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Nutrition in a time of crises – Priorities for feed cost control

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Introduction

These are unprecedented times in food animal production. Virtually every ingredient that we use in our diets has increased in price and some have increased substantially. It appears that the 'Cheap Feed' era, that placed North America at a distinct advantage in a global market, is over for the foreseeable future. A combination of the fast growing economies of Brazil, China and India, with their impact on global oil and agricultural inputs, and the increasing dependence of the US on foreign oil has precipitated a perilous Food for Fuel policy. This is further complicated by US dependency on foreign imports for some diet ingredients.

This paper briefly summarizes: (1) Projected 2008 feed cost of production, and the (2) key decisions that must be made to control feed cost. The Nutritionist must know the diet options and their performance result. The options are best studied as a team that involves key members of the production team and with the aim of optimizing profit rather than cutting cost. Nutritionists should not act in isolation because financial opportunity will be lost.

Projected feed cost of production - 2008

The US mandate for corn derived ethanol has led Animal Agriculture into perilous times, from the standpoint of equity loss. Even the most successful feed cost controls will contribute little to saving a Farm, but they can make a significant impact on preserving some equity for those farms or systems that survive.

The impact of estimated corn, soya, projected diet and performance cost for 2008 is summarized in **Table 1**. These estimates are based on cash bids to Hanor for Iowa, Illinois and Oklahoma with baseline years (1999–2006) being selected for comparison. Feed cost of gain (FCOG) for finish pigs, including grind, mix and delivery, is estimated to be 2.44 fold higher than observed for the baseline period (FCR 2.70 assumed). This amounts to ca. $100 Feed cost from 50 lbs to 280; $72 of which is from corn alone. Corn accounts for ca. $80 of the Feed cost from wean to finish.

This estimated FCOG is at risk because of signficant increases in the price of other ingredients. Changes for selected ingredients are presented in **Table 2**. Prices for 2006 were used as the basis to compare 2008 prices. Price increases are especially noteworthy for phosphate, fat and Vitamin E. The latter is expected to increase further before the end of the year.

Priorities in feed cost control

Feed cost control priorities were classed into four categories for discussion purposes: Feed conversion, Market weight, Diet controls, Health and Management. Priorities are not necessarily presented in hierarchal order with especial attention to diet considerations.

Feed conversion. Two of the most powerful determinants of total feed cost are (1) FCR and (2) Market weight. Improving FCR by 0.01, during the Finish period, changes total feed cost by $0.28-0.30 per pig at current grain and soya prices (**Table 1**). The greatest opportunity for FCR change lies within the fields of Nutrition, Health and Management. The rate of Genetic improvement in FCR has begun to decline for some genetic lines because the primary driver of improved FCR is the reduction in carcass fat; the rate of change for fat depth is declining.

From a practical standpoint, the best FCR does not always deliver the lowest cost of gain. This will be illustrated below. However, once Diet Energy level and the Lysine curve is selected, any improvement in FCR from that diet determined baseline will be more profitable.

Market weight. Optimum Profit Market weight is such a powerful determinant of profit that it must be computed and delivered on. FCOG increases at every point beyond 25 lbs body weight because FCR erodes more rapidly than diet cost declines (**Figure 1**). A reliable Market Model, that integrates all the variables in performance, feed cost and Meat Plant matrix, is an absolute must in identifying the minimum weight to optimize profit. Under current conditions, our Market model predicts that profit is optimized at 196 Carcass lbs, remains flat thereafter through 212 lbs and then begins to decline (based on load average, 18% variation in HCW).

Diet considerations. The most difficult decision to make involves items 1 and 2 below. Research-based outcomes must be known in order to compute which 'settings' give the best return on investment.

