**	111.3
Arginine	91.6	95.5**	104.3
Valine	79.2	90.1**	113.8
Isoleucine	80.8	90.3**	111.8
Crude Protein	86.2	91.3**	105.9
	84.2	90.8	107.8

Index: Without= 100; ANOVA: * P<0.05; ** P<0.01;

Corn-Soy Diets 1 & 2: Amino Acids Standardized Ileal Dig. Coeffs for Broilers

Amino Acid	Experiment 1			Experiment 2		
	Without	Proact	Index	Without	Proact	Index
Lysine	88.0	91.4**	103.9	82.0	87.7**	107.0
Methionine	95.6	97.1**	101.6	93.4	94.1 Int	100.7
Met + Cys	87.4	92.6**	105.9	86.9	89.0 Int	102.4
Threonine	80.6	89.3**	110.8	73.8	79.3**	107.5
Arginine	88.4	93.5**	105.8	85.8	88.1**	102.7
Valine	85.5	90.4**	105.7	74.4	83.0**	111.6
Isoleucine	85.4	90.0**	105.4	76.7	83.6**	109.0
Crude Protein	85.2	90.1**	105.8	79.9	83.5**	104.5
	87.0	91.8	105.5	81.6	86.0	105.4

Index: Without = 100; ANOVA: * P<0.05; ** P<0.01;
Int: Interaction Diet x Proact



Experiment 3 & 4



Effect of Proact on the metabolizable energy of full fat soybean (Expt 3), soybean meal (Expt 4) and a corn-soybean diet (Expt 3 & 4) for broilers.



Effect of Proact on the Metabolizable Energy of Full Fat Soybean, Soybean Meal and a Corn Soybean (C-S) Diet for Broilers

EXPERIMENT 3

Without

With Proact

T1 C-S Diet 1 T2 C-S Diet 1

T3 C-S1+FFSB T4 C-S1+FFSB

70% C-S1 + 30% FFSB

EXPERIMENT 4

Without

With Proact

T1 C-S Diet 2 T2 C-S Diet 2

T3 C-S2+SBM T4 C-S2+SBM

70% C-S2 + 30% SBM

FFSB: Full Fat Soybean. SBM: Soybean Meal
Proact: 200 g/ton

Proact and Metabolizable Energy of full fat soybean, soybean meal and a corn-soybean diet for broiler chickens.



- **Metabolism Cages.**
- **Broilers:** 168 Cobb 500 males
- **Experimental Period:** Expt 1: 12- 22 days; Expt 2 14-23 days
- **Total Collection of Excreta:** Last 4 days.



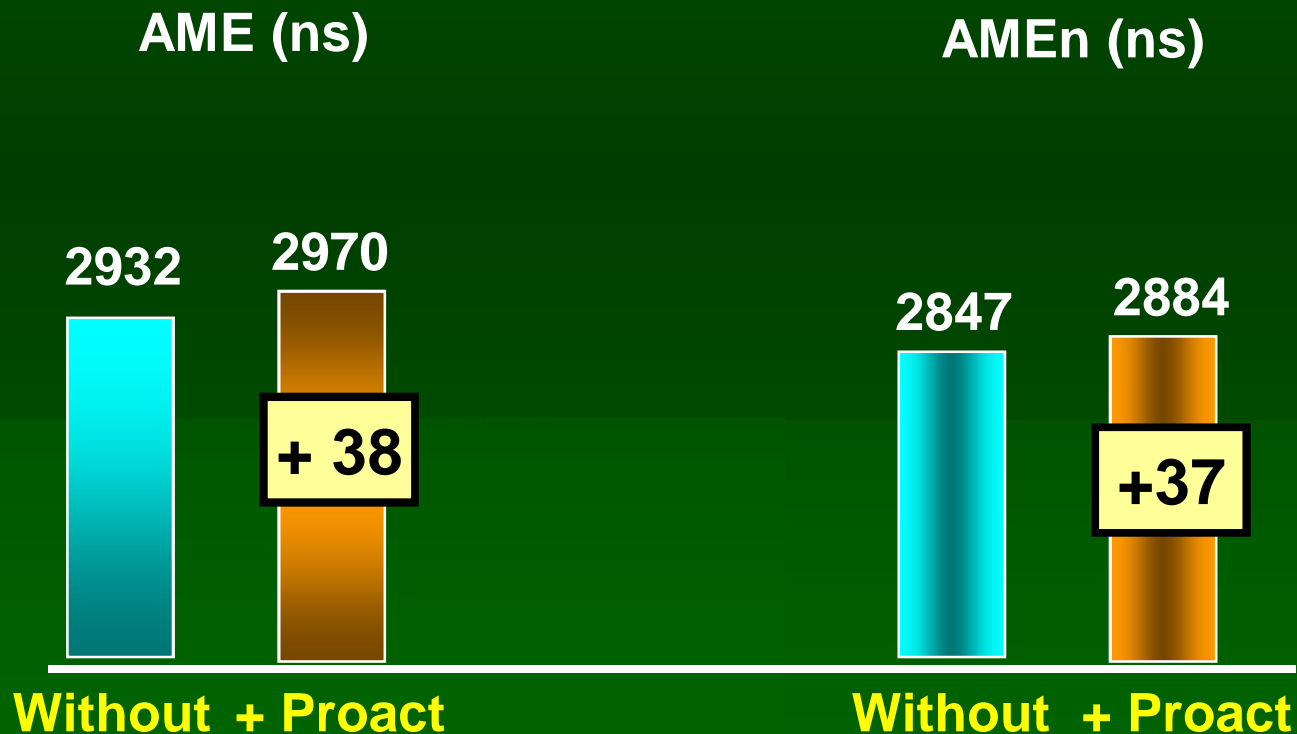
**Effect of Proact on the Metabolizable Energy of Full Fat Soybean,
Soybean Meal and a Corn Soybean (C-S) Diet for Broilers**

