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THE EFFECT OF PROTEIN LEVEL AND AMINO
ACID SUPPLEMENTATION OF SUNFLOWER MEAL
DIETS FOR YOUNG PIGS

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Dietary protein recommendations for pigs were developed using corn-soybean meal diets. Diets formulated to contain less protein than recommended will result in reduced performance because of a deficiency of amino acid(s). However, more recent research suggests that pig performance can be maintained when feeding diets containing a substantially reduced protein content if limiting amino acids are supplemented to meet dietary requirements. Previous research at South Dakota State University has identified lysine, tryptophan and threonine as deficient amino acids in a 12% protein, corn-sunflower meal diet. The objectives of the trial reported herein were to study the effect of protein level (12, 15, 18 and 21%) in corn-sunflower meal diets containing all essential amino acids in excess of National Research Council recommendations and to determine the effect of glutamic acid supplementation to a low protein (12%) diet as a non-essential amino acid nitrogen source.

(Key Words: Pigs, Protein Level, Amino Acids, Sunflower Meal, Glutamic Acid.)

Experimental Procedure

Ninety-six crossbred pigs, weaned at 3 to 4 weeks of age were allowed a 14 day adjustment period preceeding the initiation of the trial. During the adjustment period, pigs were fed an 18% protein, corn-soybean meal diet. Following the adjustment period, pigs were allotted on the basis of litter, weight and sex to one of six dietary treatments. There were four pigs per pen and each treatment was replicated four times. The pigs averaged 18.6 lb initially and were housed in an environmentally controlled nursery located in the Animal Science Complex. Feed and water were provided ad libitum during the 28 day trial. Pig weights and feed weighbacks were taken weekly throughout the trial. Blood samples were obtained on day 28 for serum urea nitrogen, calcium, phosphorus and zinc determination.

The composition of the diets are shown in table 1. All diets contained 1.0% lysine. An 18% protein, corn-soybean meal diet was included as a positive control.

Table 1. Composition of Experimental Diets (%)

Ingredient	Treatment					
	1	2	3	4	5	6
Yellow corn	85.84	79.30	77.38	68.75	59.85	71.055
Sunflower meal	10.30	11.80	19.50	28.73	38.00	--
Soybean meal	--	--	--	--	--	26.50
Dicalcium phosphate	1.25	1.25	.84	.35	--	1.30
Limestone	.80	.80	.95	1.18	1.30	.65
Salt, white	.30	.30	.30	.30	.30	.30
Trace mineral premix	.05	.05	.05	.05	.05	.05
Vitamin premix	.03	.03	.03	.03	.03	.03
Aurofac-50 ^a	.05	.05	.05	.05	.05	.05
L-lysine	.83	.83	.70	.56	.42	.065
L-tryptophan	.10	.10	.05	--	--	--
L-threonine	.20	.20	.09	--	--	--
L-isoleucine	.15	.15	.02	--	--	--
DL-methionine	.10	.10	.04	--	--	--
Glutamic acid	--	5.04	--	--	--	--

a

Aureomycin.

Experimental treatments were:

1. 12% C.P. sunflower meal diet plus amino acids^a
2. 12% C.P. sunflower meal diet plus amino acids and glutamic acid to equal 15% C.P.
3. 15% C.P. sunflower meal diet plus amino acids^a
4. 18% C.P. sunflower meal diet plus .56% L-lysine
5. 21% C.P. sunflower meal diet plus .42% L-lysine
6. 18% C.P. soybean meal diet plus .065% L-lysine

Results

Performance data for the 28 day trial are summarized in table 2. Average daily gain and feed intake did not differ ($P < .05$) among pigs fed the 12, 15, 18 or 21% protein corn-sunflower meal diets or the 18% corn-soybean meal diet, treatments 1, 3, 4, 5 and 6 respectively. Including glutamic acid in

a

See Table 1 for amino acid additions.

the diet reduced ($P < .05$) feed consumption and rate of gain. Feed utilization was most efficient when pigs were fed the 18% protein soybean meal diet; however, feed/gain of these pigs was not different ($P > .05$) from pigs fed the 15% protein sunflower meal diet. More feed/gain was required for pigs fed the 12% protein diet supplemented with glutamic acid but feed efficiencies were not different ($P > .05$) from those of pigs fed the 12, 18 or 21% protein sunflower meal diets.