1. **Select diet energy concentration.** This is fundamental but the basis for choosing among the options too often not clear. Three very different choices are presented in **Tables 3-5**. FCR and ADG (not shown)

Table 1: Impact of corn and soya price on diet cost

Item	Basis 1999-2006	2007	2008 est.
Corn, $/ton	82	136	282
Soya 47.5%, $/ton	188	235	362
Diet, $ G.M. deliv./ton	132	199	321
Feed Cost gain, $/lb	0.178	0.268	0.433

Actual bid prices to Hanor for Iowa, Illinois and Oklahoma.
2008 Corn price ($4.84/bu. - $6.87), SBM ($268 – 346/ton)

Table 2: Price increase of ingredients other than corn, soya

Other ingredients	2006 $ / ton	2008 $ / ton	Fold Change
DDGS	$ 101.0	$ 205.0	1.03
Wheat midds	$ 78.0	$ 158.0	1.03
Fish meal	$ 720.0	$ 960.0	0.33
Lactose	$ 375.0	$ 520.0	0.39
Poultry meal	$ 280.0	$ 460.0	0.64
CWG	$ 290.0	$ 850.0	1.93
Lysine	$ 1,320.0	$ 2,060.0	0.56
DL methionine	$ 2,480.0	$ 4,080.0	0.65
Threonine	$ 1,840.0	$ 2,460.0	0.34
VTM premix	$ 2,320.0	$ 4,480.0	0.93
Vitamin E 50%	$ 2,000.0	$ 24,000.0	11.00
Copper sulphate	$ 700.0	$ 1,940.0	1.77
Choline chloride	$ 400.0	$ 960.0	1.40
MonoCalcium phosphate	$ 242.0	$ 925.0	2.82
S.D. plasma	$ 3,200.0	$ 3,840.0	0.20

Data base - Anonymous

data were verified through trial in our Field Research center. The high Fat approach in **Table 3** is normally preferable in a Fixed Time scenario, but it decreases profit (or increases loss) when the Fat: Corn price relationship ($/cwt: $/cwt) exceeds 4.0 under the Variable time scenario.

Table 4 is an alternative Energy strategy for Non-Summer and a Variable time scenario. FCR is greater (2.678 vs 2.564) for this Low Energy format but results in a Net Savings of $2.20 / pig corrected for 5.5 extra days to achieve the same body weight. Utilization of wheat Midds (replaces SBM, Phosphate) requires some addition of Fat to maintain ME.

Table 5 presents a very important approach in formulating diets – maximization of Net Energy without the addition of Fat. This approach uses DDGS (10-20%) and Bakery by-product to displace Corn, SBM and Phosphate. High levels of Phytase and synthetic Amino Acids displace Phosphate and SBM, thereby increasing Net Energy level. FCR is greater than the high Fat standard in Table 4 (2.676 vs 2.564). Under current conditions, this approach is expected to Net

Figure 1: Feed cost of gain (FCR $) is presented for each phase and a cumulative. GMD not included, No drug. June 2008.

