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WEANING WEIGHT RESPONSE OF PIGS TO SIMPLE AND COMPLEX DIETS[1]

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ABSTRACT

Five experiments were conducted to determine (1) the value of simple vs complex diets on gains and feed conversion of pigs weaned at a constant age but varying in weight, (2) the optimum postweaning time to change from a complex to a simple diet and (3) the effect of previous treatment on subsequent performance. In the first experiment, pigs were weaned at 3 wk ± 3 d and assigned within four weight groups (4.1, 5.0, 5.6 and 6.7 kg) to a simple or complex diet that was fed for 28 d. The complex diet improved (P<.01) pig performance in all weight groups. As anticipated, the heavier pigs (5.6 and 6.7 kg) ate more (P<.02) and grew faster (P<.03) than did their lighter weight littermates (4.1 and 5.0 kg). The second experiment involved pigs weaned at 3 wk ± 3 d that were assigned within two weight groups (4.4 and 6.6 kg) and fed a complex diet for 10 d, after which one-half of each weight group was switched to a simple diet. Pigs fed the complex diet for the entire 24-d period gained faster (P<.05) and were more efficient (P<.05) than those changed to the simple diet after 10 d. The heavier weight (6.6 kg) pigs ate more (P<.02) and gained faster (P<.02) than did the lighter weight (4.4 kg) pigs. A diet × weight interaction (P<.02) for feed to gain ratios indicated that the heavier pigs showed better feed conversion when changed to the simple diet than did the light weight pigs, but the reverse was true for those fed the complex diet for 24 d. Pigs in Exp. 3 weaned at 4 wk ± 3 d and assigned within two weight groups (6.6 and 8.4 kg) to the same dietary treatments that were fed in Exp. 2 responded similarly when fed either simple or complex starter diets. Experiments 4 and 5 were conducted to determine the optimum postweaning time to change 3-wk-old weanling pigs of various weights from a complex to a simple diet. In Exp. 4, pigs were assigned within two weight groups (5.0 and 6.6 kg); they were initially fed a complex diet, then changed to a simple diet on d 5, 10, 15 or 20. Average daily gain increased linearly as day of change from the complex to the simple diet increased for pigs that were lighter in weight initially. There was no difference in gain due to change date for the heavier littermates. For Exp. 5, pigs were assigned within two weight groups (4.4 and 6.0 kg) to three dietary regimens. A control group was fed a simple diet while the others were fed a complex diet initially, then changed to a simple diet on d 10 or 20 of the 34-d test period. The heavier pigs (6.0 kg) gained more (P<.01) and had higher feed intakes (P<.01) than did the lighter weight pigs (4.4 kg). Daily gain increased linearly as day of change increased (P<.01). Daily feed intake showed a quadratic effect (P<.04), with the greater intake occurring when pigs were fed the complex diet for 10 and 20 d. The effects of previous dietary treatment on subsequent performance during the growing--finishing period were significant only for carcass length (P<.04) and muscling (P<.02). Feeding complex diets to pigs weaned at 3 wk of age and weighing less than 5.6 kg seems to be a beneficial practice.

(Key Words: Diets, Weaning Weight, Pigs, Performance.)

Introduction

Annual sow productivity, expressed as number of total pigs produced, has been reported to be optimized when litters are weaned at approximately 3 wk of age (Self and Grummer, 1958; Cole et al., 1975; Krug et al., 1975). Pigs weaned at an early age generally require a complex diet in order to reach fully their growth potential (Jones and Pond, 1964;

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Meade et al., 1969b; Okai et al., 1976; Graham et al., 1981).

The majority of research that has examined the nutritional and managerial requirements of early-weaned pigs has been based on pig age at weaning. Liebbrandt et al. (1975) noted that feed intake and rate of gain increased at a faster rate after weaning as weaning age increased from 2 to 4 wk. Pig weaning weight increased as weaning age increased, suggesting that initial weight may be a factor in early-weaned pig performance. This concept is supported by the research of Graham et al. (1981), who reported that initial weaning weight had a curvilinear effect on postweaning average daily gain. The effect may be due to the influence of physiological size on enzyme development (Kitts et al., 1956).

The objectives of these experiments were to determine (1) the effect of simple vs complex diets on gains and feed conversion of pigs of similar age and farrowing group but varying in weaning weight, (2) the optimum postweaning time for changing pigs weaned at various weights but of similar age from a complex to a simple diet and the effect of previous treatment on subsequent performance, during the growing-finishing period.

