

Evaluating Enzyme Applications

Using BroilerOpt[®] Feed Program

by F. J. Ivey

Feed2Gain, LLC

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Formulating with Enzymes

- Testing and using an enzyme can be difficult as availability of final nutrients and expected growth are not clear.
- Some use a nutrient profile for each enzyme. Others use their normal formulation and “Add the Enzyme” on top.
- The question, for me, was how big is the difference between the two approaches? Which can be used to test an enzyme in the field?
- I used BroilerOpt[®] Feeding Program to see.
- You can make the pictures bigger to read easier.

Start with the Program

- BroilerOpt[®] Feed Program is a computer program with both a least cost formulation part and a growth evaluation.
- A “Location” is calibrated automatically to match growth and nutrition.
- Then, using the Location costs, changes in growth with nutrient changes can be evaluated accurately.
- The program can optimize to the lowest cost formulas with or without an enzyme “added on top”
- All results are Cost driven, as the final nutrition is set by formulation of ingredients based on the Cost of the ingredients.

Start the Evaluation

- I made up a Location named New Brazil (the Ingredient Data for NewBrazil Matrix is from Tabelas Brasileiras para Aves e Suinos (Rostangno et al., 2011) except enzyme matrix values. <http://www.fmva.unesp.br/ppfr>
- Costs are also made up to give fairly normal formulations.

The screenshot shows a software interface for diet formulation. The 'Calibration of Location' section has 'NewBrazil' selected in a dropdown menu. The 'Current Flock' section has an 'Open Diets' button. A table of 'Nutrient Based Diets_LP Restrictions' is displayed, showing 4 diets with their respective types, changes, costs, and nutrient levels.

Diet #	Diet Type	Diet Change	Feed Cost	Feed/Weigh	Energy	Protein	Arginine
1	Starter	1/8/2014	1014.3	0.5500	2950.0	23.000	1.4
2	Grower	1/8/2014	997.03	1.5000	3150.0	22.600	1.3
3	Withdrawal 1	1/8/2014	838.04	1.5000	3150.0	18.500	1.0
4	Withdrawal 2	1/8/2014	838.04	1.7430	3150.0	18.500	1.0

Calculate the Diets and Growth for the Initial Formulas

- We see the flock is mixed sex and the live weight we expect is 2.8 kg.
- The Diets specify the nutrients and amount of each of the four feeds.
- The result is a feed conversion of 1.864 and cost of 4.7654.

The screenshot shows a software interface for diet calculation. The 'Current Calculation' button is circled in red. Below it, a table shows diet types (Starter, Grower, Withdrawal 1, Withdrawal 2) and various nutrients. To the right, a table lists ingredients like Corn, Soybean, and Canola Meal. A red box highlights the 'Initial Weight' (2.840 kg), 'Feed Conversion' (1.864), and 'LP COST' (48.7) fields.

Diet Type	Starter	Grower	Withdrawal 1	Withdrawal 2
Diet Change	1/8/2014	1/8/2014	1/8/2014	1/8/2014
Feed Cost	987.89	997.03	838.04	838.04
Feed Weight	0.550	1.500	1.500	1.743
Energy	2950	3150	3150	3150
Protein	22.99	22.60	18.50	18.50
Arginine	1.412	1.384	1.064	1.064
Histidine	0.564	0.498	0.408	0.408
Lysine	1.209	1.209	1.000	1.000
Tryptophan	0.261	0.238	0.180	0.180
Phe + Tyros	1.034	0.945	0.751	0.751
Phenylalani	1.770	1.595	1.277	1.277
Met_Cys	0.780	0.663	0.604	0.604
Methionine	0.478	0.343	0.328	0.328
Threonine	0.786	0.760	0.621	0.621

