

*Director's
Digest*



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EFFECT OF FAT SOURCE AND LEVEL OF ADDITION
IN RECEIVING DIETS ON PERFORMANCE TO SLAUGHTER WEIGHT
OF COMMINGLED FEEDER PIGS.

TALLOW VERSUS VEGETABLE OIL

THIS PROJECT WAS CONDUCTED BY DR. MICHAEL C. BRUMM AT THE UNIVERSITY OF NEBRASKA, NORTHEAST RESEARCH AND EXTENSION CENTER.

INTRODUCTION - BACKGROUND & RELEVANT CURRENT RESEARCH

FEEDER PIGS REPRESENT A SIGNIFICANT PORTION OF THE TOTAL UNITED STATES SWINE INDUSTRY. DEPENDING ON THE SOURCE OF DATA AND METHOD OF CALCULATION, APPROXIMATELY 26% OF THE TOTAL U.S. PIG SLAUGHTER IS FROM FEEDER PIGS THAT ARE FINISHED ON FARMS SEPARATE FROM THE FACILITY AND OWNERSHIP WHERE THEY ARE FARROWED. VAN ARSDALL AND NELSON REPORTED THAT "PRODUCTION PERIODS IN 1980 AVERAGED 10 TO 12% LONGER WHEN PIGS WERE PRODUCED ON ONE FARM AND FINISHED ON ANOTHER THAN WHEN ALL PRODUCTION OCCURRED ON THE SAME FARM, NOT COUNTING TIME FOR MARKETING PIGS AND TRANSPORTING THEM TO THE FINISHER".

IT IS NOT UNCOMMON FOR FEEDER PIGS TO REQUIRE ONE WEEK OR MORE IN A FINISHING FACILITY TO RECOVER PAYWEIGHT. THIS ONE WEEK PERIOD REPRESENTS 40% OF THE LAG DESCRIBED BY VAN ARSDALL AND NELSON AS TYPICAL FOR FEEDER PIG FINISHERS VERSUS FARROW TO FINISH.

A DEPRESSED FEED INTAKE FOR TWO WEEKS POST-ARRIVAL MAY PARTIALLY EXPLAIN THIS GROWTH CHECK OBSERVED IN FEEDER PIGS. USING THE FORMULA OF EWAN FOR VOLUNTARY FEED INTAKE, PIGS WEIGHING 17 TO 24 KG CAN BE EXPECTED TO CONSUME 3770 Kcal OF METABOLIZABLE ENERGY (ME) DAILY. NRC (1979) ESTIMATES DAILY ME INTAKES FOR 10 TO 20 KG PIGS AT 3160 Kcal AND 4740 Kcal FOR 20 TO 35 KG PIGS.

IN OUR RESEARCH FOR THE FIRST TWO WEEKS POST-ARRIVAL, TOTAL DAILY CALCULATED AVERAGE ME INTAKES FOR 3091 FEEDER PIGS OFFERED A VARIETY OF EXPERIMENTAL RECEIVING DIETS HAS AVERAGED 2763 Kcal WITH A RANGE IN VARIOUS TRIALS OF 2279 TO 3388.

BECAUSE OF ITS HIGH ENERGY VALUE, FAT (ANIMAL AND VEGETABLE) IS FREQUENTLY ADDED TO SWINE DIETS TO INCREASE CALORIC DENSITIES. CAMPBELL REPORTED MAXIMUM DIETARY INTAKE OCCURRED FOR WEANED PIGS AGED THREE TO EIGHT WEEKS AT A DENSITY OF 3640 Kcal OF ME PER KILOGRAM OF DIET. IN CONTRAST, THE FEEDER PIG RECEIVING DIETS INVESTIGATED BY BRUMM RANGED IN ME CONTENT FROM 2865 Kcal TO 3161 Kcal ME PER KILOGRAM OF DIET.

