Using a Stochastic Model to Evaluate Swine Production Management with Paylean® III: Fixed Schedule Environment

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Introduction

Modern swine producers often face a fixed schedule for barn closeout, either due to a contracted date for delivering market hogs or the arrival of a new group of feeder pigs. With a fixed schedule, producers have to adjust their management strategies in order to shift the growth rate of the animals and raise the hogs to the packer's desired weight range. Because Paylean (ractopamine, RAC) has proved to be able to enhance swine growth rate, as well as change the lean growth rate, it is a potential tool for producers to handle a fixed schedule environment and increase returns of swine production. In this research, the economically optimal return and management strategies for swine production with the application of Paylean were investigated for alternative fixed schedule environments.

Simulation Setting

A simulation approach using the stochastic model introduced in Part I was employed in this study. Pigs were assumed to be marketed under payment scheme 3; thus, the revenue is approximately related to lean growth through a linear function. The alternative fixed schedule environments were simulated as restricted marketing dates for the last batch of pigs. Fixed schedules investigated here ranged from day 137 to 177, with a step size of 4 days and day 157 being the optimal marketing age of the last batch of pigs without any restrictions (see Table 4 in Part I). Two types of Paylean management strategies were investigated: 1) fixing the dietary Paylean concentration as 5.9 g/ton (6.5 ppm), which was optimal without restrictions; and 2) optimizing the Paylean concentration under each fixed schedule.

Result Analysis

Model predictions of optimal return and management under each fixed schedule are displayed in Tables 1 and 2 for fixed and optimized Paylean concentration management, respectively. In both tables, the first row denotes the days when the last batch has to be marketed, and again day 157 is the obtained optimal age without restrictions. Therefore, for those marketing days less than 157, pigs are raised and marketed on tight schedules; otherwise, pigs are on loose schedules.

The results showed that tight schedules tended to lead to a fewer number of batches for marketing the pigs, and a loose schedule resulted more batches. The optimal sort weight for schedules where pigs were not marketed in a single batch was around 270 lbs for both tight and loose schedules, which corresponds to approximately a 200 lb carcass weight. The highest premium weight range of Hormel's grid is from 181-208 lbs. Therefore, the optimal sort weight was about the median value in part of the grid. For schedules which resulted in a single-batch marketing, there was no optimal sort weight.

The listed "return over control" in the tables was the net return from using Paylean under each schedule. The net returns of Paylean were higher for tight schedules than for loose schedules, and a tighter schedule always yielded a higher net return than a less tight schedule. The results indicated that the economic value of Paylean was higher when producers faced relatively tight schedules.

When dietary Paylean concentrations were allowed to be optimized, pigs on tight schedules had relatively higher optimal Paylean concentrations than those with loose schedules. As expected, the net returns of the optimal Paylean concentrations were higher than or equal to those with a fixed Paylean concentration of 5.9 g/ton (6.5 ppm). The net returns per dollar spent on Paylean were higher for tight schedules than for loose schedules. The highest return ratio for Paylean was 5.86 and the lowest was 1.83. Thus, even for conservative Paylean users, using Paylean seemed to be plausible in swine production.

The model also predicted the number of pigs receiving discounts when carcass weights were outside the packer's desired range. When pigs were marketed at their optimal weight or age, the number of underweight and overweight pigs were both small, close to 7-8%. However, in tight or loose schedules, either the underweight or the overweight pigs were higher than the optimal level. This indicated that the optimal marketing age was obtained by balancing the number of underweight pigs with overweight pigs. The tables also display the amount of sort loss due to under- and overweight carcasses. The total amount of sort loss was the least when there was no fixed schedule restriction. All these indicated that the packer's discount grid was a critical factor in determining the revenue of production and the optimal marketing ages for each batch.

The optimal return and management of control pigs are displayed in Table 3, where day 165 yielded the highest average daily return. Thus, the restricted marketing days before day 165 were tight schedules and those after were loose schedules. Compared with Paylean-treated pigs, control pigs had a higher percentage of underweight carcasses and lower percentage of overweight carcasses under the same restricted marketing age. Control pigs generally yielded a higher sort loss than Paylean-fed pigs, except around day 165, which was close to the optimal marketing age under no restriction.

Application

Paylean proved to have higher economic values under tight marketing schedules than when pigs were marketed under the optimal marketing age or under loose schedules. With extremely tight schedules, the dietary concentration of Paylean should be increased to a large degree, while with loose schedules, the Paylean concentration should be decreased slightly. In most cases, the supplementation of Paylean reduced the sort loss from under- and overweight carcasses, except when the marketing age of control pigs were approximately optimized. Under all fixed environments examined, Paylean fed pigs produced a higher return than control pigs. A major contribution to revenue from Paylean was that it reduced the numbers of underweight pigs.

