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EFFECT OF RECEIVING DIETS CONTAINING ALFALFA AND CERTAIN FEED ADDITIVES ON PERFORMANCE OF FEEDER PIGS TRANSPORTED LONG DISTANCES[1,2,3]

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ABSTRACT

Three experiments were conducted to determine the effect of receiving diets containing alfalfa meal and certain feed additives on performance of comingled feeder pigs transported 900 to 1,100 km. In Exp. 1, the inclusion of 9.4% dehydrated alfalfa meal in receiving diets for 2 wk resulted in no difference (P>.1) in gain or feed conversion from purchase to market compared with pigs fed a basal corn-soybean meal (CS) diet or a diet containing 20% ground whole oats (O). In Exp. 2, pigs fed receiving diets containing 10% dehydrated alfalfa meal had no improvement (P>.1) in gain (.60 vs .61 kg/d) or conversion (3.25 vs 3.17) compared with CS-fed pigs. In Exp. 3, pigs fed a receiving diet for 2 wk containing 10% mid-bloom alfalfa ate more (P<.002) feed daily for 2 wk (.82 vs .76 kg) and overall (P<.04; 1.92 vs 1.85 kg) and had an improved (P<.03) daily gain from purchase to market (.61 vs .59 kg) compared with CS-fed pigs. In Exp. 2, pigs fed diets containing 44 mg/kg tylosin (T) gained similar to pigs fed no additive (O) and slower (P<.01) than pigs fed 110 mg/kg chlortetracycline (CTC; .59, .60 and .63 kg/d), with no significant differences in feed to gain conversion (3.12, 3.23 and 3.18). Pigs fed CTC gained faster overall (P<.04) than did pigs fed 55 mg/kg bacitracin methylene disalycilate (BMD) or the unsupplemented control diet in Exp. 3 (.62, .59 and .58 kg/d), while CTC- and BMD-fed pigs improved (P<.02) in feed conversion (3.11, 3.11 and 3.26). In each experiment, the inclusion of alfalfa meal resulted in a reduction in scours for several days immediately post-arrival. Pigs fed CTC had less scours from d 8 to 14 post-arrival than did the control, T- and BMD-fed pigs. There was no difference (P>.1) in pig death loss in any of the experiments due to experimental treatments.
(Key Words: Pigs, Lucerne, Feed Additives, Diets.)

Introduction

Nebraska researchers have reported on the nutritional values of various levels of ground whole oats in feeder pigs receiving diets (Fritschen and Moser, 1979; Brumm et al., 1982). For many finishers of feeder pigs, oats are limited in availability and questions arise as to alternatives. Alfalfa products are one of many suggested alternatives (Brumm et al., 1983).

Antibiotic feed additives effectively promote growth in periods of stress (Hayes, 1978; CAST, 1981). Brumm et al. (1983) recommended the routine addition of an antimicrobial feed additive to feeder pig receiving diets. Jesse et al. (1983) state that a common practice among feeder pig finishers is to include feed additives at the highest approved level and they conclude that the feeder pig stands to benefit from the disease-control aspects of chemotherapeutics.

The objectives of this study were to evaluate the effect of dehydrated alfalfa meal and mid-bloom alfalfa in feeder pig receiving diets and subtherapeutic levels of selected feed additives on performance of comingled feeder pigs transported long distances.

Materials and Methods

Eight hundred forty crossbred, comingled feeder pigs were used in three experiments conducted from April, 1981 through January, 1983 at the University of Nebraska Northeast

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TABLE 1. DISTANCE TRAVELED AND PERCENTAGE SHRINK FROM PAY WEIGHT OF PURCHASED FEEDER PIGS

Experiment	Trial	Month	Distance, km	Shrink, %
1[a]	1	April	900	9.8
	2	November	1,065	12.7
	3	June	928 – 1,116	12.1
2 and 3[b]	1	March	1,077	8.8
	2	September	1,030	8.4

[a]One hundred twenty pigs/trial.

[b]One hundred twenty pigs•trial^{-1}•experiment^{-1}.