BRUMM PREVIOUSLY COMPLETED A PRELIMINARY EXPERIMENT INVESTIGATING VARIOUS FAT SOURCES IN FEEDER PIG RECEIVING DIETS FOR A THREE WEEK PERIOD POST-ARRIVAL. WHEN ADDED AT 4% OF THE TOTAL DIET, FANCY BLEACHABLE TALLOW INCREASED DAILY FEED INTAKE DURING THE THREE WEEK POST-ARRIVAL PERIOD AND OVERALL COMPARED TO A BLENDED VEGETABLE OIL PRODUCT OR SOYBEAN OIL. THIS RESULTED IN A NON-SIGNIFICANT INCREASE IN OVERALL DAILY GAIN. THESE RESULTS AGREE WITH ABREU-SIERRA, WHO CONCLUDED WEANED PIGS SHOW A PREFERENCE FOR TALLOW OVER OTHER FAT SOURCES.

TWO HUNDRED EIGHTY-EIGHT (288) COMMINGLED FEEDER PIGS WERE PURCHASED THROUGH A BROKER FROM AUCTION MARKETS IN SOUTHERN MISSOURI. UPON ARRIVAL AT THE RESEARCH FACILITY AFTER A 700+ MILE TRANSPORT, THE PIGS WERE INDIVIDUALLY WEIGHED, SEXED, EARTAGGED AND ASSIGNED TO EXPERIMENTAL TREATMENTS BASED ON ARRIVAL WEIGHT AND SEX OUTCOME GROUPS. TOTAL SHRINK FROM PAYWEIGHT TO ARRIVAL WEIGHT WAS 9.8%, TYPICAL FOR PIGS PREVIOUSLY PURCHASED FROM THESE SOURCES.

ALL PIGS WERE LIMIT-FED TWICE DAILY ON THE SOLID FLOOR SLEEPING AREA FOR THE FIRST SEVEN DAYS AFTER ARRIVAL. FEED WAS RESTRICTED TO THE AMOUNT A PEN OF PIGS WOULD CONSUME IN A TWO TO THREE HOUR PERIOD. BEGINNING 7 DAYS AFTER ARRIVAL, ALL DIETS WERE OFFERED AD LIBITUM FOR THE DURATION OF THE EXPERIMENT.

THE EXPERIMENTAL RECEIVING DIETS WERE OFFERED IN MEAL FORM FOR THE FIRST THREE WEEKS (0-21d) POST-ARRIVAL. THE EXPERIMENTAL DIETS WERE: 1) CONTROL WITH NO ADDED FAT (CON); 2) CON WITH 4% ADDED VEGETABLE OIL BLEND SUBSTITUTED FOR CORN (VO); 3) CON WITH 4% TALLOW SUBSTITUTED FOR CORN (TAL); 4) CON WITH 4% GREASE SUBSTITUTED FOR CORN (YGR). THE VO WAS FURNISHED BY NUTRITION SPECIALTIES OF WEST POINT, NE., AND CONSISTED OF A BLEND OF CORN, SOYBEAN AND COCONUT OILS. THE TAL AND YGR WAS FURNISHED BY NATIONAL BY-PRODUCTS, INC., OF OMAHA, NE. THE FATTY ACID PROFILE OF THE VO WAS FURNISHED BY NUTRITION SPECIALTIES, WHILE THE PROFILES FOR THE TAL AND YGR WERE OBTAINED BY LABORATORY ANALYSES.

RESULTS

AS DOCUMENTED IN TABLE 2, THE FATTY ACID COMPOSITIONS OF TAL AND YGR WERE VERY SIMILAR. VO, AS EXPECTED, WAS CONSIDERABLY DIFFERENT IN

COMPOSITION.

BECAUSE OF CONSIDERABLE VARIATION IN PIG WEIGHT UPON ARRIVAL AT THE RESEARCH UNIT, THE PIGS WERE BLOCKED INTO LIGHT, MEDIUM AND HEAVY WEIGHT OUTCOME GROUPS PRIOR TO ASSIGNMENT TO EXPERIMENTAL TREATMENTS TO MINIMIZE WITHIN PEN WEIGHT VARIATION. THERE WAS NO INTERACTION OF INITIAL WEIGHT GROUP AND ANY OF THE EXPERIMENTAL TREATMENTS.