Experimental Procedure

Exp. 1. Ninety-six weanling, crossbred pigs of the same farrowing group were used in three replicates of a 2 × 4 factorial arrangement of treatments consisting of two diet types (complex and simple) and four initial weight groups (4.1, 5.0, 5.6 and 6.7 kg). Diets for all experiments were calculated to contain 22% crude protein, .85% Ca, .65% P and at least 1.25% lysine. The simple diet was formulated with corn, soybean meal, minerals and vitamins, whereas the complex diet contained in addition sugar, dried skim milk, dried fish solubles and dried brewer's yeast (table 1). Pigs were weaned at 3 wk ± 3 d and allotted to the treatments in a randomized complete-block design. Feed and water were allowed ad libitum. Pigs were weighed and feed intake recorded every 4 d over a 28-d feeding period.

Exp. 2. A second experiemnt was conducted with 120 crossbred pigs in three replicates of a 2 × 2 factorial arrangement of treatments. Pigs of the same farrowing group were weaned at 3 wk ± 3 d and assigned within two weight groups (4.4 and 6.6 kg) to two dietary treatments, in a randomized complete-block design, to determine their subsequent performance after initially being fed a complex diet for 10 d.

TABLE 1. PERCENTAGE COMPOSITION OF DIETS

Ingredient	Simple	Complex
Corn (IFN 4-02-931)	46.67	20.20
Soybean meal (IFN 5-04-604)	36.96	18.90
Oats (IFN 4-03-309)	10.00	10.00
Sugar (IFN 4-04-701)		10.00
Dried skim milk (IFN 5-01-175)		30.00
Dried fish solubles (IFN 5-01-971)		5.00
Dried brewers yeast (IFN 7-05-527)		1.00
Tallow (IFN 4-07-880)	3.00	3.00
Dicalcium phosphate (IFN 6-01-080)	1.46	.45
Limestone (IFN 6-02-632)	1.06	.60
Salt (IFN 6-04-151)	.30	.30
Trace mineral premix[a]	.05	.05
Vitamin premix[b]	.20	.20
Se premix[c]	.05	.05
Chembiotic[d]	.25	.25

[a]Supplied per kilogram of diet: 100 mg Zn, 50 mg Fe, 27.5 mg Mn 5 mg Cu and .75 I.

[b]Supplied per kilogram of diet. 3,300 IU vitamin A, 440 IU vitamin D_3, 2.2 mg riboflavin, 13.2 mg d-pantothenic acid, 17.6 mg niacin, 110 mg choline chloride, 22 μg vitamin B_{12}, 2.2 mg menadione sodium bisulfate, 4.4 mg ethoxyquin and 22 IU vitamin E.

[c]Supplied .1 mg Se/kg diet.

[d]Supplied 55 g carbadox/metric ton.

At the end of 10 d, a random half of each weight group was changed to a simple diet; the other half was fed the complex diet for an additional 14 d, for a total 24-d feeding period. Pigs were weighed and feed intake recorded on d 10, 17 and 24.

Exp. 3. This experiemnt was similar in design to Exp. 2 except that the 4-wk-old weanling, crossbred pigs (n = 120) used weighed 6.6 and 8.4 kg.

Exp. 4. Ninety-six weanling, crossbred pigs from the same farrowing group were used in three replicates of a 2 × 4 factorial arrangement of treatments consisting of two initial weight groups (5.0 and 6.6 kg) and four dietary regimens. Pigs were weaned at 3 wk ± 3 d and allotted to treatment in a completely random design. Initially, all pigs were fed a complex diet. They were then changed to a simple diet on d 5, 10, 15 or 20, and the experiment was continued until 34 d postweaning. Feed and water were allowed ad libitum. All pigs were weighed and feed intake recorded at 5-d intervals through d 20 and weekly thereafter until termination of the 34-d experimental period.

Exp. 5. A second trial was conducted with 192 weanling gene-pool pigs used in two replicates of a 2 × 3 factorial arrangement of treatments. Replicate 1 contained 20 pigs/treatment and replicate 2, 12 pigs/treatment. Pigs were weaned at 3 wk ± 3 d and allotted according to sex to two weight groups (4.4 and 6.0 kg) and three dietary regimens in a randomized complete-block design. A control group was fed a simple diet for the entire 34-d test period, while the others were initially fed a complex diet, then changed to a simple diet on d 10 or 20. Pigs were weighed and feed intake recorded on d 10, 20 and 34.

