1 (meal form ration) and treatment 4 (3/8 inch pellet ration). Pigs on treatment 2 required significantly less feed per pound of gain than those on treatment 1.

No significant differences were noted in average daily feed intake or probed backfat thickness. Pelleting in general tended to improve average daily gains and the smallest size pellet (3/16 inch) tended to result in the best feed efficiency.

The Effect of Ration Ingredient Change on Pig Performance

W. G. Luce, C. V. Maxwell and D. C. Zoltner

Story in Brief

Two trials were conducted involving 128 growing-finishing pigs to measure the effect of marked ration ingredient change on pig performance.

Treatments involved in both trials were (1) a basal milo-soybean meal ration fed throughout the trials; (2) the cereal grain portion of the rations (milo, corn, and wheat) was rotated every 7 days; (3) the protein source (all soybean meal, ⅓ meat and bone scraps and ⅔ soybean meal, and ⅓ peanut meal and ⅔ soybean meal) was rotated every 7 days; (4) both the cereal grain and protein sources, as outlined in Treatments 2 and 3 were rotated every 7 days (nine different combinations).

No significant differences were noted in average daily gains, average daily feed intake, feed efficiency and probed backfat thickness. The results suggest that marked ration ingredient changes has little effect on pig performance when nutritional requirements are met.

Introduction

It is now possible through the use of high speed electronic computors to overcome many of the physical problems formerly associated with formulating least cost, nutritionally adequate rations from a wide number of available feedstuffs. This method of ration formulation commonly referred to as linear programming has gained some acceptance by industry and university personnel working in the area of swine nutrition.

One concern of many nutritionists and swine producers was that frequently the prices of commodities fluctuate enough from week to week to greatly influence the ingredients selected by the computor in a least cost ration. Thus the purpose of these experiments was to study the effect of marked ration ingredient change in the pig's diet on rate of gain, daily feed intake, feed utilization and probed backfat thickness.

Experimental Procedure

Two trials involving 128 purebred Hampshire or Yorkshire pigs were used in this experiment. All pigs were housed in indoor concrete pens equipped with self feeders and automatic waterers. All pigs were self fed from an average weight of 71.5 and 57.6 lb. to 213.9 and 222.2 lb. in trials 1 and 2 respectively. In both trials the pigs were randomly allotted within breed, sex and litter to four experimental treatments with eight pens (two pigs per pen) in each treatment.

The four treatments in both trials were as follows:

1. Treatment 1. A basal 16.0 percent crude protein milo-soybean meal ration was fed throughout both trials. (See ration 1 in Tables 1 and 2 for Trials 1 and 2 respectively.
2. Treatment 2. The cereal grain portion of the ration (milo, corn and wheat) was rotated every seven days. (See rations 1, 2 and 3 in Tables 1 and 2 for Trials 1 and 2 respectively.)
3. Treatment 3. The protein sources (all soybean meal, ⅓ meat and bone scraps and ⅔ soybean meal, and ⅓ peanut meal and ⅔ soybean meal) were rotated every seven days. (See rations 1, 4 and 5 in Tables 1 and 2 for Trials 1 and 2 respectively.
4. Treatment 4. Both the cereal grain and protein sources as outlined in Treatment 2 and 3 were rotated every 7 days. This was a total of nine different combinations. The combinations were: milo and soybean meal, milo and ⅓ meat and bone scraps and ⅔ soybean meal, milo and ⅓ peanut meal and ⅔ soybean meal, corn and soybean meal, corn and ⅓ meat and bone scraps and ⅔ soybean meal, corn and ⅓ peanut meal and ⅔ soybean meal, wheat and soybean meal, wheat and ⅓ meat and bone scraps and ⅔ soybean meal and wheat and ⅓ peanut meal and ⅔ soybean meal. (See rations 1 through 9

Table 1. Composition of Experimental Rations in Trial 1

	Ration number[1]								
	1	2	3	4	5	6	7	8	9
Ingredients, %									
Milo, ground[2]	74.20	–	–	78.00	76.25	–	–	–	–
Wheat, ground[2]	–	84.70	–	–	–	87.00	86.00	–	–
Corn, ground[2]	–	–	73.50	–	–	–	–	77.30	75.30
Soybean meal, 44%	22.50	12.10	23.40	13.80	13.60	7.20	7.20	14.30	14.20
Meat and bone scraps, 50%	–	–	–	6.90	–	3.60	–	7.15	–
Peanut meal, 50%	–	–	–	–	6.80	–	3.60	–	7.10
Calcium carbonate	0.90	0.90	0.80	0.15	0.85	0.60	0.90	0.15	0.80
Dicalcium phosphate	1.40	1.30	1.50	0.15	1.50	0.60	1.30	0.10	1.60
Vitamin-trace mineral mix[3]	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Composition, %									
Protein	15.99	16.01	16.00	16.01	15.98	15.99	15.99	15.98	16.01
Lysine[4]	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Calcium	0.71	0.70	0.70	0.69	0.70	0.71	0.70	0.71	0.72
Phosphorus	0.60	0.61	0.60	0.60	0.61	0.60	0.60	0.59	0.61

[1] Tylan 40 was added at the rate of 0.05% for each ration.
[2] The milo, wheat and corn analyzed 8.6, 12.8 and 8.2% crude protein respectively.
[3] Vitamin-trace mineral mix supplied 1500 I.U. vitamin A, 150 I.U. vitamin D_3, 2 mg. riboflavin, 15 mg. niacin, 10 mg. pantothenic acid, 500 mg. choline, 7.5 mcg. vitamin B_{12}, 0.22 ppm iodine, 99 ppm iron, 22 ppm manganese, 11 ppm copper and 99 ppm zinc per pound of feed.
[4] 0.03, 0.19, 0.07, 0.15, 0.24, 0.26, 0.09 and 0.13% L-lysine added to rations 1,2,4,5,6,7,8, and 9 respectively to make them equivalent in lysine content to ration 3.