PIG PERFORMANCE IS DOCUMENTED IN TABLE 4 FOR THE MAIN EFFECT OF FAT SOURCE ON PIG PERFORMANCE AND IN TABLE 5 FOR THE INTERACTION OF PIG SOURCE AND TEMPERATURE.

IN EXAMINATION OF THE MAIN EFFECTS OF FAT SOURCE (TABLE 4), ONE SEES NOT ONLY A TYPICAL PATTERN OF RESPONSE TO DIETARY FAT (IMPROVED GAIN/FEED FOR 0-21d AND 7-21d: IMPROVED DAILY GAIN FOR 7-21d AND 0-21d) BUT ALSO A DIFFERENCE IN RESPONSE DUE TO DIETARY FAT SOURCES.

FOR THE 0-7d PERIOD WHEN PIGS WERE LIMIT FED THE RESPECTIVE RECEIVING DIETS, VO FED PIGS GAINED SLOWER THAN TAL OR YGR PIGS DUE TO A DECREASE IN VOLUNTARY FEED CONSUMPTION. ALTHOUGH BOTH FACILITIES WERE MANAGED SIMILARLY DURING THIS PERIOD, THIS EFFECT WAS PRIMARILY EVIDENT IN THE FACILITY DESTINED TO BE MANAGED BY A REDUCED NOCTURNAL TEMPERATURE SCHEME.

OVERALL, PIGS FED RECEIVING DIETS CONTAINING TAL OR YGR HAD AN IMPROVED AVERAGE DAILY GAIN COMPARED TO VO FED PIGS WITH NO DIFFERENCE IN DAILY FEED OR GAIN/FEED RATES. THIS DIFFERENCE WAS EVIDENT IN BOTH TEMPERATURE REGIMENTS (TABLE 4), ESPECIALLY FOR TAL FED PIGS.

IN THIS TRIAL NOCTURNAL TEMPERATURE REDUCTION WAS NOT EFFECTIVE IN STIMULATING FEED INTAKE COMPARED TO THE CONTROL TREATMENT. HOWEVER, PIGS OFFERED RECEIVING DIETS CONTAINING 4% ADDED FAT AD LIB (7-21d PERIOD) IN THE CONTROL FACILITY HAD AN INCREASED FEED DISAPPEARANCE COMPARED TO CON, WHILE THERE WAS NO DIFFERENCE IN FEED DISAPPEARANCE FOR THE MODIFIED TEMPERATURE HOUSED PIGS OFFERED THE SAME DIETS.

THESE RESULTS SUPPORT THE CONCLUSION THAT TALLOW AND YELLOW GREASE ARE EFFECTIVE IN IMPROVING FEEDER PIG PERFORMANCE WHEN ADDED TO CORN-SOYBEAN MEAL BASED DIETS. IN ADDITION, PIGS OFFERED RECEIVING DIETS CONTAINING TALLOW FOR A 3 WEEK POST-ARRIVAL PERIOD MAY HAVE AN IMPROVED RATE OF GAIN TO MARKET WEIGHT. THE POSSIBLE EXPLANATIONS FOR THIS ARE UNCLEAR FROM THIS TRIAL AND MERIT FURTHER RESEARCH.

