

Optimizing Grow/Finish Close-Out Strategies

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▪ Introduction

Grow/finish management is one of those areas in pig production that gets some attention and yet is often relegated to “things that I should do” in pig production. It is the end of the line - the result of the successes and failures we have had in that crop of pigs and it is the overall measure of the success in the system. In comparison to most industrial production systems, we find that the process of rearing pigs is quite complex and often governed by subjective and errant assumptions. In this paper we want to examine the problem of the determination of the financially optimal endpoint for an all-in:all-out (AIAO) group of pigs. This decision has historically been done where the group's productivity during the growth phase is not measured or poorly measured. The struggle has been to improve measurement and then interpret performance in terms of optimizing across different requirements.

Optimization is a grandiose word that has been overused and probably is here as well. Optimization means that we find the decision that meets competing requirements as efficiently as possible. In this area the competing restrictions include, but are not limited to:

- ▶ limited finishing capacity or capital
- ▶ costs of inputs
- ▶ the specifications of the buyer
- ▶ a variable supply of pigs to produce
- ▶ a variable price for the output

The combination of all these factors is a difficult, if not impossible, combination of factors to model, much less understand the outcome. In this paper the aim is to combine two or three factors in optimization calculations, not only to come to a complete answer, but also allow us to understand the interactions to a greater

extent. The aim here is to optimize these variables to maximize profits or to approximate such a decision.

▪ The Problem of Optimization

When we speak of financially optimizing a decision, three things must be emphasized. The first is that such optimization is never a cost-minimizing endeavor. Cost minimization is a restrictive optimum which, in the long run, inevitably reduces profits. It often is easier to understand and calculate and it does simplify the decision making process. Conversely, maximization of productivity falls into the same trap of not maximizing profit. Lastly, it is only in a perfect world that productivity would be consistent, predictable and efficient. We must strive for these things but nonetheless we must emphasize a cogent strategy for marketing pigs that do not meet these circumstances.

Consistency

As we have argued in the past, one of the major measures of quality should be consistency. Consistency is the factor that increases productivity by refining input requirements, but more importantly it also makes the product more attractive and finally, it makes calculations and manipulations at close-out much easier. Thus, we have spent some time looking at methods of reducing variation in growth rates in growing swine. This is always considered the first step in proper manufacturing optimization.

The examination of the process and looking at methods of reducing variation in the process is a difficult area. The math is not the same as for improving productivity and, in fact, there is a distinct trade-off between maximization of productivity and the stabilization of that productivity either between animals or between groups of animals. For instance, maximizing individual feed intakes for pigs shows the differences in appetites due to various factors such as genetics and disease. Limit feeding may decrease feed intakes more in the high appetite pigs than in the low appetite pigs and thus reduce the average growth rate and also the variation.

We have looked at some sources of variation and we have come to some of the following guidelines:

- ▶ Most sources of variation are multiplicative; they have little effects independently but work together, to a great deal, in growth rates.
- ▶ Pathogens involved in respiratory disease play a major factor in variation in growth, mostly through appetite.

- ▶ Interventions to improve growth rates should look also at variation in growth rates as the effect maybe much more on slower growing pigs. If the opposite is true, the effect is probably useless.
- ▶ The benefits of decreasing variation in growth rates are greater in fixed turnover systems.

System Capabilities and Design

The second area that needs to be identified in optimizing grow/finish management is to match the capabilities of the system in terms of the variable output with the capabilities of the buyer to handle this output. Matching these capabilities is something that is emphasized in statistical process control but is rarely mentioned in pig production. It probably goes along with the idea that the seller of pigs should not only passively accept prices but also specifications. This should be actively reexamined as the two are far from being independent.

In regular manufacturing the simple question is whether your product is capable of adequately meeting buyers' specifications. In the case of swine production, the buyers' specifications are reflected in the grading grid. There is some expectation of variation in input characteristics and there is a reduction in price when pigs coming in do not meet the specifications, particularly for weight.

The grid assumes the ability of the producer to meet these specifications and they are biologically plausible. The main question is whether meeting the specifications of the packer is financially beneficial. In an AIAO production system this depends upon:

- ▶ the variation in weights within a barn
- ▶ the cost to select pigs within the correct weight range and market them as they reach those weight ranges
- ▶ the cost to retain slow growing pigs until they meet the targeted weight range

Taking this to absurdity, we could argue that every pig can meet the targeted weight category of the buyer. However, this will come at considerable cost and therefore much time is spent in balancing the cost and benefits of intervention to reduce the variability of weights at time of marketing.