Results
Experiments 3 & 4

Experiment 3: Corn Soy Diet 1

Mean values of Apparent Metabolizable Energy (AME) and N Corrected Metabolizable Energy (AMEn) (kcal/kg as fed)

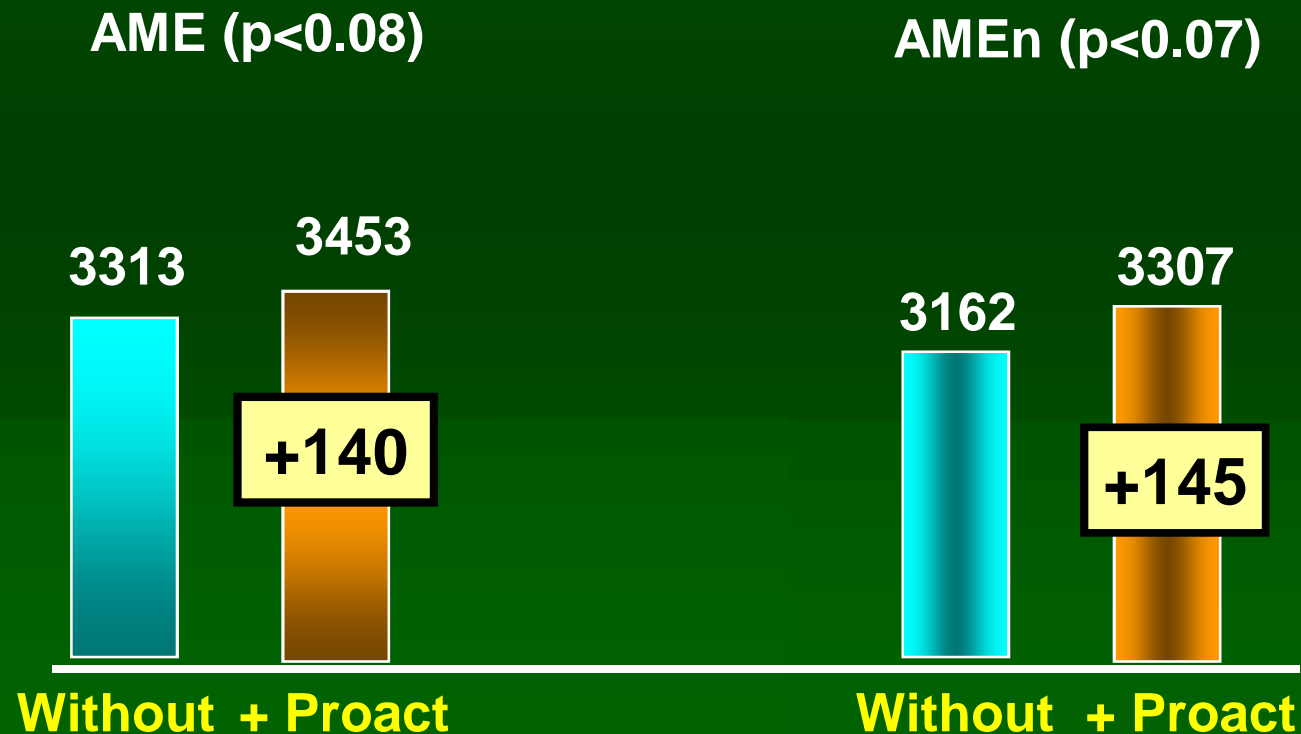
Corn – Soy Diet 1 (kcal/kg as fed)