HOW I WOULD USE THIS DATA TO SELL

ANIMAL FAT TO SWINE PRODUCERS

1. THERE ARE DOZENS OF VEGETABLE OIL FEEDING FAT PRODUCTS ON THE MARKET. SOME ARE STRAIGHT SOYBEAN OIL, OTHERS ARE MIXTURES OF SEVERAL VEGETABLE OILS WITH A LARGE DOSE OF A FLAVORING AGENT.
2. THE SALESMEN OF THESE PRODUCTS CLAIM THAT VEGETABLE OILS HAVE MORE ME FOR SWINE (UNTRUE, JUST THE OPPOSITE) AND IS SUPERIOR IN HANDLING CHARACTERISTICS AND PALATABILITY. THESE ARE ALL EXAGGERATIONS, BUT THEY MOVE THROUGH THE COUNTRY SELLING THEIR HIGH PRICED AND HIGH MARGIN VEGETABLE PRODUCTS.
3. DR. BRUMM AND DR. PEO HAVE COMPARED ANIMAL FATS VERSUS VEGETABLE OILS IN SWINE DIETS FOR SEVERAL YEARS AND IN ALL CASES THE ANIMAL FAT OUTPERFORMED THE VEGETABLE OILS.

4. TAKE TABLE 4 INTO THE COUNTRY AND USE IT AS A TOOL TO SELL ANIMAL FAT IN SWINE DIETS. KEEP THIS DIGEST AND ADD IT TO YOUR FAT MANUAL NEXT YEAR.

5. THE 1988 NRC "NUTRIENT REQUIREMENTS OF SWINE" LISTS THE FOLLOWING ME VALUES FOR ANIMAL AND VEGETABLE OILS:

Feed Name Description	International Feed Number	Dry Matter (%)	Ether Extract(%)	Linoleic Acid(%)	DE (kcal/kg)	ME (kcal/kg)
Animal						
Lard	4-04-790	100	100	18.3	7,860	7,750
Poultry, fat	4-00-409	100	100	11.8	8,635	7,975
Tallow	4-08-127	100	100	3.1	8,200	7,895
Plant						
Corn oil	4-07-882	100	100	58.0	7,620	7,350
Soybean oil	4-07-983	100	100	65.7	7,560	7,280
Corn starch	4-02-889	100	0	0.0	4,045	4,040
Glucose monohydrate	4-02-125	100	0	0.0	3,735	3,620
Sucrose	4-04-701	100	0	0.0	3,850	3,670

NOTE: Feed-grade fats and oils usually contain water and other nonfat materials; energy concentrations should be adjusted accordingly.

SOURCE: R. C. Ewan, Iowa State University, unpublished summary of energy values of feed ingredients.

Table 1. Experimental Receiving Diets.

Ingredient	Fat Source			
	CON	VO	TAL	YGR
	-----1bs-----			
Corn	1275	1185	1185	1185
44% Soybean Meal	450	460	460	460
Oats	200	200	200	200
Limestone	19	19	19	19
Dicalcium Phosphate	18	18	18	18
Vitamin Premix ^a	4	4	4	4
Trace Mineral Premix ^b	1	1	1	1
Salt	8	8	8	8
Vegetable Oil Blend ^c		80		
Tallow ^d			80	
Yellow Grease ^d				80
Mecadox (50g/T)	20	20	20	20
Chromic Oxide	5	5	5	5
<u>Calculated Analysis:</u>				
Protein,%	16.4	16.3	16.3	16.3
Lysine,%	.85	.85	.85	.85
Ca,%	.65	.65	.65	.65
P,%	.52	.51	.51	.51
ME,Kcal/lb	1428	1509	1508	1506

^aFurnished the following vitamins per ton of complete diet: 5×10^6 IU A, 5×10^5 IU D, 20,000 IU E, 5 gm riboflavin, 18 gm d-pantothenic acid, 30 gm niacin, 500 gm choline chloride, 15 mg B₁₂ and 2 gm menadione sodium bisulfite.

^bFurnished the following concentrations of minerals in the complete diet: 75 ppm zinc, 87.5 ppm iron, 30 ppm manganese, 8.75 ppm copper and 1 ppm iodine.

^cFurnished by Nutrition Specialties, West Point, NE.

^dDonated by National By-Products Inc., Omaha, NE.

Table 2. Fatty Acid Composition of Fats Used in Feeder Pig Receiving Diets.