Upon completion of the initial 34-d nursery period, random representatives were selected from each treatment and were moved to an individual feeding unit where subsequent performance during the growing-finishing period was evaluated. Only barrows were used, seven from the first replicate and four from the second, for a total of 11 replications/treatment. Pigs were allotted to treatment in a randomized block design. All pigs received the same 16% crude protein, simple corn-soybean meal diet until reaching 45 kg, after which the diets contained 14% crude protein until the pigs reached 100 kg. Pigs were weighed and feed intake recorded every 2 wk. At 100 kg the pigs were taken off test, slaughtered and carcass measurements taken. The response criteria were analyzed using initial weight and final weight as covariates.

Response criteria for all experiments were analyzed according to statistical methods described by Steel and Torrie (1980) and implemented by SAS (1979). The pen mean was used as the experimental unit and the data were subjected to regression analysis. Orthogonal contrasts were made among treatment means.

Results and Discussion

Exp. 1. During the 28-d trial, pigs weaned at 3 wk (same farrowing group) and fed a complex starter diet gained faster ($P<.01$), consumed more feed ($P<.01$) and showed improved feed conversion ($P<.01$) as compared with those fed a simple diet (table 2). Numerous reports in the literature indicate that daily gains improved when complex diets were fed to 2- to 3-wk-old weanling pigs, seemingly associated with greater feed intake or improved feed conversion or a combination of the two, when compared with pigs fed a simple diet (Danielson et al., 1960; Graham et al., 1981; Jones and Pond, 1964; Okai et al., 1976). There are contrasting results as regards feed conversion. Hays et al. (1959), Meade et al. (1965), Graham et al. (1981) and Wilson and Leibholz (1981) all reported improvements in feed conversion when complex starter diets were fed, whereas Meade et al. (1969b) and Okai et al. (1976) did not observe any improvement in feed efficiency when diets containing dried skim milk were fed to weanling pigs.

Pigs in the two heavier groups (5.6 and 6.7 kg) gained faster ($P<.03$) and consumed more ($P<.03$) feed than the pigs in the two lighter weight groups (4.1 and 5.0 kg). The heavier pigs' ability to consume more feed appeared to result in the observed increase in average daily gain, because feed conversion ratios were similar. Graham et al. (1981) found that initial weight in pigs weaned at 2 wk had a curvilinear effect on average daily gain. Daily gain was improved but the effect decreased progressively with each increment increase in initial weight. Performance differences in the experiment reported herein between the two lighter weight groups were not significant. Similar results were observed between the two heavier groups and suggest there may be a favorable weaning weight between 5.0 and 5.6

kg for optimum adaptation to diets after weaning. There were no significant diet × weight interactions for any of the response criteria. The results are somewhat in contrast to those reported by Oaki et al. (1976). The difference between the two studies might be explained on the basis that the pigs used in the studies reported herein were younger and lighter in weight than those used by Okai et al. (1976).

Exp. 2. The results of changing 3-wk-old weanling pigs of various weights to a simple diet after initially being fed a complex diet for 10 d are presented in table 3. Pigs fed the complex diet for the entire 24-d trial gained faster ($P<.05$), ate more ($P<.05$) and exhibited improved ($P<.05$) feed conversion when compared with pigs switched to a simple diet after 10 d. Based on these results, it appears that the complex diet must be fed to 3-wk-old weanling pigs for more than 10 d to obtain maximum performance. Pigs in the heavier group (6.6 kg) had greater ($P<.02$) daily gains and consumed more ($P<.02$) feed than did the lighter weight (4.4 kg) pigs.

Exp. 3. Contrary to the response observed with pigs weaned at 3 wk of age (Exp. 2), there was no advantage to feeding the complex diet for longer than 10 d for 4-wk-old weanling pigs (table 4). Gain, feed intake and feed to gain ratio for the pigs fed the complex diet for 10 d, then switched to a simple diet, were similar to those of pigs fed the complex diet for the entire 24-d period. None of the main effects or interactions was significant.