Short-run Decisions

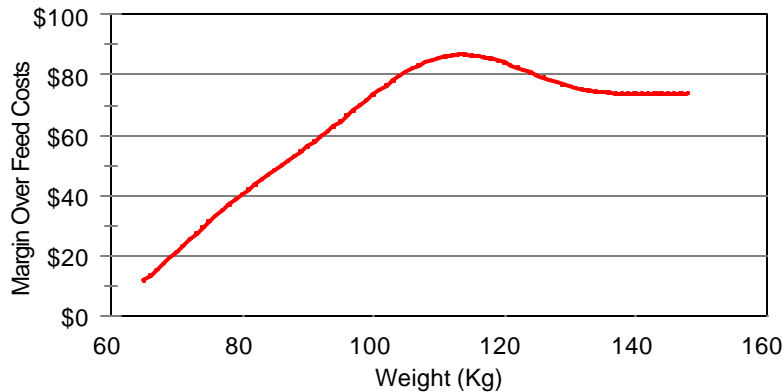
In AIAO barns the decisions made, in developing a strategy to market pigs as they reach market weight, must balance the demands to use the capital invested in facilities efficiently with meeting packer specifications. However, we must remember that marketing is an end decision, not an overall strategy. In other words, we must focus on the economic pressures experienced during a

relatively short period. Thus, averages are not applicable in most cases and decisions are made on marginal economic performance, commonly marginal profit, which is usually approximated by additional margin over feed costs. The corollary is thus that most marketing decisions should ignore fixed costs. Instead, marketing decisions must focus on opportunity cost (those potential profits or losses to be made if an alternative course is taken).

In most cases the first step that we should do is to define the profitability at the level of the pig. This has been shown in the past and involves identifying the value of the pig over time and the feed cost of maintaining a pig over time.

The feed costs are relatively straightforward to identify if we know the feed conversion curve. The value of the pig involves knowing the value of the average pig at different weights for a particular pricing grid. Figure 1 shows one such relationship; the margin over feed cost that the pig experiences if marketed at differing weights. This margin increases quickly as the pig enters the target weights as defined by the pricing grid. It then quickly decreases as the pig exceeds that target weight and increases in feed cost due to a worsening feed conversion. The optimal weight is when there are no further profits to be gained by retaining that pig. In Figure 1 this occurs when the pig reaches a weight of 114 Kg.

Figure 1. MOFC for pigs on the Fletcher grid at \$130/100 Kg base price



The opportunity cost can be of two types. First, there are pigs sold before that optimal weight. These pigs lose the opportunity to have added margin over feed costs and thus the producer loses potential profits. If pigs are too heavy, we see real losses due to the added cost of retaining the pig and the decreased value of that pig. These are simply estimated as the differences between the margin over feed costs at the optimal weight and the actual weight.

Of course, not all costs are included in determining the optimal weight. For AIAO groups it is not an optimal weight we are targeting, but an optimal closing time where the cost of maintaining the population does not justify the retention of the pigs. This always involves a proportion of the herd that is below the optimal marketing weight on an individual base.

Therefore, we not only have to create a daily margin over feed cost for individual pigs, we must also create it for a population of pigs. The populations of pigs that exist are not homogeneous; they are at different weights at the same time, have different marginal average daily gains, feed conversions and carcass characteristics. In our model, which we use in PigGain® (PigWin® at www.pigwin.com), we take a distribution of weights of pigs and model average daily gain and feed conversion as a function of those individual weights. This is then simulated over the population in the barn to give, at any point in time, a total margin over feed cost curve of the pigs in the inventory.

Figure 2. Margin over feed costs for a group

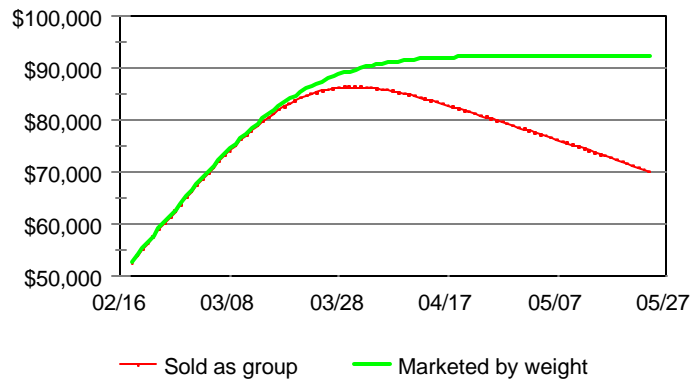
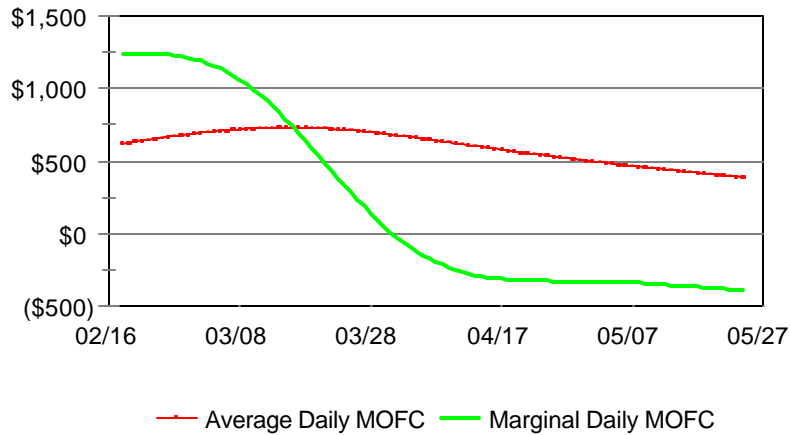