No.	Ing. Name	Starter	Grower	Withd
2	Corn, Grain 7.86%	56.808	50.506	64.1
16	Soybean, Full-Fat	6.3292	35.518	21.1
14	Canola Meal	0	5.6658	5.6
20	Soybean Meal 46%	30.005	0	
23	Poultry Byproduct	2.0000	2.0000	2.0
35	Catalão Rock Pho	2.4137	1.8043	1.7
27	Feather Meal 75%	0	2.0000	2.0
17	Meat and Bone Me	0	1.0000	1.0
40	Disodium Phosph.	0.5585	0.5853	0.4
44	L-Lysine HCl	0.1060	0.2704	0.3
56	Mineral premix Wit	0	0	
54	Mineral premix Ste	0	0.5000	
55	Mineral Premix Gro	0	0	0.5
28	Blood Meal	1.0000	0	

Change Restrictions on our Enzyme

- We change the restrictions on the enzyme we choose, which is Rovabio[®] Excel, applied at 0.05%. A max of -1 blocks use of an ingredient.

The screenshot shows the 'Ingredient Restrictions' window with the following table:

	Diet 1 MIN	Diet 1 Mx	Diet 2 MIN	Diet 2 MAX	Diet 3 Ml	Diet 3 Mx	Diet 4 M	Diet 4 MAX
L-Lysine HCl	0	0	0	0	0	0	0	0
DL Methionine	0	0	0	0	0	0	0	0
Methionine MHA	0	0	0	0	0	0	0	0
L-Threonine	0	0	0	0	0	0	0	0
Threonine	0	0	0	0	0	0	0	0
L-Tryptophan	0	0.3000	0	0	0	0	0	0
Mineral Premix	0	0	0	0	0	0	0	0
Vitamins Premix	0	0	0	0	0	0	0	0
Bicar. sódicoNaHCO3	0	0	0	0	0	0	0	0
Pre-Initial Mineral Premix	0.5000	0.5000	-1.0000	-1.0000	0	-1.0000	0	-1.0000
Mineral premix Starter	0	-1.0000	0.5000	0.5000	0	-1.0000	0	-1.0000
Mineral Premix Growth	0	-1.0000	-1.0000	-1.0000	0.5000	0.5000	0	-1.0000
Mineral premix Withdrawal	0	-1.0000	-1.0000	-1.0000	0	-1.0000	0.5000	0.5000
Anticoccid agent.	0	-1.0000	0	-1.0000	0	-1.0000	0	-1.0000
Antibiotic	0	-1.0000	0	-1.0000	0	-1.0000	0	-1.0000
Rovabio Excel 0.05 %	0.05	0.05	0.05	0.05	0.05	-1.0000	0.05	-1.0000
Rovabio Max 0.005 %	0.005	-1.0000	0.005	-1.0000	0.005	-1.0000	0.005	-1.0000

A Maximum Restriction Of -1 Prevents The Use Of An Ingredient, Zero Is No Restriction!

Buttons: View ING Restrict., Show Ingredient Info, Show Nutrient Specs, Keep Track, Plot Current Feed, Plot Daily, Print

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Run the Current Calculation with Enzyme

- Now, the program will formulate to the same specs, using our enzyme.
- Clicking current calc will show the result.
- Feed conversion is nearly unchanged from 1.864, but cost is down from 4.7654 . The enzyme was added, below right.

The screenshot displays a software interface for diet formulation. On the left, a control panel includes a dropdown menu set to 'Mixed', a 'Save Diets' button, and several input fields: 'e' (25000), 'diets' (4), 'inal' (2.840 kg), 'ed or' (1.866), '3' (48.6 days), and 'irc' (4.5527). Below these are buttons for 'Save All Current', 'Use Calibration Diets', 'LP COST' (dropdown), 'Run LP', 'View Report', and 'Enzyme Ton Off'. The central table shows nutrient levels for Starter, Grower, and Withdrawal stages. The right-hand table lists ingredients and their quantities for each stage. Red circles highlight the feed conversion ratio (1.866) and cost (48.6) in the control panel, and the addition of 'Rovabio Excel 0.0' in the ingredient table.