Station at Concord, Nebraska. Pigs used in all experiments were transported at least 900 km from auction market facilities in southern Missouri (table 1).

Facilities. In Exp. 1, pigs were housed in a non-mechanically ventilated, modified open-front building. In Exp. 2 and 3, pigs were housed in mechanically ventilated buildings. Each facility consisted of 12 partially slatted pens (1.4 × 4.9 m) accommodating 10 pigs/pen. Further facility details have been reported by Brumm et al. (1982).

Management and Diets. Immediately after arrival, all pigs were weighed, sexed, ear tagged and assigned to their experimental treatment on the basis of sex and arrival weight outcome group.

Experiment 1 consisted of three trials with four pens per treatment. Dietary treatments for the first 14 d post-arrival were: 1) a 16% crude protein, corn-soybean meal, basal grower diet (CS); 2) the CS basal diet with 20% ground whole oats (O) and 3) the CS basal diet with 9.4% dehydrated alfalfa meal (D1). The dehydrated alfalfa meal was added at 9.4% to approximate the energy and fiber content of the diet used in treatment 2. The composition of the experimental diets is presented in table 2.

For 5 d after assignment to their experimental diet, all pigs were given access to drinking water containing a commercial sulfa-electrolyte solution[5]. On d 6 after arrival, the pigs were treated for worms with levamisole hydrochloride[6] in the drinking water. Pigs were retreated approximately 3 wk later with dichlorvos[7]. Pigs were sprayed with a lindane solution for control of lice and mange as needed.

After the 14-d receiving period, all pigs were fed a common commercially prepared 16% crude protein CS grower diet and at approximately 57 kg the pigs were switched to a 14% crude protein CS diet until slaughter. All diets contained 55 mg/kg carbadox until 34 kg live weight, followed by 2.2 mg/kg bambermycins until slaughter.

Exp. 2 and 3. Experiment 2 and 3 consisted of two trials each with two pens per treatment combination per trial. Dietary treatments for the first 14 d post-arrival in Exp. 2 consisted of: 1) 16% crude protein CS basal diet with no feed additive (O); 2) the CS basal diet plus 44 mg/kg tylosin (T); 3) the CS basal diet plus 110 mg/kg chlortetracycline (CTC); 4) the CS basal diet plus 10% dehydrated alfalfa meal (D2); 5) the D2 diet plus T and 6) the D2 diet plus CTC.

Dietary treatments for the same time period in Exp. 3 consisted of: 1) the CS basal diet; 2) the CS basal diet plus 55 mg/kg bacitracin methylene disalycilate (BMD); 3) the CS basal diet plus CTC; 4) the CS basal diet plus 10% mid-bloom, third-cutting alfalfa (A); 5) the A diet plus BMD and 6) the A diet plus CTC.

No sulfa-electrolyte water solution was offered to the pigs in Exp. 2 and 3. Pigs were treated for internal parasites with levamisole hydrochloride in the drinking water the day after arrival and again in the feed 3 wk later. Pigs were sprayed with a lindane solution at the

[5]Zole-Lite™, International Multifoods, Minneapolis, MN 55402.

[6]Tramisol, American Cyanamid Co., Princeton, NJ 08540.

[7]Atgard, Diamond Shamrock Corp., Cleveland, OH 44114.