Exp. 4. Effects of feeding a complex diet for various intervals to 3-wk-old weanling pigs before changing to a simple diet are presented in table 5. There was a weaning weight × linear day of change interaction ($P<.03$) for daily gain. Daily gain increased linearly as day of change increased for pigs weighing 5.0 kg at weaning, but was essentially unchanged for those weighing 6.6 kg. Okai et al. (1976) found a similar weight response when pigs weaned at 5 wk of age were divided into light and heavy groups and fed either a complex or simple diet. Thus, weaning weight might be used as a criterion for minimizing the time that complex diets are fed to early-weaned pigs.

Daily feed intake increased linearly ($P<.05$) as the length of time that the complex diet was fed increased. The increase in daily gain by the light weight (5.0 kg) pigs was undoubtedly a reflection of their increase in daily feed intake because feed conversion was not significantly affected by the length of time that they were fed the complex diet. No significant weight × linear interaction was observed for daily feed intake. It appears that the heavier 3-wk-old weanling pigs were less dependent on a complex diet to maximize daily feed intakes.

TABLE 2. WEANING WEIGHT RESPONSE OF PIGS FED SIMPLE AND COMPLEX DIETS (EXP. 1)[a]

Item	Diet type	Weaning weight, kg 4.1	5.0	5.6	6.7	Diet effect	CV[b], %
Avg daily gain, kg[cd]	Simple	.27	.27	.33	.30	.29	12.5
	Complex	.36	.38	.39	.44	.39	
Weight effect		.32	.33	.36	.37		
Avg daily feed, kg[cd]	Simple	.39	.44	.49	.47	.45	11.8
	Complex	.49	.50	.54	.60	.53	
Weight effect		.44	.47	.52	.54		
Feed to gain ratio[c]	Simple	1.45	1.66	1.49	1.58	1.55	6.1
	Complex	1.34	1.34	1.37	1.35	1.35	
Weight effect		1.40	1.50	1.43	1.47		

[a]Pigs weaned at 3 wk ± 3 d.

[b]Coefficient of variation.

[c]Diet effect ($P<.01$).

[d]Weight effect (4.1 and 5.0 vs 5.6 and 6.7, $P<.03$).

Feed efficiency was not significantly affected by dietary regimen. The failure of increased number of days fed the complex diet to improve overall feed efficiency is in agreement with previous research by Meade et al. (1969b) and Okai et al. (1976).

Exp. 5. Pigs heavier at weaning (6.0 kg) had greater (P<.01) average daily gains and improved daily feed intake than did their lighter weight (4.4 kg) litter mates (table 6). Daily gain increased linearly as days fed the complex diet increased (P<.01) from 0 to 20 d. There was a quadratic response (P<.04) for daily feed intake related to days fed the complex diet. Intake increased when the complex diet was fed for 10 d, but failed to increase linearly when fed for 20 d. Feed efficiency was not significantly affected by dietary regimen.

TABLE 3. EFFECTS OF CHANGING 3-WEEK-OLD WEANLING PIGS TO A SIMPLE DIET (S) AFTER INITIALLY BEING FED A COMPLEX (C) DIET FOR 10 DAYS (EXP. 2)

Item	Diet treatment	Weaning weight, kg		Diet effect	CV[a], %
		4.4	6.6		
Avg daily gain, kg[bc]	C–S	.15	.21	.18	11.7
	C	.24	.29	.27	
Weight effect		.20	.25		
Avg daily feed, kg[bc]	C–S	.34	.41	.38	9.6
	C	.38	.48	.43	
Weight effect		.36	.45		
Feed to gain ratio[bd]	C–S	2.34	1.97	2.16	7.0
	C	1.57	1.67	1.62	
Weight effect		1.96	1.82		

[a]Coefficient of variation.

[b]Diet effect (P<.05).

[c]Weight effect (P<.02).

[d]Diet × weight effect (P<.02).

TABLE 4. EFFECTS OF CHANGING 4-WEEK-OLD WEANLING PIGS TO A SIMPLE DIET (S) AFTER INITIALLY BEING FED A COMPLEX (C) DIET FOR 10 DAYS (EXP. 3)

Item	Diet treatment	Weaning weight, kg		Diet effect[a]	CV[b], %
		6.6	8.4		
Avg daily gain, kg	C–S	.39	.38	.39	8.4
	C	.39	.40	.40	
Weight effect		.39	.39		
Avg daily feed, kg	C–S	.56	.57	.57	7.2
	C	.56	.58	.57	
Weight effect		.56	.58		
Feed to gain ratio	C–S	1.44	1.50	1.47	3.5
	C	1.45	1.46	1.46	
Weight effect		1.45	1.48		

[a]None of the differences was significant.