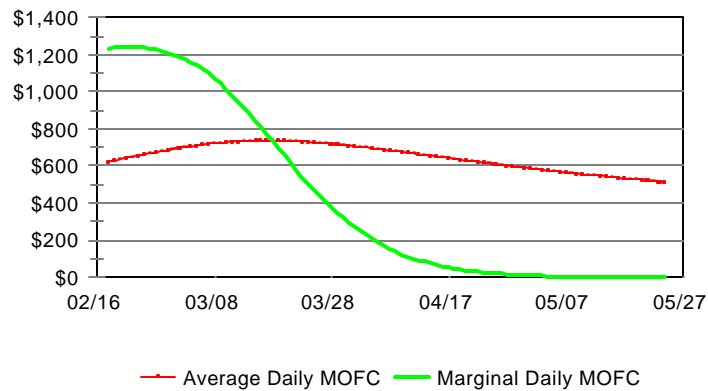
Figure 2 shows the margin over feed cost curve for all pigs in the barn of 1,000 pigs. It shows a similar relationship as portrayed for the individual pig MOFC curve. In this graph we also show the curve for a barn where the pigs are not retained past their optimal weight, but instead marketed. Weekly marketing or marketing by load closely approximates this curve. Of course, the effects of pulling the heaviest pigs out of a pen are not modeled. Over the whole herd the effects are usually relatively small as many pens are not affected and other pens have a large proportion of pigs removed with the remaining pigs responding more heavily to the added space available.

Figure 3. Daily margins over feed costs (MOFC for a one pull system)



Figures 3 and 4 are not used to identify optimal market weights, but instead optimal close out times. The decision to close out can be driven by simply the design of the system where the close out period is preordained. It can also be driven simply by the pressure by pigs to be placed in that facility. However, in both cases design consideration should also be involved. If unlimited contracts are available, these barns should be retained until that point at which the daily margin over feed cost goes below the fixed cost of maintaining that sight. Often this is simply the contract price. With a fixed capacity of pigs, the group should be closed out to maximize the average daily margin over feed costs. Figures three and four show this for barns sold as a group and marketed by weight, respectively.

If the capacity is static and there is an adequate supply of pigs to put in these facilities then a different rule should be followed. Here the barn should be closed where the daily margin over feed cost drops below the average margin over feed cost. In other words there is more profit to be made by emptying the barn and replacing those pigs with new pigs. This of course assumes that prices stay static and so do input prices. The one pull method should close out at 107 days to give an average daily margin over feed costs of \$731 and the multiple pull system closes similarly, at 109 days and \$737 of average daily margin over feed costs.

Figure 4. Daily margins over feed costs (MOFC for a multiple pull system)

▪ The Challenge

There is a balance between creating an expected performance, and creating a marketing strategy based on that expected performance. If that expected performance is reasonable and relatively consistent, then we can schedule when the trucks will roll out to the barn. We must then monitor the performance of that group of pigs to ensure that they are meeting expected performance levels. The question is “how much of a deviation from expected performance does there have to be before the marketing strategy will be changed”. If this is relatively broad then the monitoring can be quite simple. In some cases, it can be as simple as the disappearance of feed. This is called a robust marketing model.

Conversely, if the changes are relatively small before we create a change in our strategies, then the monitoring system must be much more sensitive to ensure that we have the correct measure. This is more difficult to obtain and assumes a rather sensitive marketing strategy that is prone to error.

To achieve a robust marketing strategy, we must have consistent performance, a complex predictive model that takes into account factors such as seasonality, and a grid that allows for some variation in specification of pigs delivered. This is what we are seeing developing in the American market and if this continues we will be much closer to a marketing model that is seen in other industries. It is only then that the design and approach to grow/finish can be done in an efficient manner.