Using a Stochastic Model to Evaluate Swine Production Management with Paylean® V: Split-weight Management

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Introduction

The concept of split-weight feeding management for swine production has existed for a long time. However, because of the high cost of separating pigs by hand, split-weight management is not widely adopted by pig producers. Recently, with the introduction of the Automatic Sorting Technology (AST) into the hog industry, split-weight management is made easier and cheaper to accomplish once the AST barn is invested. To help producers implementing split-weight management, it is necessary to evaluate the benefit of split-weight feeding and to investigate the optimal dietary nutrition management for different weight groups of pigs.

Model Restrictions

In this research, the return and optimal management of split-weight management was investigated using a stochastic growth model. The model assumed pigs were split by weight into two groups when pigs were 100 days of age: a heavier group versus lighter group, at the late finishing stage when they average 146 lbs. The model assumed that Paylean (ractopamine, RAC) was used in the swine production and it could be fed at different concentrations and durations for each group. Different dietary lysine concentrations were allowed to be fed with Paylean. Although the model can actually be utilized to optimize the timing of splitting, this was not examined in this research.

There were several model restrictions incorporated in the research. The model assumed that three diets were fed to each split weight group, one diet before Paylean onset and two diets containing Paylean. The same dietary lysine concentration was fed to both groups before Paylean. The lysine concentration in diet 1 was fixed as the optimal concentration without splitting (see Table 4 in Part I). It was also assumed that diet 2 must be fed for exactly 2 weeks, and then switched to the diet 3.

The optimal management was derived for four payment schemes: (1) carcass payment with discounts on underweight and overweight carcasses; (2) carcass merit payment system adopted from Hormel's Carcass Lean Value Program; (3) lean to fat price ratio of 2:1, with discounts on underweight and overweight carcasses; and (4) lean to fat price ratio of 4:1, with discounts on underweight and overweight carcasses. The carcass weight discount grid for payment schemes 1, 3 and 4 were also adopted from Hormel's Carcass Lean Value Program, which was the standardized grid for 0.51-0.90 inch last rib backfat. Payment schemes 1 and 2 reflected the marketing approaches by independent producers. Payment scheme 3 simulated the producers under limited coordination with packers, while payment scheme 4 reflected vertically integrated producers, because the lean to fat ratio of 4:1 allowed producers to capture the full benefit of the increase in carcass value.

The barn size of 1,000 head was used; thus, each weight group consisted of 500 head. Pigs were marketed together regardless of weight groups. It was assumed that as long as the number of pigs heavier than the sort weight exceeded 170 head, the heaviest 170 pigs were marketed on a semi-truck. For a group size of 1,000 head, six truckloads were needed to market all the pigs. To

sum up, the model optimized 14 variables: two Paylean concentrations, two optimal Paylean onset ages, two dietary lysine concentrations for diet 2, two dietary lysine concentration for diet 3, and six marketing days.

Results

The optimal return and management for split-weight management are displayed in Table 1. Compared with the non-split return, the increased return for split-weight management was $95 to $129 per barn per year, which indicated that the return would be very close to each other.

The difference in optimal dietary Paylean concentration was not significantly different for the heavier half versus the lighter half. The optimal RAC concentrations for heavier group were either equal to or 0.5 ppm higher than that for the lighter group. Pigs with low growth rate in the lighter group required much higher dietary lysine concentrations than pigs in the heavier group.

The optimal marketing batches were three for payment scheme 1 and two for the other three payment schemes. The results, as well as the optimal marketing ages, were the same as the optimal management without splitting. The first batch of marketed pigs contained only or almost only pigs from the heavier group, while the last marketing batch consisted mostly or all of pigs from the lighter group. Therefore, even with split-weight management for Paylean and dietary lysine concentrations, the lighter half of pigs still marketed at the same older ages, like the non-split management.

The optimal average duration of feeding Paylean increased as the payment for lean increased and was one to four days greater for the light group of pigs than for the heavy group of pigs. Overall the optimal management resulted in the pigs of the two groups starting Paylean at similar ages. The heaviest group of pigs started on Paylean and were marketed at heavier weights than pigs in the light group. Other than the initial and final weights on Paylean, the optimal management of Paylean for the two groups was similar.

It is important to note that this simulation was for pigs of the same sex and farrowed within a 7 day period. Facilities with larger amounts of variation would be expected when they contain barrows and gilts, a greater range in age (i.e. 2 weeks), or poorer health status. This would result in a greater difference in the optimal time to start the feeding of Paylean and marketing time for the heavy and light groups. The optimal duration of Paylean feeding for each group would be expected to stay in the 22 to 30 day range. The benefits of split-weight management is likely a function of the variation in weight within the facility and closely associated difference in optimal Paylean feeding start date for the two groups. With increased variation, the annual returns to the facility will decline as optimal marketing (sort loss versus facility utilization) will be more difficult.

Application

Simulation results showed that split-weight management for swine production with Paylean did not increase the returns to a large degree. Although the lighter half of pigs were optimally fed with a higher Paylean and dietary lysine concentrations, the optimal marketing ages would be the same as for the non-split-weight management. Because producers usually market their pigs to a targeted weight range, the growth rate of the lighter pigs has to be increased to speed up the barn turnover, and thus increase the production return.

The predicted return from the model simulation would be helpful for producers to assess if split-weight management was economically optimal to implement. However, this research only investigated the split-weight management of a constant Paylean concentration to be fed to each weight group. In future research, split-weight management of Paylean step-up programs should be examined, because the Paylean step-up program has a greater potential to increase the growth rate of the lighter half.

Table 1. Optimal split-weight management under different marketing systems (SEW gilts; 1,000 head)

Payment system	Scheme 1		Scheme 2		Scheme 3		Scheme 4	
Group [a]	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light
Return ($/day/barn)	245.91		282.23		315.13		347.01	
Return over control ($/pig)	1.81		2.66		3.14		4.97	
Return over non-splitting ($/barn/year)	113.51		125.19		63.62		128.88	
1st batch, day	152		152		152		149	
2nd batch, day	158		157		157		155	
3rd batch, day	160		N/A		N/A		N/A	
Sort Weight	123		123		123		121	
RAC, g/ton	4.5	5.0	4.5	5.0	5.9	5.9	9.5	10.0
Lysine in diet 1, %	0.77	0.77	0.83	0.83	0.79	0.79	0.82	0.82
Lysine in diet 2, %	0.86	0.92	0.91	0.98	0.94	0.98	1.01	1.04
Lysine in diet 3, %	0.76	0.78	0.8	0.84	0.78	0.83	0.85	0.87
RAC Start age, day	133	134	131	130	128	129	125	127
Pigs on 1st batch	170	0	169	1	169	1	170	0
Pigs on 2nd batch	151	19	331	499	331	499	330	500
Pigs on 3rd batch	179	481	N/A	N/A	N/A	N/A	N/A	N/A
Average days on RAC	23.7	25.9	22.7	27.0	27.3	28.0	28.0	30.0

[a] Pigs are split based on weight at 100 days of age with equal numbers in heavy and light groups.