Experiment 3: Full Fat Soybean

Mean values of Apparent Metabolizable Energy (AME) and N Corrected Metabolizable Energy (AMEn) (kcal/kg as fed)

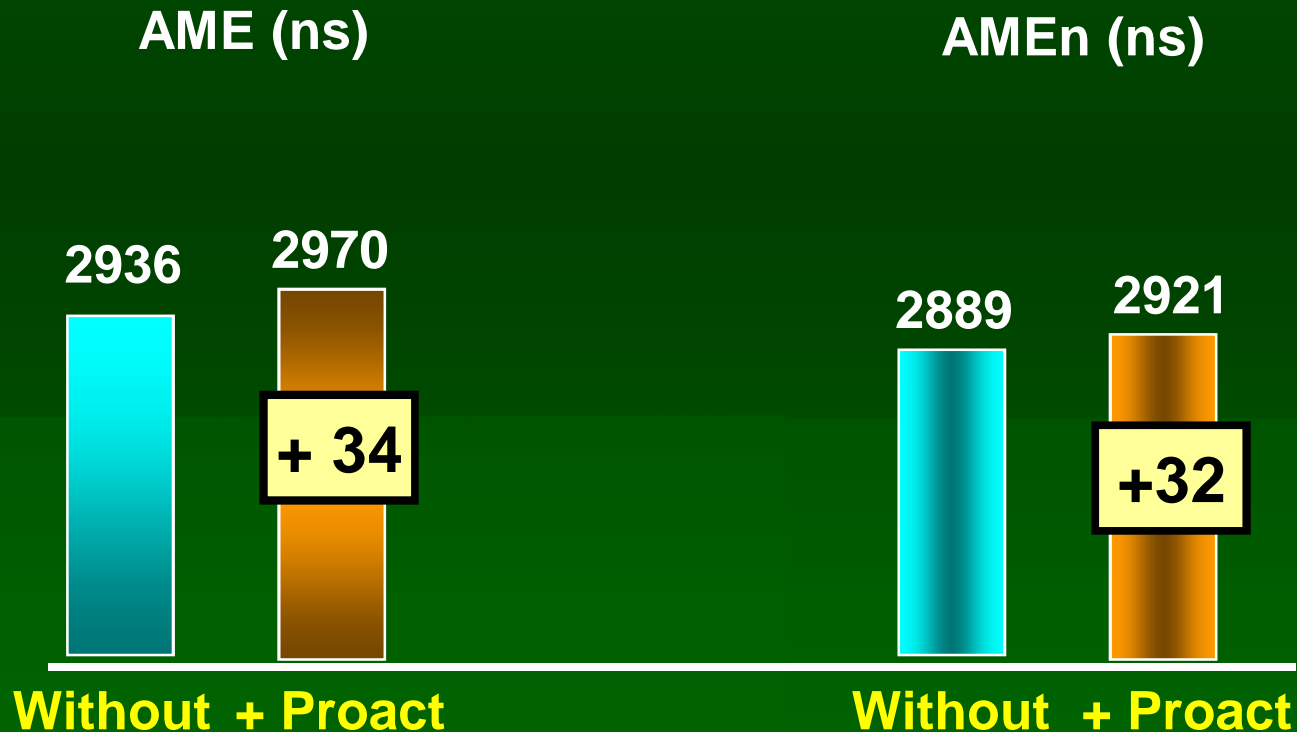
Full Fat Soybean (kcal/kg as fed)



Experiment 4: Corn Soy Diet 2

Mean values of Apparent Metabolizable Energy (AME) and N Corrected Metabolizable Energy (AMEn) (kcal/kg as fed)