Diet Type	Starter	Grower	Withdrawal 1	Withdrawal 2
Diet Change	1/8/2014	1/8/2014	1/8/2014	1/8/2014
Feed Cost	930.14	960.01	800.82	800.8
Feed Weight	0.550	1.500	1.500	1.74
Energy	2950	3150	3150	315
Protein	22.60	22.60	18.50	18.5
Arginine	1.433	1.455	1.137	1.13
Histidine	0.511	0.481	0.392	0.39
Lysine	1.209	1.209	1.000	1.00
Tryptophan	0.257	0.249	0.191	0.19
Phe + Tyros	0.858	0.888	0.695	0.69
Phenylalani	1.452	1.499	1.182	1.18
Met_Cys	0.830	0.771	0.684	0.68
Methionine	0.419	0.381	0.337	0.33
Threonine	0.851	0.837	0.698	0.69
Leucine	1.584	1.613	1.379	1.37
Isoleucine	0.858	0.883	0.699	0.69
Valine	1.013	1.039	0.860	0.86

No.	Ing. Name	Starter	Grower	Withdrawal
2	Corn, Grain 7.86%	49.097	53.309	67.514
16	Soybean, Full-Fat	22.815	28.776	14.623
14	Canola Meal	21.958	9.5559	9.5532
23	Poultry Byproduct	2.0000	2.0000	2.0000
35	Catalão Rock Pho	2.6273	1.9117	1.8477
27	Feather Meal 75%	0	2.0000	2.0000
17	Meat and Bone Me	0	1.0000	1.0000
40	Disodium Phosph.	0.4615	0.5914	0.4661
44	L-Lysine HCl	0.2009	0.2347	0.3021
56	Mineral premix Wit	0	0	0
54	Mineral premix Ste	0	0.5000	0
55	Mineral Premix Gr	0	0	0.5000
39	Monosodium Phos	0.2899	0	0.1440
53	Pre-Initial Mineral F	0.5000	0	0
59	Rovabio Excel 0.0	0.05	0.05	0.05
37	Calcium Carbonat	0	1.070502	0

Set up for Addition on Top

- We return the restriction on the enzyme to prevent its use in formulation, just as we started.
- Then Click on “Enzyme Top Off”. Click on [click here](#) to see if your enzyme was recognized by the program.
- Select the enzyme, The example is #59 in the ingredient list (name is filled in by program) and you choose the dose and diets to dose.

Evaluate Growth with Enzyme on Top”

- The program now solves the least cost formulations, just as the initial calculation.
- The nutrient values for the enzyme are added and growth calculated.
- We are told the addition is ON. Feed conversion is down to 1.788 and Cost is down to 4.5764.

The screenshot displays a software interface for diet formulation. On the left, there are input fields for various parameters, with a red circle highlighting the 'Feed Conversion' field (value: 1.788) and the 'LP COST' field (value: 4.5764). Below these fields, a red arrow points to a text box that reads 'Addition of Rovabio... is ON'. The main area of the interface is a table showing the results of the least cost formulation for four different diet stages: Starter, Grower, Withdrawal 1, and Withdrawal 2.

Diet Type	Starter	Grower	Withdrawal 1	Withdrawal 2
Diet Change	1/8/2014	1/8/2014	1/8/2014	1/8/2014
Feed Cost	989.29	998.43	839.44	839.4
Feed Weight	0.550	1.500	1.500	1.52
Energy	3019	3219	3219	321
Protein	23.93	23.54	19.44	19.4
Arginine	1.569	1.541	1.222	1.22
Histidine	0.564	0.498	0.408	0.40
Lysine	1.303	1.303	1.094	1.09
Tryptophan	0.287	0.264	0.206	0.20
Phe + Tyros	1.034	0.945	0.751	0.75
Phenylalani	1.770	1.595	1.277	1.27
Met_Cys	0.917	0.800	0.741	0.74
Methionine	0.546	0.412	0.397	0.39
Threonine	0.891	0.865	0.726	0.72
Leucine	1.800	1.675	1.439	1.43
Isoleucine	0.968	0.938	0.753	0.75
Valine	1.130	1.083	0.903	0.90
Ether Extrac	4.499	9.302	7.169	7.16
Dry matter %	87.25	88.23	87.83	87.8