TABLE 2. PERCENTAGE COMPOSITION OF FEEDER PIG RECEIVING DIETS

	Diet[a]					
	Experiment 1			Experiments 2 and 3		
Item	CS	O	D1	CS	D2	A
No. 2 corn (IFN 4-02-935)	75.74	57.36	68.80	74.88	67.75	67.70
Soybean meal, 44% CP (IFN 5-04-604)	20.72	19.12	18.48	21.72	19.17	19.20
Alfalfa meal, dehy (IFN 1-00-023)			9.44		10.00	
Alfalfa hay (IFN 1-00-078)						10.00
Oats (IFN 4-03-309)		20.00				
Dicalcium phosphate (IFN 6-01-080)	.90	.86	.96	.87	.92	.93
Limestone (IFN 6-01-069)	1.04	1.06	.72	.98	.62	.62
Salt	.50	.50	.50	.50	.50	.50
Trace mineral mix[b]	.05	.05	.05	.05	.05	.05
Vitamin mix[c]	1.00	1.00	1.00	1.00	1.00	1.00
Selenium mix[d]	.05	.05	.05			
Analysis						
Calculated						
Protein, %	15.78	15.92	15.84	16.15	16.15	15.96
Lysine, %	.79	.78	.78	.82	.80	.78
Fiber, %	3.18	4.82	5.14	3.23	5.30	5.69
Metabolizable energy, kcal/kg	3,159	3,032	3,073	3,161	3,072	2,976
Analyzed						
Protein, %				16.61	16.39	16.70
Lysine, %				.83	.79	.82

[a]CS = corn-soybean meal; O = 20% oats; D1 = 9.4% dehydrated alfalfa meal; A = 10% alfalfa.

[b]Provided the following minerals in the complete diet (ppm): Zn, 100; I, .165; Fe, 100; Cu, 10 and Mn, 27.5.

[c]Provided the following vitamins per kg of complete diet: vitamin A, 3,300 IU; vitamin D, 550 IU; riboflavin, 2.2 mg; niacin, 17.6 mg; pantothenic acid, 9.9 mg; choline chloride, 220 mg; vitamin E, 11 mg; vitamin K, 2.2 mg and vitamin B_{12}, .022 mg.

[d]Provided .1 ppm supplemental Se in the complete diet.

auction market and 10 d after arrival for control of lice and mange. No other medications, either injectables or in the feed or water, were administered in Exp. 2 and 3.

After the 14-d receiving period, pigs were fed the 16% crude protein, CS, basal diet with the respective feed additive until approximately 57 kg. They were then fed a 14% crude protein, CS, basal diet with the same additive until slaughter at approximately 95 kg.

In all experiments (1, 2 and 3) the pigs were limit-fed the respective receiving diets for 7 d on the solid floor area of their pen. Feed was made available twice daily and was limited to the amount of feed a pen of 10 would consume in a 2-h period. After 7 d, all diets were offered ad libitum from three-hole self feeders.

Scour Scoring and Health Observations. Each pen of 10 pigs was rated daily in the morning for the presence and severity of diarrhea (scours). In Exp. 1, three persons rated the pens for 21 d, while in Exp. 2 and 3, the rating was done by two persons for 14 d. A scale of 1 to 5 was used in all experiments, with 1 being a normal, firm stool and 5 severe diarrhea.

Statistical Analysis. Results were analyzed according to the methods of SAS (1979) with the pen of 10 pigs as the experimental unit. Experiment 1 data for each trial were analyzed as a completely random design, while Exp. 2 and 3 were analyzed as 2 × 3 factorials. Planned orthogonal contrasts were used to compare treatment means.

Results and Discussion

Live weight shrink for the comingled feeder pigs used in these experiments ranged from 8.4 to 12.7% (table 1). Shrink is reported as the percentage change in total live weight from auction market pay weight to total arrival weight at the research unit. These shrinks are consistent with the 6 to 12% shrink routinely expected for purchased feeder pigs (Jesse et al., 1983).

The performance for the three trials in Exp. 1 was pooled and presented in table 3. Feeder pigs fed the D1 and O receiving diets gained similar ($P>.1$) to the feeder pigs fed the CS diet for both the 14-d receiving period (.50, .50, .48 kg/d) and overall (.61, .62, .62 kg/d). There was no effect ($P>.1$) of receiving diet on daily feed intake for either period reported.

There was a trial × diet interaction ($P<.04$) for 14-d feed conversion. In trial 1, the 14-d feed conversions were 1.97, 1.88 and 2.14 for the D1, O and CS diets, respectively. In trials 2 and 3, the respective 14-d feed conversions were 1.88, 2.05, 1.84 and 1.76, 1.80 and 1.89.