Table 2. Effect of Amino Acid Supplementation at Various Protein Levels on Performance of the Young Pig

Treatment	Sunflower Meal Diets					SBM
	1	2	3	4	5	Diet
Protein, %	12	12+GA ^a	15	18	21	18
Initial wt, lb	18.5	18.6	18.5	18.6	18.7	18.6
Final wt, lb	41.3 ^b	34.8 ^c	41.9 ^b	41.3 ^b	40.3 ^b	42.9 ^b
Avg daily gain, lb	.82 ^b	.58 ^c	.83 ^b	.81 ^b	.77 ^b	.87 ^b
Avg daily feed, lb	1.76 ^b	1.29 ^c	1.66 ^b	1.72 ^b	1.65 ^b	1.60 ^b
Feed/gain	2.15 ^{b,c}	2.25 ^b	2.00 ^{c,d}	2.11 ^{b,c}	2.13 ^{b,c}	1.86 ^d
Serum urea nitrogen, mg/dl	7.03 ^b	10.68 ^c	9.58 ^c	15.00 ^d	17.83 ^e	14.55 ^d
Serum calcium, mg/dl	10.15 ^{b,c}	9.89 ^c	10.34 ^{b,c}	10.50 ^{b,c}	10.43 ^b	10.12 ^{b,c}
Serum phosphorus, mg/dl	10.60 ^b	9.75 ^c	9.30 ^d	8.32 ^e	6.81 ^f	10.39 ^b
Serum zinc, ppm	.71 ^b	.68 ^b	.58 ^c	.55 ^c	.53 ^c	.74 ^b

a

Glutamic Acid.

b, c, d, e, f

Means without a common superscript differ ($P < .05$).

Serum urea nitrogen was lowest in pigs fed the 12% protein, sunflower meal diet (trt 1) and increased when protein or protein equivalent of the diet increased. These results indicate the 12% protein diet (trt 1) was adequate in supplying dietary essential amino acids as well as containing an adequate supply of nitrogen for non-essential amino acid synthesis. Serum calcium remained relatively constant regardless of dietary treatments. Serum phosphorus decreased with increasing dietary protein in pigs fed sunflower meal diets; however, serum phosphorus of pigs fed the 18% protein corn-soybean meal diet did not differ ($P > .05$) from those pigs fed the 12% protein corn-sunflower meal diet (trt 1). Serum zinc decreased numerically as dietary protein increased but again serum zinc concentrations of pigs fed the 18% protein, corn-soybean meal diet were not

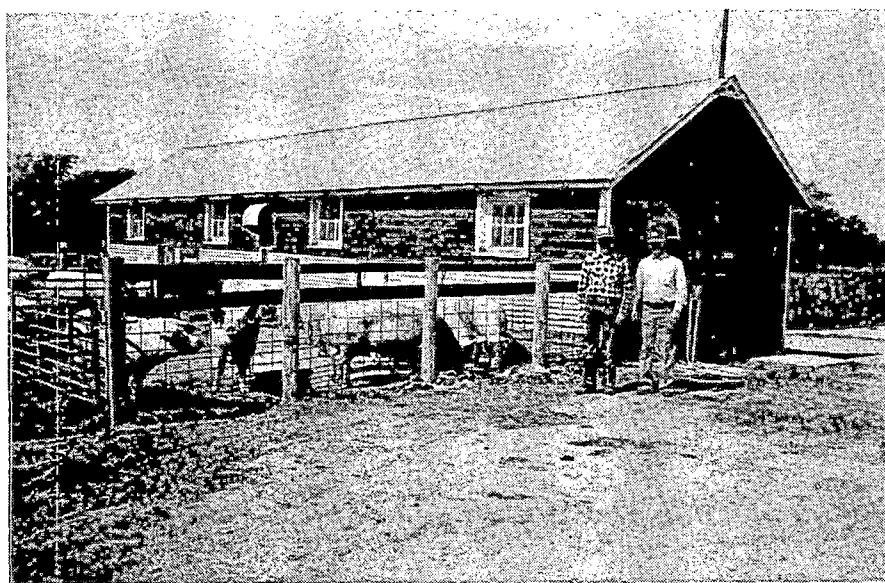
different ($P > .05$) from those pigs fed the 12% protein, corn-sunflower meal diet (trt 1).

The results of this trial indicate a 12% protein, corn-sunflower meal diet supplemented with amino acids, supplies sufficient nutrients to provide for growth equal to other higher protein sunflower meal diets. It does not however, provide nutrients for equivalent feed utilization to an 18% protein, lysine supplemented, corn-soybean meal diet. However, the diets were not equalized in energy content, thus the soybean meal diet contained more energy because of the higher fiber content of sunflower meal. Serum urea nitrogen measurements indicate the low protein, corn-sunflower meal diet contains the best amino acid balance of the diets used in this trial.

Summary

A 28 day trial, utilizing ninety-six pigs, was conducted to study the effects of amino acid supplementation of low protein, corn-sunflower meal diets and to compare 18% protein corn-sunflower and corn-soybean meal diets.

There were no differences in performance of pigs fed amino acid supplemented, corn-sunflower meal diets of 12, 15, 18 or 21% protein. Adding glutamic acid to the 12% diet at a level that increased the dietary protein to 15% resulted in decreased gain and feed intake. Feed efficiency was improved when pigs were fed an 18% protein corn-soybean meal diet. Serum urea nitrogen was lowest in pigs fed the 12% protein diet. Serum phosphorus and zinc decreased with increasing dietary protein when pigs were fed corn-sunflower meal diets.



SOW GESTATION BUILDING NORTH OF CAMPUS, WITH MANAGERS BILL HEYLENS AND MIKE KIDWILLER