No.	Ing. Name	Starter	Grower
2	Corn, Grain 7.86%	56.808	50.506
16	Soybean, Full-Fat	6.3292	35.518
14	Canola Meal	0	5.6658
20	Soybean Meal 46%	30.005	0
23	Poultry Byproduct	2.0000	2.0000
35	Catalão Rock Pho	2.4137	1.8043
27	Feather Meal 75%	0	2.0000
17	Meat and Bone Me	0	1.0000
40	Disodium Phosph.	0.5585	0.5853
44	L-Lysine HCl	0.1060	0.2704
56	Mineral premix Wit	0	0
54	Mineral premix Ste	0	0.5000
55	Mineral Premix Gro	0	0
28	Blood Meal	1.0000	0
39	Monosodium Phos	0.1131	0
45	DL Methionine	0.1669	1.031346
53	Pre-Initial Mineral f	0.5000	0
37	Calcium Carbonat	0	0.1182

Summary of Results

- Using the Keep Track button, we can recall the last four Growth Calculations.
- To the far right is the starting feed results.
- The program predicts carcass impact and Male and Female Weights.
- We can also find the Lowest Cost use of the Enzymes -

Feed2Gain Change Tracking

Current is Enzyme On Top
Earlier is Enzyme in Feed

Comparison	Current	Previous	Earlier	Initial
Flock Sex	Mixed	Mixed	Mixed	Mixed
Live Weight	2.840	2.840	2.840	2.840
Feed/Gain	1.788	1.864	1.866	1.864
Age	47.35	48.68	48.63	48.68
Cost / Bird	4.5764	4.7564	4.5527	4.7564
Cost/WT	1.6114	1.6749	1.6021	1.6749
Feed Cost	4.5764	4.7564	4.5527	4.7564
Cost milling	0	0	0	0
energy per	5717.7	5831.6	5837.7	5831.6
By Flock				
Breast Meat	0.497	0.523	0.489	0.523
Leg Thigh	0.499	0.497	0.509	0.497
Male Wt	3.054	3.051	3.051	3.051
Female Wt	2.626	2.629	2.629	2.629
F2G M	1.726	1.798	1.800	1.798
F2G F	1.860	1.940	1.942	1.940
T Cost M	4.7437	4.9249	4.7136	4.9249
T Cost F	4.4092	4.5878	4.3919	4.5878
M Cost/WT	1.5534	1.6140	1.5449	1.6140
F Cost/WT	1.6789	1.7453	1.6706	1.7453
By Flock				
First Catch				

of Rows is ON

Optimized Feed Cost – No Enzyme

- Using the Formulation Program and Minimum and Maximum Energy and Protein (amino acids in ratio), the program searches for the lowest cost.
- With the costs that were made up, the feed costs with no enzyme could be reduced almost 6 percent with a higher feed conversion (6 points)
- Not shown, holding to the same f2g or better, min. cost is 4.7032 or 1.1 % and f2g 1.703.

Optimization Report

Copy to Clipboard Target Wt. 2.840

Optimum Nutrient Restrict. Ingredient Re

	Cost / Bird	Feed/Gain	Flock Age	Percent Saved	Profit/Sqm
Optimized	4.4766	1.924	49.14	5.882	0
Initial	4.7564	1.864	48.7		0
	Cost/Kg	Mill & Haul	Cost / Bird	Saved per Mil.	
Optimized	1.5763		0	279779	
Initial	1.6748		0		
	Optimized	Initial	Maximum	Minimum	Lp Restrict.
Diet 1					
Energy	2991	2950	3039	2862	2991
Protein, %	21.58	22.60	24.86	20.34	21.20
Feed Weight	0.303	0.550	0.825	0.275	
Diet 2					
Energy	3214	3150	3245	3056	3214
Protein, %	20.50	22.60	24.86	20.34	20.50
Feed Weight	0.814	1.500	2.250	0.750	
Diet 3					
Energy	3243	3150	3245	3056	3243
Protein, %	16.70	18.50	20.35	16.65	16.70
Feed Weight	1.707	1.500	2.250	0.750	
Diet 4					
Energy	3238	3150	3245	3056	3238
Protein, %	16.80	18.50	20.35	16.65	16.80
Feed Weight	2.639	1.743	2.292	0.764	

Number Of Growouts Run To Find Optimum Was 873

Optimized Feed Cost –Enzyme in Formula

- Optimizing with the enzyme, costs were reduced by 6 percent over using the enzyme in formulating our original feeds.
- With the enzyme, optimization predicts saving 10 percent over the original formulas.
- Not shown, when f2g was held constant, savings were 5 percent (4.518 and f2g of 1.81).