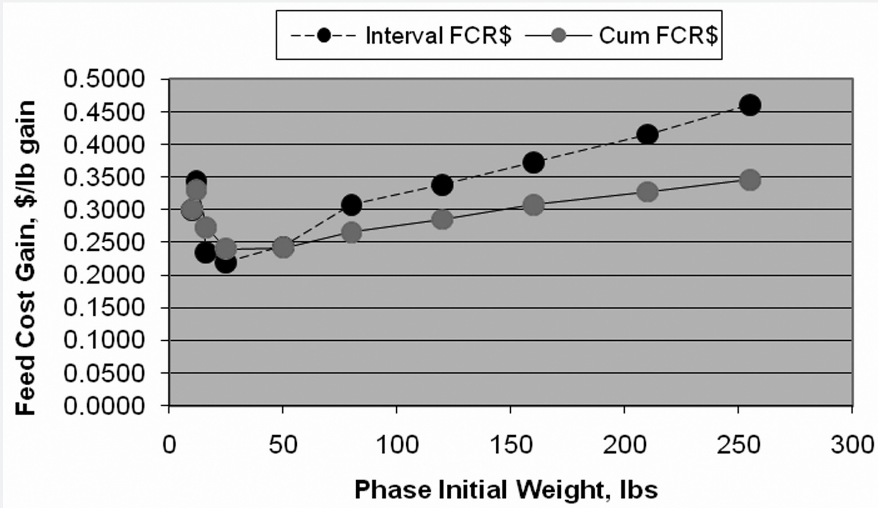

Table 3: High fat formulation as the basis for comparison

Diet	Start lbs	End lbs	TID Lysine %	Trial FCR	Diet Energy	Kcal ME/ lb gain	Feed lbs/pig	$ / Ton	$/Phase
Nurs 4	25	50	1.28	1.38	1510	2084	35	276.92	$ 4.777
Fin 1	50	80	1.18	1.66	1545	2565	50	270.94	$ 6.746
Fin 6	80	130	1.02	2.04	1550	3162	102	267.28	$ 13.631
Fin 7	130	180	0.88	2.32	1550	3596	116	258.59	$ 14.998
Fin 8	180	230	0.76	2.64	1550	4092	132	257.41	$ 16.989
Fin 9	230	250	0.69	2.95	1550	4573	59	248.98	$ 7.345
Fin 12	250	290	0.98	2.70	1500	4050	108	280.91	$ 15.169
Total	(4.0% DL)						**640**	265.86	**$ 84.74**

* Corn and SBM prices February 25. 2008; Fat: Corn price ratio ($/cwt : $/cwt), 4.0.

Table 4: Low ME formulation using 10% wheat midds (non-summer program)

Diet	Start lbs	End lbs	TID Lysine %	Trial FCR	Diet Energy	Kcal ME/ lb gain	Feed lbs/pig	$ / Ton	$/Pig
Nurs 4	25	50	1.28	1.41	1480	2084	35	265.60	$ 4.674
Fin 1	50	80	1.18	1.75	1468	2565	52	252.26	$ 6.611
Fin 6	80	130	1.02	2.15	1468	3162	108	244.18	$ 13.149
Fin 7	130	180	0.88	2.45	1468	3596	122	231.77	$ 14.194
Fin 8	180	230	0.76	2.79	1468	4092	139	236.55	$ 16.484
Fin 9	230	250	0.69	3.11	1468	4573	62	234.33	$ 7.299
Fin 12	250	290	0.98	2.76	1468	4050	110	272.69	$ 15.046
Total	(4.0% DL)		Lysine/Mcal equiv.				**670**	248.20	**$ 82.40**

Table 5: Low ME formulation but maximizing net energy without fat

Diet	Start lbs	End lbs	TID Lysine %	Trial FCR	Diet Energy	Kcal ME/ lb gain	Feed lbs/pig	$ / Ton	$/Pig
Nurs 4	25	50	1.28	1.36	1530	2084	34	289.10	$ 4.922
Fin 1	50	80	1.18	1.74	1470	2565	52	262.68	$ 6.874
Fin 6	80	130	1.02	2.16	1464	3162	108	251.98	$ 13.606
Fin 7	130	180	0.88	2.45	1472	3608	123	242.32	$ 14.847
Fin 8	180	230	0.76	2.78	1472	4092	139	230.80	$ 16.040
Fin 9	230	250	0.69	3.10	1474	4573	62	227.27	$ 7.050
Fin 12	250	290	0.98	2.78	1456	4050	111	268.80	$ 14.954

* Utilizing DDGS, Bakery by-product; high Phytase (545 FTU/lb) and synthetic amino acids to eliminate Phosphate and reduce SBM since the latter reduces useful or Net Energy.

$1.45 / pig corrected for 6.6 extra days to achieve the same body weight. This could be improved on by more aggressive DDGS use.

2. **Select lysine curve for optimum profit.** This embraces the question of what level of amino acid input is justified for FCR and Lean vs the input cost of Soya. Under current conditions, the Optimum Profit Lysine curve is 12% below that required to achieve 96% asymptote FCR response.

3. **Select ideal pattern of amino acids.** These differ by phase and help to establish the maximum synthetic amino acids that can be added to displace SBM. Ajinimoto, PIC USA and the U. Missouri have validated the patterns for each phase of growth for threonine, total sulfur amino acids, tryptophan, isoleucine and valine. Maximum levels of synthetic lysine were then titrated independently by phase. Normally, maximum use of synthetic amino acids saves $0.35–0.75 / pig. Under current conditions, a savings of $1.20 / pig is achieved unless PLN is used ($1.30/pig). This is the result of savings in SBM and Fat cost.