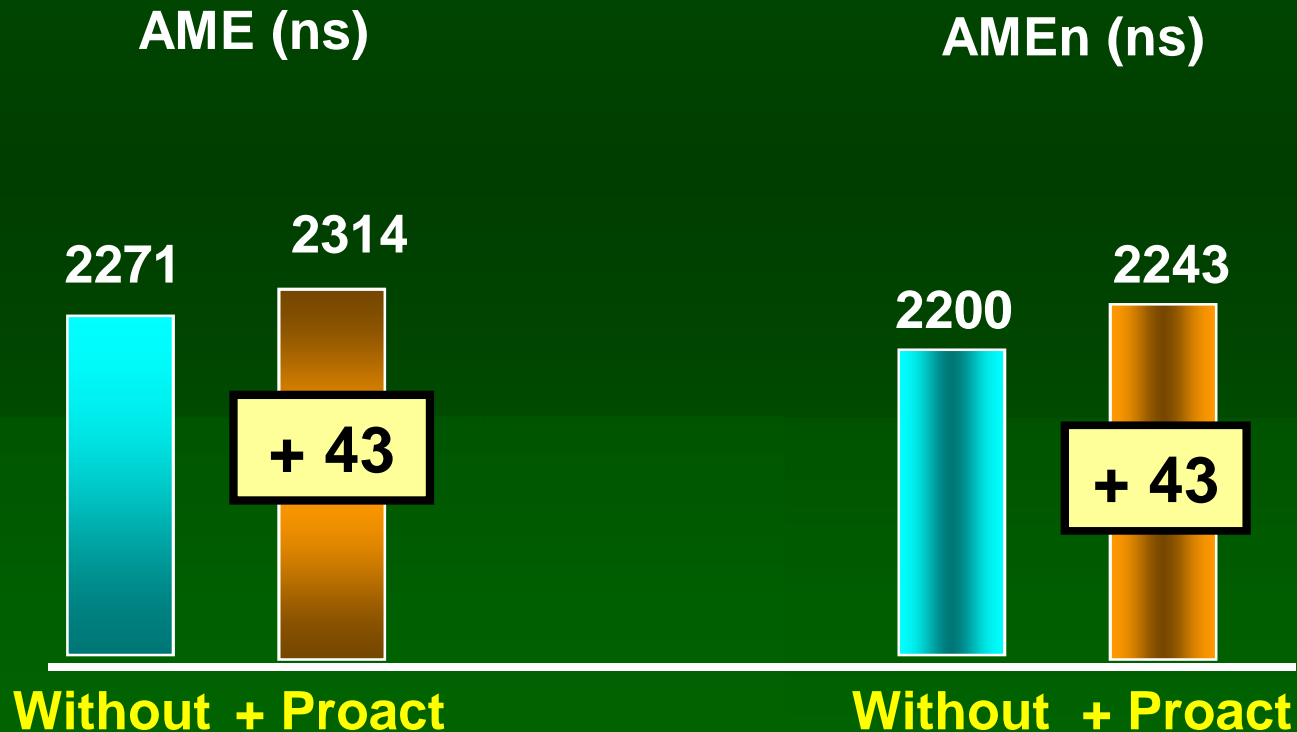
Corn – Soy Diet 2 (kcal/kg as fed)



Experiment 4: Soybean Meal

Mean values of Apparent Metabolizable Energy (AME) and N Corrected Metabolizable Energy (AMEn) (kcal/kg as fed)

Soybean Meal (kcal/kg as fed)



Contribution of Proact to the Content of SID Amino Acids and AMEn of FFSB, SBM and a Corn-Soy Diet for Broilers

FULL FAT SOYBEAN: Contribution of Proact to the Content of SID Amino Acids and AMEn for Broilers (% or kcal/kg as fed)

Amino Acid (%) / AMEn (kcal/kg)	FFSB	FFSB + Proact	Proact Contribution
Lysine	1.824	1.879	0.055
Methionine	0.489	0.505	0.016
Met + Cys	0.755	0.819	0.064
Threonine	1.170	1.252	0.082
Arginine	2.586	2.700	0.114
Valine	1.265	1.291	0.026
Isoleucine	1.330	1.366	0.036
Crude Protein	31.373	32.526	1.153
AMEn	3162	3307	145

Proact Contribution: FFSB+Proact - FFSB.

Proact: 200 g/ton

SOYBEAN MEAL: Contribution of Proact to the Content of SID Amino Acids and AMEn for Broilers (% or kcal/kg as fed)

Amino Acid (%) / AMEn (kcal/kg)	SBM	SBM + Proact	Proact Contribution
Lysine	2.166	2.318	0.152
Methionine	0.464	0.487	0.023
Met + Cys	0.920	0.968	0.048
Threonine	1.462	1.626	0.164
Arginine	3.122	3.254	0.132
Valine	1.705	1.940	0.235
Isoleucine	1.354	1.513	0.159
Crude Protein	40.255	42.637	2.382
AMEn	2200	2243	43

Proact Contribution: SBM+Proact - SBM.