Copy to Clipboard Target Wt. 2.840

Optimum Nutrient Restrict. Ingredient Res

	Cost / Bird	Feed/Gain	Flock Age	Percent Saved	Profit/Sqm
Optimize	4.2552	1.924	50.94	6.535	0
Initial	4.5527	1.866	48.6		0
	Cost/kg		Cost / Bird	Saved per Mil.	
Optimized	1.4983	Mill & Haul	0	297526	
Initial	1.6031		0		
	Optimized	Initial	Maximum	Minimum	Lp Restrict.
Diet 1					
Energy	3037	2950	3039	2862	3037
Protein, %	20.30	22.60	24.86	20.34	20.30
Feed Weight	0.275	0.550	0.825	0.275	
Diet 2					
Energy	3243	3150	3245	3056	3243
Protein, %	20.40	22.60	24.86	20.34	20.40
Feed Weight	0.827	1.500	2.250	0.750	
Diet 3					
Energy	3244	3150	3245	3056	3244
Protein, %	16.70	18.50	20.35	16.65	16.70
Feed Weight	1.043	1.500	2.250	0.750	
Diet 4					
Energy	3244	3150	3245	3056	3244
Protein, %	16.70	18.50	20.35	16.65	16.70
Feed Weight	3.320	1.743	2.292	0.764	

Number Of Growouts Run To Find Optimum Was 908

Optimized Feed Cost –Enzyme “Added on Top”

- Added “On Top” saved less on Optimization than formulation.
- Feed cost was reduced 3 percent from On Top of the original formulas and 7.8 percent from our original costs.
- Note the final energies fed were above the maximums because the Energy and protein from the enzyme were not counted.

	Cost / Bird	Feed/Gain	Flock Age
Optimized	4.3833	1.827	48.34
Initial	4.5764	1.788	47.4
	Cost/kg		Cost / Bird
Optimized	1.5434	Mill & Haul	0
Initial	1.6114		0
	Optimized	Initial	Maximum
Diet 1			
Energy	3029	2950	3039
Protein, %	20.38	22.60	24.86
Feed Weight	0.312	0.550	0.825
Diet 2			
Energy	3169	3150	3245
Protein, %	20.38	22.60	24.86
Feed Weight	0.865	1.500	2.250
Diet 3			
Energy	3309	3150	3245
Protein, %	19.44	18.50	20.35

Conclusion

- Adding the enzyme “on Top” of our formulations worked almost as well as including the enzyme as part of the formulation. Cost was 4.58 vs 4.55 when added to the formulas. Both were better than the initial non-enzyme cost of 4.76. Adding on top resulted in higher energy and lower feed conversion. Breast meat yield was also lower.
- While formulation with an enzyme gave the best cost results and kept feed conversion constant, testing an enzyme with the “On Top” application appears to be very useful.
- “On Top” Application would give visible improvement in feed conversion that formulating would not. Feed2Gain Improvement is something all can see and understand.

F. J. Ivey, Feed2Gain, LLC

Feed2Gain, LLC is responsible for all content.

- • Using the Formulation Program and
- Minimum and Maximum Energy and
- Protein(amino acids in ratio), the
- program searches for the lowest
- cost.
- • With the costs that were made up,
- the feed costs with no enzyme could
- be reduced by almost 6 percent with
- a higher feed conversion points).
- • Not shown, holding to the same f2g
- Or lower, min. cost is 4.7032 or 1.1 %
- lower and f2g 1.703.
- • Carcass composition can also be
- controlled, as well as withdrawal
- time, Age and even Total Energy.