Fatty acid		Fat		
		VO	TAL	YGR
		%		
Caprylic	8:0	.9	0	0
Capric	10:0	.7	.1	0
Lauric	12:0	6.0	.1	.2
Myristic	14:0	2.6	2.0	2.0
Myristoleic	14:1		.4	.4
Pentadecanoic	15:0		.4	.4
Pentadecenoic	15:1		.1	.1
Palmitic	16:0	10.1	22.5	22.1
Palmitoleic	16:1		3.6	4.0
Heptadecanoic	17:0		.5	.6
Heptadecenoic	17:1		.3	.3
Stearic	18:0	3.9	13.5	12.4
Oleic	18:1	19.9	44.4	45.3
Linoleic	18:2	47.7	9.4	9.7
Linolenic	18:3	7.7	.7	.8
Nonadecanoic	19:0		0	0
Arachidic	20:0		.2	.2
Eicosenoic	20:1		1.4	1.5
Eicosadienoic	20:2		0	0
Eicosatrienoic	20:3		0	0
Arachidonic	20:4		0	0
Behenic	22:0		.1	.1
Erucic	22:1		0	0
Lignoceric	24:0		.2	.2

Table 4. Main Effect of Receiving Diet Fat Sources on Feeder Pig Performance.

	Source				SE
	CON	VO	TAL	YGR	
Pens, No.	6	6	6	6	
Pigs, No.	72	72	72	72	
Pig Wt, lb.					
Initial	43.1	43.3	43.1	43.2	
7d	49.3	49.1	49.7	49.8	.7
21d ^a	69.0	71.3	71.1	70.7	.6
56d	116.5	117.5	120.6	119.4	1.9
119d ^b	212.1	207.9	221.0	214.8	2.6
Average Daily Gain, lb.					
0-7d ^c	.88	.82	.95	.95	.09
7-21 ^a	1.41	1.59	1.52	1.49	.04
0-21 ^a	1.23	1.33	1.33	1.31	.03
7-119 ^d	1.45	1.42	1.53	1.47	.03
0-119 ^e	1.42	1.38	1.50	1.44	.02
Average Daily Feed, lb.					
0-7d ^d	1.70	1.65	1.74	1.73	.02
7-21d	3.10	3.21	3.07	3.13	.05
0-21d	2.63	2.69	2.63	2.66	.03
7-119d	5.04	4.96	5.12	5.02	.11
0-119d	4.84	4.77	4.92	4.82	.10
Gain/Feed					
0-7d	.52	.50	.55	.55	.08
7-21d ^f	.45	.50	.50	.48	.01
0-21d ^a	.47	.50	.51	.49	.01
7-119d	.29	.29	.30	.29	.01
0-119d	.29	.29	.30	.30	.01
No. Dead/Removed	4	1	7	2	

^aControl vs fat sources (P<.02).

^bControl vs fat sources (P<.01).

^cVO vs TAL + YGR (P<.1).

^dVO vs TAL + YGR (P<.05).

^eVO vs TAL + YGR (P<.01).

^fControl vs fat sources (P<.05).

Table 5. Interaction of Temperature and Receiving Diet Fat Sources on Feeder Pig Performance.