Proact: 200 g/ton

CORN- SOY DIET 1 & 2: Contribution of Proact to the Content of SID Amino Acids and AMEn for Broilers (% or kcal/kg as fed)

Amino Acid (%)	Corn-Soy Diet 1 & 2	Corn-Soy Diet 1 & 2 + Proact	Proact Contribution
Lysine	1.067	1.125	0.058
Methionine	0.584	0.501	0.008
Met + Cys	0.800	0.834	0.034
Threonine	0.695	0.759	0.064
Arginine	1.283	1.336	0.053
Valine	0.775	0.842	0.067
Isoleucine	0.681	0.729	0.048
Crude Protein	18.18	19.11	0.930
AMEn	2868	2921	35

Proact Contribution: Corn-Soy Diet+Proact – Corn-Soy Diet (2 Expts)
Proact: 200 g/ton

Proact Utilization in Corn-Soybean Meal Broiler Diets

Nutrient	Proact Contribution (0.020%)	
	AAs+ME	AAs
Lys dig, %	0.058	0.058
M+C dig, %	0.008	0.008
Thr dig, %	0.034	0.034
Val dig, %	0.067	0.067
Ile dig, %	0.048	0.048
Arg dig, %	0.053	0.053
Protein, %	0.93	0.93
ME, kcal/kg	35	--

COMPUTER PROGRAM FOR BROILER FEEDING

Starting Wt, g	42
Slaughter, Days	44
Daily Wt Gain, g	63
Feed Conversion	1.750
Slaughter Wt, g	
Feed Intake, g	
Total Wt Gain, g	

Sex: Males & Females

Temperature: 21°C

Phases	Days	Intake g	Gain, g	Conv	ME, kcal/kg
Pre-Starter	1-10				
Starter	10-21				
Grower	21-36				
Finisher	36-44				
Total	1-44				

COMPUTER PROGRAM FOR BROILER FEEDING

Starting Wt, g	42
Slaughter, Days	44
Daily Wt Gain, g	63
Feed Conversion	1.750
Slaughter Wt, g	2772
Feed Intake, g	4851
Total Wt Gain, g	2730

Sex: Males & Females

Temperature: 21°C

Phases	Days	Intake kg	Gain, kg	Conv	ME, kcal/kg
Pre-Starter	1-10	0.279	0.239	1.164	2975
Starter	10-21	0.822	0.596	1.379	3025
Grower	21-36	2.417	1.337	1.807	3125
Finisher	36-44	1.334	0.599	2.226	3200
Total	1-44	4.851	2.772	1.750	

Nutritional Requirements - Brazilian Tables (2011) Calculator

Broilers (males/females): Growth Phase; Mean Wt, Daily Gain & Intake

Nutrients	PreStarter	Starter	Grower	Finisher
	1 – 10 d	10-21 d	21 - 36	36- 44 d
ME, kcal/kg	2975	3025	3125	3200
Protein, %	22.2	20.8	19.0	18.0
Ca, %	0.92	0.819	0.732	0.638
Pdig, %	0.395	0.343	0.313	0.273
Pavail, %	0.470	0.391	0.342	0.298
Lys dig, % (100/100)	1.310	1.174	1.078	1.010
M+C dig, % (72/73)	0.944	0.846	0.787	0.737
Thr dig, % (65/65)	0.852	0.763	0.701	0.656
Val dig, % (77/78)	1.009	0.904	0.841	0.788
Ile dig, % (67/68)	0.878	0.787	0.733	0.687
Arg dig, % (108/108)	1.415	1.268	1.164	1.091

Corn Soy Diets – Without & With ProAct (AAs+ME)

Ingredients (%)	PreStarter	Starter	Grower	Finisher
Corn	53.30	57.76	61.08	64.07
Soybean Meal	36.85	36.21	32.46	29.27
Soybean Oil	1.91	2.67	3.52	4.05
L-Lysine HCl	0.288	0.171	0.163	0.174
DL-Methionine	0.287	0.274	0.248	0.225
L-Threonine	0.054	0.030	0.027	0.024
Mins, Vits, Others	7.311	2.885	2.502	2.187