TABLE 3. EFFECT OF RECEIVING DIET ON POOLED PERFORMANCE OF PURCHASED FEEDER PIGS (EXP. 1)

Period	Receiving diet[a] CS	D1	O	SE[b]
	Daily gain, kg[c]			
14 d	.48	.50	.50	.01
Overall	.62	.61	.62	.01
	Daily feed intake, kg			
14 d	.93	.93	.94	.01
Overall	1.93	1.92	1.95	.03
	Feed:gain ratio			
14 d	1.96	1.87	1.91	.04
Overall	3.15	3.13	3.16	.03

[a]One hundred twenty pigs/diet; CS = corn-soybean meal; D1 = CS with 9.4% dehydrated alfalfa meal, O = CS with 20% oats.

[b]Pooled standard error of the mean.

[c]Initial weight, 16.4 kg.

At the conclusion of the trials, no interaction was evident (P>.5). There was no effect (P>.1) of receiving diet on overall feed conversion.

The pooled performance data for Exp. 2 is presented in table 4. While not significant (P>.1), there was a small decrease in gain for the 14-d receiving period for D2-fed pigs compared with that of CS pigs (.38 vs .42 kg/d). There was no effect (P>.1) of receiving diet on overall daily gain. There was an additive effect (P<.04) on 14-d daily gain, with pigs fed the CTC diets gaining faster (P<.02) than T- or O-fed pigs (.45, .38 and .37 kg/d).

Overall, feeder pigs fed CTC diets outgained

TABLE 4. EFFECT OF RECEIVING DIET AND FEED ADDITIVE SELECTION ON POOLED PERFORMANCE OF PURCHASED FEEDER PIGS (EXP. 2)

Period	Receiving diet[a]	Additive[b] O	T	CTC	Avg for diets	SE[c]
		Daily gain, kg[d]				
14 d[e]	CS	.38	.39	.48	.42	
	D2	.35	.38	.41	.38	
	Avg effect of additive	.37	.38	.45		.02
Overall[fg]	CS	.59	.58	.66	.61	
	D2	.61	.59	.61	.60	
	Avg effect of additive	.60	.59	.63		.02
		Daily feed intake, kg				
14 d	CS	.86	.88	.92	.88	
	D2	.87	.87	.88	.87	
	Avg effect of additive	.86	.88	.90		.03
Overall[hi]	CS	1.88	1.83	2.08	1.93	
	D2	1.99	1.92	1.94	1.95	
	Avg effect of additive	1.93	1.88	2.01		.04
		Feed:gain ratio				
14 d[jk]	CS	2.23	2.30	1.91	2.15	
	D2	2.48	2.32	2.18	2.33	
	Avg effect of additive	2.36	2.31	2.05		.12
Overall	CS	3.19	3.15	3.16	3.17	
	D2	3.26	3.27	3.21	3.25	
	Avg effect of additive	3.23	3.21	3.18		.05

[a]CS = corn-soybean meal; D2 = CS with 10% dehydrated alfalfa meal.

[b]O = control; T = 44 mg/kg tylosin; CTC = 110 mg/kg chlortetracycline in complete diet.

[c]Pooled standard error of the mean.

[d]Initial weight, 19.1 kg.

[e]O vs T + CTC (P<.04); T vs CTC (P<.02).

[f]O vs T + CTC (not significant); T vs CTC (P<.01).

[g]Diet × additive (P<.08).

[h]Diet × additive (P<.03).

[i]O vs T + CTC (not significant); T vs CTC (P<.01).

[j]Diet (P<.05).

[k]O vs T + CTC (P<.06); T vs CTC (P<.02).

(P<.01) T- and O-fed pigs (.63 vs .59 and .60 kg/d). The interaction of diet and additive approached significance (P<.08). The greatest overall gain occurred in pigs fed the CS receiving diet and CTC, while the least was for pigs fed the CS and T combination (.66 vs .58 kg/d).

This nonsignificant interaction was accompanied by a significant (P<.03) diet × additive interaction for overall daily feed intake. The lowest daily feed intake was for pigs fed the CS receiving diet and T, while the greatest daily feed intake was by CS-fed feeder pigs receiving CTC (1.83 vs 2.08 kg/d).