Table 1. Optimal Paylean and marketing management for alternative fixed schedules (SEW gilts marketed under payment scheme 3 and fed 5.9 g/ton (6.5 ppm) of Paylean, 1,000 head)

Fixed schedule day [a]	137	141	145	149	153	157	161	165	169	173	177
Return, $/barn,day	177.52	237.43	278.72	301.51	311.08	315.64	313.11	308.14	300.79	291.91	283.95
Return over control pig ($/head) [b]	12.00	10.13	10.02	6.55	4.86	4.02	3.09	2.57	2.21	1.79	1.65
Marketing batches	1	1	1	1	2	2	3	4	5	5	6
Days on RAC (first batch)	28	28	28	28	26	23	20	18	16	11	11
Days on RAC (last batch)	28	28	28	28	28	29	29	31	30	25	25
Average days on RAC [c]	28.0	28.0	28.0	28.0	27.7	28.0	26.8	26.9	26.7	22.3	23.1
RAC intake (gram/group)	910.04	924.62	938.06	950.04	473.70	484.72	463.98	466.50	460.76	389.19	400.87
Return Ratio of RAC ($/$)[d]	5.86	4.87	4.75	3.06	4.56	3.68	2.96	2.45	2.14	2.04	1.83
% underweight carcass	76.0	58.6	40.2	23.8	13.5	7.5	3.8	1.8	1.1	0.6	0.2
% overweight carcass	0.1	0.4	1.2	4.3	6.7	10.8	12.3	14.0	10.1	15.9	16.9
Sort loss due to under-weight carcasses ($/1,000 head)	13,285	8,321	4,664	2,455	1,267	808	259	141	83	35	20
Sort loss due to over-weight carcasses ($/1,000 head)	24	51	116	319	574	485	883	900	644	880	931

[a] Fixed schedule day is the marketing day for the last batch.

[b] Return over control pigs is calculated as the daily return of RAC-treated pigs minus that for control pigs under the same payment scheme, then the difference is multiplied by the number of days on feed for RAC pigs from a 50 day old feeder pig, allowing 5 days with the barn empty in-between each group.

[c] Average days on RAC is computed as the weighed average of days for each batch of pigs fed on RAC.

[d] The ratio is the net return of RAC divided by total cost of RAC, which denotes the amount of dollars received for one dollar spent on RAC.

Table 2. Optimal Paylean and marketing management for alternative fixed schedules (SEW gilts marketed under payment scheme 3)

Fixed schedule day [a]	**137**	**141**	**145**	**149**	**153**	**157**	**161**	**165**	**169**	**173**	**177**
RAC, g/ton	12.7	11.8	10.4	8.6	7.7	5.9	5.9	5.9	5.0	4.5	4.5
Return, $/barn,day	182.96	241.77	281.06	302.29	311.97	315.64	313.11	308.14	301.20	292.32	284.40
Return over control pig ($/head) [b]	12.50	10.55	10.25	6.63	4.96	4.02	3.09	2.57	2.27	1.84	1.71
Marketing batches	1	1	1	1	2	2	3	4	5	5	6
Days on RAC (first batch)	26	27	27	28	26	23	20	18	16	12	12
Days on RAC (last batch)	26	27	27	28	29	29	29	31	30	32	36
Average days on RAC [c]	26.0	27.0	27.0	28.0	28.5	28.0	26.8	26.9	26.7	23.3	24.1
RAC intake (gram/group)	1,810.9	1,768.9	1,590.7	1,380.1	633.4	484.7	464.0	466.5	390.7	313.1	322.2
Return Ratio of RAC ($/$)[d]	3.07	2.65	2.87	2.13	3.48	3.68	2.96	2.45	2.58	2.61	2.35
% underweight carcass	74.	55.7	38.5	23.2	13.3	7.5	3.8	1.8	1.1	0.7	0.3
% overweight carcass	0.1	0.5	1.4	4.4	6.1	10.8	12.3	14.0	10.0	14.7	16.1
Sort loss due to under-weight carcasses ($/1,000 head)	12,688	7,829	4,387	2,370	1,210	808	259	141	83	39	24
Sort loss due to over-weight carcasses ($/1,000 head)	24	55	124	330	469	485	883	900	602	861	922

[a] Fixed schedule day is the marketing day for the last batch.

[b] Return over control pigs is calculated as the daily return of RAC-treated pigs minus that for control pigs under the same payment scheme, then the difference is multiplied by the number of days on feed for RAC pigs from a 50 day old feeder pig, allowing 5 days with the barn empty between groups.

[c] Average days on RAC is computed as the weighed average of days for each batch of pigs fed on RAC.

[d] The ratio is the net return of RAC divided by total cost of RAC, which denotes the amount of dollars received for one dollar spent on RAC.

Table 3. Optimal marketing management for fixed schedules (SEW gilts without Paylean and marketed under payment scheme 3; 1,000 head/group)

Fixed schedule day	137	141	145	149	153	157	161	165	169	173	177
Return, $/barn,day	47.05	131.93	178.52	238.58	266.05	279.78	286.43	286.74	282.93	277.95	271.48
Marketing batches	1	1	1	1	1	2	3	4	4	5	5
Sort weight, lbs	N/A	N/A	N/A	N/A	N/A	269	269	269	271	271	271
Mean weight of pigs sold	220	228	235	243	251	257	263	268	272	274	276
% underweight carcasses	90.4	78.0	62.9	44.4	27.8	16.1	9.2	4.5	2.6	1.4	0.7
% overweight carcasses	0.1	0.1	0.5	1.2	3.0	3.2	3.9	4.8	9.7	10.7	13.0
Sort loss due to underweight carcasses ($/1,000 head)	21,039	14,303	9,302	5,383	2,874	1551	710	342	211	109	59
Sort loss due to overweight carcasses ($/1,000 head)	10	31	47	101	284	291	319	353	702	720	907