Table 2. Composition of Experimental Rations in Trial 2

	Ration number[1]								
	1	2	3	4	5	6	7	8	9
Ingredients, %									
Milo, ground[2]	75.20	–	–	78.70	76.25	–	–	–	–
Wheat, ground[2]	–	83.10	–	–	–	85.55	83.90	–	–
Corn, ground[2]	–	–	76.60	–	–	–	–	79.90	77.70
Soybean meal, 44%	21.50	13.70	20.00	13.30	13.60	8.30	8.60	12.30	12.60
Meat and Bone scraps, 50%	–	–	–	6.65	–	4.15	–	6.15	–
Peanut meal, 50%	–	–	–	–	6.80	–	4.30	–	6.30
Calcium carbonate	0.80	0.90	0.80	0.15	0.85	0.50	0.90	0.15	0.80
Dicalcium phosphate	1.50	1.30	1.60	0.20	1.50	0.50	1.30	0.50	1.60
Vitamin-trace mineral mix[3]	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Composition, %									
Protein	16.00	16.02	16.00	16.02	16.01	16.01	16.01	16.00	15.99
Lysine[4]	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Calcium	0.70	0.70	0.71	0.69	0.71	0.70	0.70	0.71	0.70
Phosphorous	0.61	0.61	0.61	0.60	0.61	0.61	0.60	0.61	0.61

[1] Tylan 40 was added at the rate of 0.05% for each ration.
[2] The milo, wheat and corn analyzed 8.70, 12.02 and 9.40% protein respectively.
[3] Vitamin-trace mineral mix supplied 1500 I.U. vitamin A, 150 I.U. vitamin D_3, 2 mg. riboflavin, 15 mg. niacin, 10 mg. pantothenic acid, 500 mg. choline, 7.5 mcg. vitamin B_{12}, 0.22 ppm iodine, 99 ppm iron, 22 ppm manganese, 11 ppm copper and 99 ppm zinc per pound of feed.
[4] 0.15, 0.03, 0.06, 0.11, 0.19, 0.23, 0.09 and 0.15% L-lysine added to rations 2 through 9 respectively to make them equivalent in lysine content to ration 1.

in Tables 1 and 2 for Trials 1 and 2 respectively.)

In both trials vitamin and trace mineral supplementation, calcium, phosphorous, crude protein and lysine were held constant in all rations. All other amino acids were calculated to be at least above requirement stated by the National Research Council, 1968 but not constant in all rations. Energy content was similar in all rations.

Results and Discussion

The results of Trial 1 and 2 are shown in Tables 3 and 4 respectively. Average daily gain, feed efficiency and average daily feed intake was similar for pigs on all treatments in both trials with no significant differences being noted. When probed backfat thickness was measured in Trial 2, the results were similar for pigs on all treatments and no significant differences were noted.

Table 3. Effect of Ration Ingredient Change on Pig Performance in Trial 1

	Treatments			
	1	2	3	4
Pens per treatment, no.	8	8	8	8
Pigs per pen, no.	2	2	2	2
Av. initial wt., lb.	70.9	71.4	70.9	72.9
Av. final wt., lb.	214.0	214.7	213.3	213.4
Av. daily gain, lb.*	1.82	1.79	1.77	1.81
Feed per lb. gain, lb.*	3.14	3.05	3.13	3.11
Av. daily fed intake, lb.*	5.63	5.56	5.52	5.56

*Treatment means were not significantly different at the ($P<.05$) level.

Table 4. Effect of Ration Ingredient Change on Pig Performance in Trial 2

	Treatments			
	1	2	3	4
Pens per treatment, no.	8	8	8	8
Pigs per pen, no.	2	2	2	2
Av. initial wt., lb.	57.3	58.7	58.2	56.3
Av. final wt., lb.	223.9	223.5	221.1	220.1
Av. daily gain, lb.	1.74	1.73	1.77	1.71
Feed per lb., gain, lb.*	3.22	3.05	3.19	3.08
Av. daily feed intake, lb.*	5.56	5.25	5.62	5.23
Probed backfat thickness, in.*	1.00	1.00	1.05	1.09

*Treatment means were not significantly different at the ($P<.05$) level.

It would appear that marked ration ingredient change has little effect on pig performance. However it should be noted that in these trials, all known nutritional requirements were believed to be met on all diets fed. Furthermore, ingredients or level of ingredients used were those believed to be palatable to swine.

Effect of Protein Level on Nitrogen Balance and Reproductive Performance in Gilts

Rick D. Jones, Charles V. Maxwell, David C. Zoltner and Rollie E. Ennis

Story in Brief

Three trials involving a total of 90 gilts were conducted to evaluate the effect of crude protein intake on growth, nitrogen balance and reproductive performance of breeding gilts. Yorkshire gilts were fed graded levels of protein from approximately 146 days of age to slaughter at 30 days post-breeding.

Feeding a high protein ration (20 percent crude protein) resulted in little or no advantage in average daily gain to puberty, age at purberty or nitrogen retention prior to breeding when compared to the medium level diet (14 percent). Gilts fed the low protein ration (8 percent) gained significantly slower and tended to be older at puberty than gilts fed the 14 or 20 percent protein rations. The high protein diet (20 percent) resulted in a significantly greater nitrogen retention during early pregnancy.

The value of this increased nitrogen retention is not well understood. An increase in anestrous gilts seemed to be associated with the two lower protein levels; however, sufficient data were not obtained in