Feed conversion for the 14-d receiving

TABLE 5. EFFECT OF RECEIVING DIET AND FEED ADDITIVE SELECTION ON POOLED PERFORMANCE OF PURCHASED FEEDER PIGS, (EXP. 3)

Period	Receiving diet[a]	Additive[b] O	BMD	CTC	Avg for diets	SE[c]
		Daily gain, kg[d]				
14 d	CS	.31	.32	.37	.34	
	A	.37	.34	.38	.36	
	Avg effect of additive	.34	.33	.38		.02
Overall[ef]	CS	.57	.58	.61	.59	
	A	.59	.61	.64	.61	
	Avg effect of additive	.58	.59	.62		.01
		Daily feed intake, kg				
14 d[gh]	CS	.72	.75	.82	.76	
	A	.82	.80	.84	.82	
	Avg effect of additive	.77	.77	.83		.02
Overall[i]	CS	1.83	1.83	1.90	1.85	
	A	1.95	1.86	1.96	1.92	
	Avg effect of additive	1.89	1.84	1.93		.04
		Feed:gain ratio				
14 d	CS	2.33	2.36	2.21	2.30	
	A	2.22	2.37	2.23	2.27	
	Avg effect of additive	2.27	2.36	2.22		.13
Overall[j]	CS	3.21	3.16	3.13	3.17	
	A	3.32	3.06	3.09	3.15	
	Avg effect of additive	3.26	3.11	3.11		.06

[a]CS = corn-soybean meal; A = CS with 10% mid-bloom alfalfa.

[b]O = control; BMD = 55 mg/kg bacitracin methylene disalicylate; CTC = 110 mg/kg chlortetracycline in complete diet.

[c]Pooled standard error of the mean.

[d]Initial weight, 16.8 kg.

[e]Diet (P<.03).

[f]O vs BMD + CTC (P<.03); BMD vs CTC (P<.04).

[g]Diet (P<.002).

[h]O vs BMD + CTC (P<.06); BMD vs CTC (P<.006).

[i]Diet (P<.04).

[j]O vs BMD + CTC (P<.02).

period was increased (P<.05) for pigs fed the D2 diet compared with CS-fed pigs (2.33 vs 2.15). This difference in conversion remained at the conclusion of the experiment and approached significance (P<.09; 3.25 vs 3.17). The improvement (P<.02) in feed conversion for CTC-fed pigs compared with T pigs (2.05 vs 2.31) for the first 14 d was not present at the conclusion of the experiment. Neither additive improved (P>.1) feed conversion overall compared with the control diet.

In Exp. 3 (table 5), feeder pigs fed A diets performed the opposite of pigs fed D1 in Exp. 1 and D2 in Exp. 2. Although there was no effect of diet on 14-d average daily gain, pigs fed A gained faster (P<.03) from purchase to slaughter than did control pigs (.61 vs .59 kg/d). This improvement in gain was the result of increased feed intake for both the 14-d period, during which the diet containing alfalfa was fed (P<.002), and overall (P<.04). In contrast to these results, Bohman et al. (1955) reported a reduction (P<.01) in gain from weaning to market with 10% alfalfa included in the diet compared with corn-soybean-fed pigs, with no difference in average daily feed.

Similar to Exp. 2, the best overall daily gain was for pigs fed CTC. The presence of an additive (O vs BMD + CTC) improved gain (P<.03) compared with control; gain improved (P<.04) with CTC as compared with BMD. This improvement in gain was accompanied by an improved (P<.006) daily feed intake for the 14-d receiving period, with no difference in intake overall.

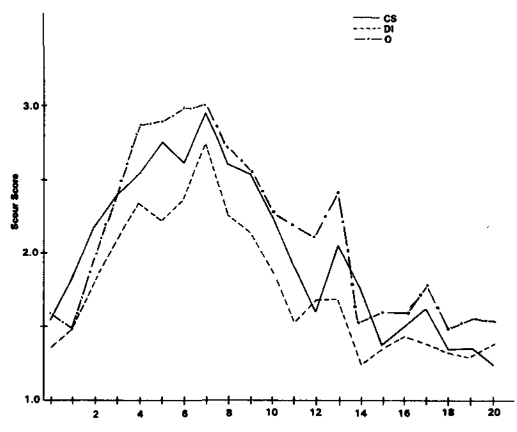

Figure 1. Effect of receiving diet on scour scores of purchased feeder pigs — Exp. 1.