Item	Temperature								SE
	Control				Reduced				
	CON	VO	TAL	YGR	CON	VO	TAL	YGR	
Pens, No.	3	3	3	3	3	3	3	3	
Pig, Wt, lb.									
Initial	43.2	43.4	43.3	43.1	43.1	43.3	42.8	43.3	
7d	49.8	49.1	50.2	49.8	48.8	49.1	49.2	49.9	.9
21d ^a	67.2	71.4	71.1	71.1	70.9	71.3	71.0	70.4	.8
56d	115.1	116.3	119.9	119.6	118.0	118.7	121.3	119.1	2.6
119d	216.6	207.2	221.2	218.6	207.7	208.6	220.7	211.0	3.7
Average Daily Gain, lb.									
0-7d	.93	.81	.99	.95	.82	.83	.92	.94	.13
7-21d ^b	1.25	1.59	1.49	1.52	1.57	1.59	1.56	1.46	.05
0-21d ^a	1.14	1.33	1.32	1.33	1.32	1.33	1.34	1.29	.04
7-119d	1.49	1.41	1.53	1.51	1.41	1.42	1.53	1.44	.04
0-119d	1.46	1.38	1.49	1.47	1.38	1.39	1.50	1.41	.03
Average Daily Feed, lb.									
0-7d	1.71	1.71	1.73	1.69	1.68	1.60	1.75	1.76	.03
7-21d ^c	2.85	3.21	3.10	3.13	3.35	3.20	3.05	3.12	.07
0-21d ^d	2.47	2.71	2.64	2.65	2.79	2.67	2.61	2.67	.04
7-119d	5.08	5.00	5.21	5.18	5.01	4.92	5.02	4.84	.15
0-119d	4.88	4.81	5.00	4.98	4.81	4.73	4.83	4.66	.14
Gain/Feed									
0-7d	.55	.47	.57	.56	.49	.52	.53	.54	.06
7-21d	.44	.50	.48	.49	.47	.50	.51	.47	.02
0-21d	.46	.49	.50	.50	.47	.50	.51	.48	.01
7-119d	.29	.28	.29	.29	.28	.29	.30	.30	.01
0-119d	.30	.29	.30	.30	.29	.29	.31	.30	.01

^aP<.1
^bP<.02
^cP<.01
^dP<.005

Table 5. Interaction of Temperature and Receiving Diet Fat Sources on Feeder Pig Performance.

Item	Temperature								SE
	Control				Reduced				
	CON	VO	TAL	YGR	CON	VO	TAL	YGR	
Pens, No.	3	3	3	3	3	3	3	3	
Pig, Wt, lb.									
Initial	43.2	43.4	43.3	43.1	43.1	43.3	42.8	43.3	
7d	49.8	49.1	50.2	49.8	48.8	49.1	49.2	49.9	.9
21d ^a	67.2	71.4	71.1	71.1	70.9	71.3	71.0	70.4	.8
56d	115.1	116.3	119.9	119.6	118.0	118.7	121.3	119.1	2.6
119d	216.6	207.2	221.2	218.6	207.7	208.6	220.7	211.0	3.7
Average Daily Gain, lb.									
0-7d	.93	.81	.99	.95	.82	.83	.92	.94	.13
7-21d ^b	1.25	1.59	1.49	1.52	1.57	1.59	1.56	1.46	.05
0-21d ^a	1.14	1.33	1.32	1.33	1.32	1.33	1.34	1.29	.04
7-119d	1.49	1.41	1.53	1.51	1.41	1.42	1.53	1.44	.04
0-119d	1.46	1.38	1.49	1.47	1.38	1.39	1.50	1.41	.03
Average Daily Feed, lb.									
0-7d	1.71	1.71	1.73	1.69	1.68	1.60	1.75	1.76	.03
7-21d ^c	2.85	3.21	3.10	3.13	3.35	3.20	3.05	3.12	.07
0-21d ^d	2.47	2.71	2.64	2.65	2.79	2.67	2.61	2.67	.04
7-119d	5.08	5.00	5.21	5.18	5.01	4.92	5.02	4.84	.15
0-119d	4.88	4.81	5.00	4.98	4.81	4.73	4.83	4.66	.14
Gain/Feed									
0-7d	.55	.47	.57	.56	.49	.52	.53	.54	.06
7-21d	.44	.50	.48	.49	.47	.50	.51	.47	.02
0-21d	.46	.49	.50	.50	.47	.50	.51	.48	.01
7-119d	.29	.28	.29	.29	.28	.29	.30	.30	.01
0-119d	.30	.29	.30	.30	.29	.29	.31	.30	.01

^aP<.1
^bP<.02
^cP<.01
^dP<.005