4. **Select corn and soya alternatives.** Ingredients that partially displace corn and (or) SBM in the US include distillers grains (*DDGS*), bakery by-products, Fat, wheat midds, fine grind corn (delivered via pellets) and *synthetic* amino acids. A list of alternatives (e.g. hominy, pet food by-product) is beyond the scope of this presentation and is covered elsewhere. DDGS can replace significant amounts of corn, SBM and phosphate. Setting DDGS limits by phase for both growing pigs and sows is financially very important. Extraordinary use of synthetic amino acids can replace 100-175 lbs SBM per ton of diet, and has the effect of increasing Net Energy of the diet because the 'useful' energy of SBM is lower than suggested by the NRC ME value.

5. **When is fat a corn alternative?** The answer depends on whether the Finish system is Fixed (i.e. not enough time to deliver optimum weight such as summer) or Variable time. It is also based on the performance response to Fat and this differs with phase of growth. Confusion exists about how to identify the Fat price that eliminates it as an option. Hanor Research suggests that when the price of Fat ($/lb) relative to Corn ($/lb) exceeds 3.6, then Fat can no longer be justified. This is based on FCOG ($/lb gain) and variable time. The range across phases is 3.0 to 4.0. The allowable threshold is considerably higher when Finish time is Fixed because of important increase in Carcass ADG. Utilization of PLN in the final phase appears to eliminate the adverse impact of high Fat diets on Lean %.

6. **Paylean for corn displacement.** The two most important FCR improvement technologies involve Fine-grind corn, delivered using pellets, and Paylean (PLN). Paylean (PLN) modifies metabolism and dramatically improves FCR during the final 3 weeks of growth. Additional SBM input is required to support increased protein deposition, but much of the increase in muscle is water; hence the improvement in FCR. This improvement is greatest during the first week and declines thereafter, so that a net saving in Feed Cost is possible for only 3 weeks. The value of this technology in reducing FCOG is negligible when Corn is $2.25 per bushel but not when it $6.50.

7. **Phytase to displace phosphate.** The enzyme Phytase is one of the most important achievements of Nutrition research. Some do not use Phytase but most use a level that is significantly lower than it could be. High levels of Phytase (450–545 FTU/lb finished diet) and DDGS essentially eliminate the need for Phosphate in Finish diets. This in effect increases Net Energy of the diet or reduces the amount of Fat that has to be added

to achieve target diet energy density. Relatively high levels can be used in Sows. Successful use depends on knowing phosphorus release and setting the Ca:Pav maxima correctly. The latter is important to Phytase effectiveness.

8. **Enyzme technologies.** The relevance of other Enzymes such as Amylase, Xylanase, β-Glucanase is less clear. US Research-based evidence is a *must*. It is possible that exogenous enzymes can deliver on improved FCR with no change in diet composition or maintain FCR with some reduction in SBM or Fat. The claim that an Enzyme mix alone replaces 40 lbs of Fat seems doubtful, whereas, replacement of 15-20 lbs is conceivable.

9. **Vitamin trace-mineral formulation margins.** The VTM formula needs to be reviewed and updated for this era. Nearly every component has increased in price but Vitamin E price has increased 12-fold. Vitamin A is also increasing but is less dramatic. Margins need to be re-considered and be justified. For example, providing 35 IU Vitamin E per lb complete diet for a Nursery pig cost approximately $0.58 per ton feed in July 2007. The cost is $3.58 per ton in July 2008.

10. **Number of feed phases.** In times of high feed cost, there is increasing reward with each additional feed phase from 25 lbs to market. Returns diminish quickly after 7-8 phases. Advances in feeding technology could deliver on a weekly change but weight variability in the barn population probably limits the capture of additional value; unless pens were organized into two sub-populations based on weight to improve weight specific feeding. Research is needed in this area.

11. **Feed budget.** Delivering on the Feed Budget is important, especially in the Nursery through early growth.

12. **Health perturbations.** Failure of vaccines to adequately control disease that cause an inflammatory response, can have a profound effect on FCR for the period affected. We have measured FCR deterioration sufficient to achieve $2.50 per pig additional feed cost.

Challenging Nursery formulation to achieve dramatic changes with the hope of reducing FCOG could be costly but in area's that may not obvious. Diet stress increases the number of pigs that must be treated with antibiotic (as much a 2-fold). Death Loss and variation (leading to Finish Culls) will also increase. 'Modest' challenges are appropriate.

Production II