Euro/ton

266

255

250

247

Ingredients (%)	PreStarter	Starter	Grower	Finisher
Corn	56.78	63.26	66.88	69.41
Soybean Meal	34.50	32.11	28.09	25.30
Soybean Oil	0.80	1.20	1.99	2.60
L-Lysine HCl	0.282	0.218	0.218	0.217
DL-Methionine	0.270	0.271	0.246	0.220
L-Threonine	0.017	0.025	0.016	0.008
Proact	0.020	0.020	0.020	0.020
Mins, Vits, Others	7.331	2.896	2.540	2.225

Euro/ton

260

246

241

238

-9

Corn Soy Grower Diets – Without & With ProAct (AAs+ME) (AAs)

Ingredients (%)	Without Proact	+Proact (AAs+ME)	+Proact (AAs)
Corn	61.08	66.88	66.07
Soybean Meal	32.46	28.09	28.22
Soybean Oil	3.52	1.99	2.67
L-Lysine HCl	0.163	0.218	0.216
DL-Methionine	0.248	0.246	0.247
L-Threonine	0.027	0.016	0.016
Proact	--	0.020	0.020
Mins, Vits, Others	2.502	2.540	2.541
Euro/ton	250	241	244
			-6

Broiler Feeding Costs Without and With Proact

Broiler Weight: 2.772 kg

Info. Costs	Without Proact		With Proact (AAs+ME)		With Proact (AAs)	
	Diet, Euro/kg	Euro / Phase	Diet, Euro/kg	Euro / Phase	Diet, Euro/kg	Euro / Phase
Pre-Starter	0.266	0.074	0.260	0.073	0.263	0.073
Starter	0.255	0.210	0.246	0.202	0.250	0.206
Grower	0.250	0.604	0.241	0.283	0.244	0.590
Finisher	0.247	0.329	0.238	0.318	0.241	0.322
Total/Broiler		1.217		1.176		1.190

Difference Without – Proact (AAs+ME): $1.217 - 1.176 = 0.041$ Euro/ Broiler.

Difference Without – Proact (AAs): $1.217 - 1.190 = 0.027$ Euro/ Broiler.

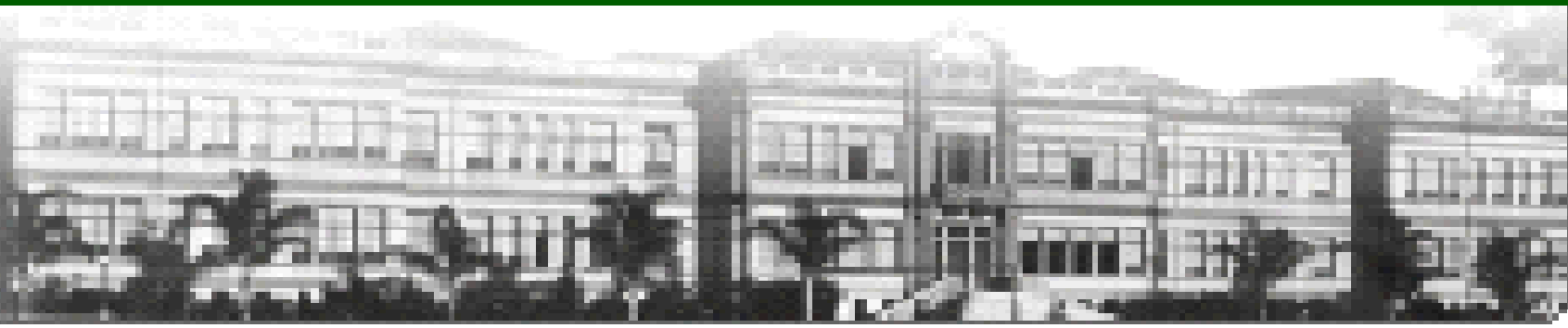
Final Considerations

- Results of two experiments with broilers showed that Proact improves the amino acids SID of FFSB, SBM and a Corn-Soy diet on average 4, 8 and 5%, respectively.
- The positive effect of Proact varies from a minimum of 1% to a maximum of 12%, depending upon the amino acid.
- Proact increased numerically the AMEn of FFSB, SBM and a Corn-Soy diet on average 145, 43 and 35 kcal/kg, respectively.
- A simulation using Brazilian prices, Proact reduced feeding cost 0.041 and 0.027 Euro/broiler, when considering AAs+ME or AAs contribution, respectively.



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Thanks



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