[b]Coefficient of variation.

TABLE 5. PERFORMANCE OF 3-WEEK-OLD PIGS CHANGED FROM A COMPLEX TO A SIMPLE DIET AT VARIOUS TIMES (EXP. 4)[a]

Item	Weaning wt, kg	Change times, d 5	10	15	20	Weight effect	CV[b], %
Avg daily gain, kg[cd]	5.0	.29	.32	.33	.39	.33	10.3
	6.6	.35	.34	.36	.34	.35	
Change effect		.32	.33	.35	.37		
Avg daily feed, kg[c]	5.0	.50	.53	.54	.65	.56	10.3
	6.6	.61	.58	.63	.60	.61	
Change effect		.56	.56	.59	.63		
Feed to gain ratio	5.0	1.75	1.67	1.65	1.66	1.68	4.3
	6.6	1.75	1.69	1.73	1.74	1.73	
Change effect		1.75	1.68	1.69	1.70		

[a]A 2 × 4 factorial with three pens of four pigs•pen^{-1}•treatment^{-1} (3 wk ± 3 d).

[b]Coefficient of variation.

[c]Linear effect of change time ($P<.05$).

[d]Weight × linear change time interaction ($P<.03$).

Contrary to Exp. 4, there was no weight × linear interaction for average daily gain. The heavier group in this experiment was lighter in weight (6.0 kg) than the heavier group in the previous experiment (6.6 kg). This may explain the contrasting results. Also, the pigs in this experiment were penned in larger groups (12 and 20 vs 4 pigs/pen) than were those in the previous experiment. Larger group size may have created a more stressful situation, resulting

TABLE 6. PERFORMANCE OF 3-WEEK-OLD PIGS CHANGED FROM A COMPLEX TO A SIMPLE DIET AT VARIOUS TIMES (EXP. 5)[a]

Item	Weaning wt, kg	Change times, d 0	10	20	Weight effect	CV[b], %
Avg daily gain, kg[cd]	4.4	.27	.32	.35	.31	4.3
	6.0	.33	.36	.39	.36	
Change effect		.30	.34	.37		
Avg daily feed, kg[ce]	4.4	.48	.58	.59	.55	4.7
	6.0	.56	.65	.62	.61	
Change effect		.52	.62	.61		
Feed to gain ratio	4.4	1.78	1.81	1.69	1.76	5.7
	6.0	1.70	1.81	1.59	1.70	
Change effect		1.74	1.81	1.64		

[a]A 2 × 3 factorial with one pen of 20 pigs•pen^{-1}•treatment^{-1} in replicate 1 and one pen of 12 pigs•pen^{-1}•treatment^{-1} in replicate 2 (3 wk ± 3 d).

[b]Coefficient of variation.

[c]Weight effect ($P<.01$).

[d]Linear effect ($P<.01$).

[e]Quadratic effect ($P<.04$).

in the heavy group responding to the complex diet in the same manner as the light weight group.

The quadratic response of daily feed intake indicates that the effect of the complex diet diminished after 10 d. This is contrary to Exp. 4, where daily intakes increased linearly as the number of days that the complex diet was fed increased. Feed efficiencies among the treatments were not significantly different; however, there was a trend for the pigs fed the complex diet for 20 d to be the most efficient.

Increased performance of the heavier pigs appeared to be a reflection of their ability to consume more feed. Previous experiments have also noted that feed intake and rate of rain increased at a faster rate as weaning weight increased (Leibbrandt et al., 1975; Graham et al., 1981).

The results of the subsequent performance of pigs switched at various times to a simple diet during the starter period are presented in table 7. Average daily gains and daily feed intakes during the growing-finishing phase were not significantly affected by previous diet fed during the starter phase. Light weight pigs fed the simple diet showed an improved ($P<.05$) feed to gain ratio when compared with the light weight pigs fed the complex diet for 10 and 20 d. Although there was a slight trend for pigs fed the simple diet in the nursery to gain more during the growing-finishing phase, the lack of a significant compensatory response by those pigs serves to justify further the use of a complex diet in the nursery for 3-wk-old weanling pigs. Because no significant compensatory response was observed, the gain advantage at the end of the nursery phase held by the pigs initially fed a complex diet was maintained throughout the growing-finishing phase. Meade et al. (1969b) found similar results.