There was no difference in feed conversion for A- vs CS-fed pigs, either for the 14-d period or overall. However, both BMD and CTC pigs had better (P<.02) conversions overall than did control pigs.

Pigs fed the D1 diet in Exp. 1 had reduced (P<.01) scour scores on d 6, 12 and 13 compared with pigs fed the O diet (figure 1). Contrary to the report of Fritschen and Moser (1979) but in agreement with the report of Brumm et al. (1982), the inclusion of 20% oats did not reduce the severity or duration of scours compared with control-fed pigs.

In Exp. 2, D2-fed pigs had reduced scour scores compared with CS-fed pigs on d 8 and 14 (P<.1) and d 11 and 12 (P<.05; figure 2). Although not significantly different except for d 11 (O vs T + CTC; P<.03), pigs fed CTC had numerically lower scour scores for all days observed except d 1. Pigs fed T had a lower incidence of scours for the first 8 d, but did not differ statistically from control pigs.

Feeder pigs fed diet A in Exp. 3 had significantly reduced scour scores compared with CS-fed pigs on d 6 and 7 (P<.1), d 3, 9 and 10 (P<.05) and d 11, 12, 13 and 14 (P<.01; figure

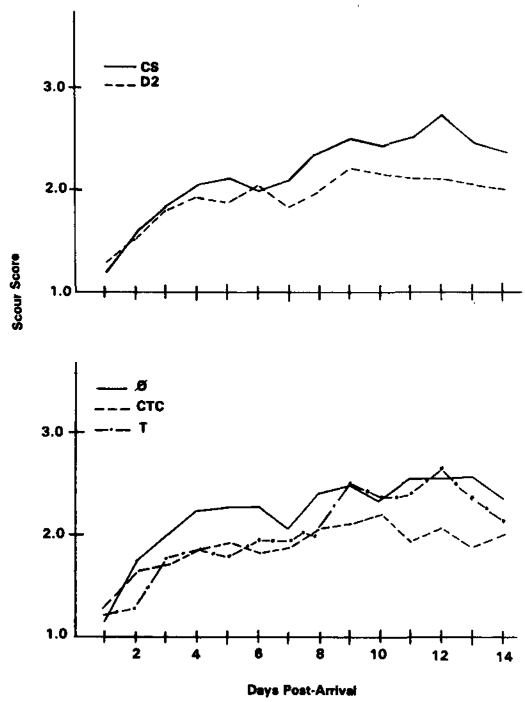

Figure 2. Effect of receiving diet and feed additive on scour scores of purchased feeder pigs — Exp. 2.

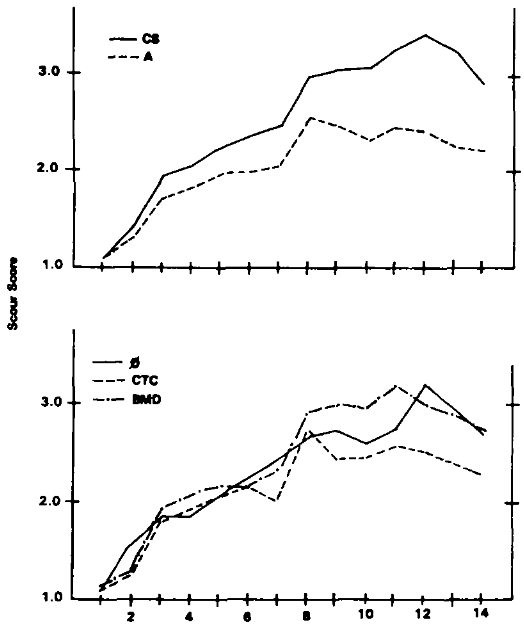

Figure 3. Effect of receiving diet and feed additive on scour scores of purchased feeder pigs – Exp. 3.

3). In addition, scour scores peaked earlier for the A-fed pigs compared with the CS-fed pigs (d 8 vs d 12). Pigs fed CTC had numerically lower scour scores than O- or BMD-fed pigs on d 7, 9, 10, 11, 12, 13 and 14, with the difference significant on d 12 and 13.

The cause of feeder pig scours reported herein and by Brumm et al. (1982) have not been established. In Exp. 2 and 3, the reduction in scour score with the inclusion of 110 mg/kg CTC, especially after 7 d on the additive, indirectly points to the possibility that the scours may be microbial in origin with a population, at least in these experiments, that is sensitive to CTC while exhibiting little or no sensitivity to BMD or T at the dietary levels investigated. This reduction in scours and the stress and dehydration associated with it may partially explain the growth response obtained with pigs fed CTC in Exp. 2 and 3 for the 14-d post-arrival period.

The lack of response in pigs fed diets containing either 9.4 (D1) or 10% (D2) dehydrated alfalfa meal is consistent with the results reported by Hitchcock et al. (1983). In their

TABLE 6. EFFECT OF RECEIVING DIET AND FEED ADDITIVE ON POOLED DEATH LOSS OF PURCHASED FEEDER PIGS

Experiment	Additive[a]	Receiving diet[b]			Total for additive
		CS	D1	O	
1[c]		6 (5%)	7 (5.8%)	8 (6.7%)	
		CS	D2		
2[d]	O	1 (2.5%)	2 (5%)		3 (3.8%)
	T	1 (2.5%)	1 (2.5%)		2 (2.5%)
	CTC	2 (5%)	0 (0%)		2 (2.5%)
	Total for diet	4 (3.3%)	3 (2.5%)		
		CS	A		
3[d]	O	3 (7%)	3 (7.5%)		6 (7.5%)
	BMD	2 (5%)	4 (5%)		4 (5%)
	CTC	2 (5%)	0 (0%)		2 (2.5%)
	Total for diet	7 (5.8%)	5 (4.2%)		

[a]O = control; T = 44 mg/kg tylosin; CTC = 110 mg/kg chlortetracycline; BMD = 55 mg/kg bacitracin methylene disalycilate.

[b]CS = corn-soybean meal; D1 = CS with 9.4% dehydrated alfalfa meal; D2 = CS with 10% dehydrated alfalfa meal; A = CS with 10% mid-bloom alfalfa; O = CS with 20% oats.

[c]One hundred twenty pigs/diet.

[d]Forty pigs/treatment combination.

trials, comingled feeder pigs fed receiving diets containing 10% dehydrated alfalfa meal for 21 d showed no difference in gain or feed conversion from purchase to market compared with CS-fed pigs.

The positive response in gain due to the inclusion of 10% mid-bloom alfalfa (diet A, Exp. 2) is in contrast to the lack of response from dehydrated alfalfa meal. Although separate sources of alfalfa products were used in these trials, the possibility exists that the lack of response on the D1 and D2 diets is due to the dehydration processing of the alfalfa. Pigs fed D1 or D2 did not show an increase in feed intake for the 14-d post-arrival period, while those fed diet A showed an increased intake resulting in increased gain as compared with CS-fed pigs. Palatability of the diet may have been a factor. Cheeke and Powley (1980) reported that in 7-d preference studies, 22- to 27-kg pigs exhibited a definite ($P<.01$) preference for a CS control diet compared with diets containing 1, 2.5, 5, 10, 20 and 30% alfalfa meal.

The death loss data are reported in table 6. In all experiments, there was no significant effect of experimental treatments on death loss. In Exp. 2 and 3 where no pigs were treated, there was a trend for reduced death loss with the inclusion of a subtherapeutic level of an antibiotic in the diets from purchase to market.

These results support the recommendation of Brumm et al. (1983) of mid-bloom alfalfa as an ingredient in feeder pig receiving diets. They do not support the use of dehydrated alfalfa meal as an alternative ingredient.

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