Improvement in feed to gain ratio by the light weight pigs fed a simple diet throughout the nursery period as compared with those fed a complex diet for 10 or 20 d indicates that there was some compensatory response by those pigs. There was not, however, a significant response in the heavier pigs. Meade et al. (1969a,b) did not observe any influence of previous treatment on feed to gain ratios.

Effects of dietary treatments during the nursery phase on carcass traits are shown in table 8. Adjusted loin eye area and average backfat were unaffected by previous treatments. Heavier-initial-weight pigs (6.0 kg) had a higher ($P<.02$) percentage of muscling than did their lighter weight (4.4 kg) littermates. Faster initial growth, when pigs are rapidly building muscle,

TABLE 7. PERFORMANCE OF 3-WEEK-OLD PIGS CHANGED FROM A COMPLEX TO A SIMPLE DIET AT VARIOUS TIMES DURING THE STARTER PERIOD ON SUBSEQUENT GROWING-FINISHING PERFORMANCE (EXP. 5)[a,b,c]

Item	Weaning wt, kg	Change times, d			Weight effect	CV[d], %
		0	10	20		
Avg daily gain, kg	4.4	.73	.70	.71	.71	8.1
	6.0	.70	.72	.69	.70	
Change effect		.72	.71	.70		
Avg daily feed, kg	4.4	2.48	2.44	2.51	2.48	7.8
	6.0	2.52	2.53	2.39	2.48	
Change effect		2.50	2.49	2.45		
Feed to gain ratio[e]	4.4	3.38	3.50	3.56	3.48	5.5
	6.0	3.60	3.51	3.56	3.53	
Change effect		3.49	3.51	3.53		

[a]Means adjusted using initial weight and final weight as covariates.

[b]Values reported are least-squares means.

[c]Eleven pens of one pig•pen^{-1}•treatment^{-1}.

[d]Coefficient of variation.

[e]Light weight pigs (4.4 kg), 0 vs 10 and 20 d ($P<.05$).

TABLE 8. ADJUSTED CARCASS TRAITS OF PIGS CHANGED FROM A COMPLEX TO A SIMPLE DIET AT VARIOUS TIMES DURING THE STARTER PERIOD (EXP. 5)[a,b]

Initial wt	Diet[c]	Loin eye area, cm^2	Length, cm[d]	Backfat, cm	Muscle, %[e]
	S	27.1	79.0	4.04	48.1
4.4 kg	C–10	26.5	80.8	4.17	47.5
	C–20	25.2	79.5	4.50	46.0
	S	27.1	80.3	4.01	48.6
6,0 kg	C–10	27.7	79.0	4.04	48.9
	C–20	29.7	79.5	3.99	50.3
CV[f], %		14.5	1.8	13.3	6.3

[a]Carcass traits adjusted according to the National Pork Producers Council procedure.

[b]Eleven pens of one pig•pen^{-1}•$treatment^{-1}$.

[c]S = simple; C = complex diet. Numbers equal days fed complex diet before changing to a simple diet.

[d]C–10 vs C–20 for 4.4-kg pigs ($P<.04$).

[e]4.4 vs 6.0 kg pooled over diet ($P<.02$).

[f]Coefficient of variation.

apparently resulted in the higher muscle percentage at slaughter. Lighter-initial-weight pigs fed the complex diet for 10 d had longer carcasses ($P<.04$) than did those fed the complex diet for 20 d. The lack of a general influence of previous treatment on carcass traits is in agreement with the experiments of Meade et al. (1969a,b).

Economic justification of feeding complex diets to 3-wk-old weanling pigs must be investigated by the individual swine producer. There is clearly an advantage in daily gain for pigs fed complex diets. The advantage for each producer must be weighed against the additional cost of a complex diet. Advantages such as as increased gains, decreased days to market weight and the managerial advantages associated with them vary in economic value. If justifiable, complex diets may serve as a valuable management tool for swine producers practicing 3-wk-old weaning or an "all-in, all-out" swine production program for facility usage.

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