

**EFFECT OF RESTRICTED FEEDING OF MOLASSES  
RATIONS ON FEEDLOT PERFORMANCE AND  
CARCASS CHARACTERISTICS OF SWINE**

**Isaac I. Iwanaga and Estel H. Cobb**

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# **EFFECT OF RESTRICTED FEEDING OF MOLASSES RATIONS ON FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS OF SWINE**

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A favorable lean-to-fat ratio is of considerable importance to the pork consumer. Studies have indicated that restriction of feed intake during the growing and finishing period can affect the lean-to-fat ratio of the carcass and improve the carcass characteristics of market hogs.

Results of hog feeding trials indicate that restricting daily feed intake during the last half of the growing and finishing period can result in reduction of backfat, lengthening of feeding period, and variable feed efficiency (Winters *et al.*, 1949; Brugman, 1950; Crampton *et al.*, 1954; Young *et al.*, 1962; and Wallace, 1966).

Pork consumers in Hawaii show a strong preference for lean pork. To produce lean carcasses, hogs are marketed at lighter weights, 170 to 180 pounds liveweight, than elsewhere in the United States. Cane molasses is readily available in Hawaii and is a good source of energy in swine rations. There is no information available on the effect on carcass quality of restricted feeding of molasses rations during the growing and finishing period of market hogs. This study was conducted to obtain an indication of the influence of restricted feeding of molasses rations on hog carcasses.

Two feeding trials involving 81 pigs were conducted. In trial 1, 45 purebred Yorkshire and crossbred pigs were randomly allotted to 5 treatment groups with restrictions that equal numbers of purebreds and crossbreds were assigned to each treatment group (table 1). During the entire experiment, pigs on treatment 1 were fed commercial growing and finishing rations according to the manufacturer's directions. Pigs on treatments 2, 3, 4, and 5 were fed molasses rations (table 2) in accordance with Morrison's standards until they reached average lot weights of 120 pounds. From these weights

TABLE 1. Assignment of treatments by lot, trial 1

NO.	TREATMENT	LOT NO.	PIGS IN LOT	SEX
1	Commercial ration control	1	2	Barrows
		2	2	Barrows
		3	2	Gilts
		4	2	Barrows
			1	Gilt
2	Molasses rations fed according to Morrison's standards	5	2	Barrows
		6	2	Barrows
		7	2	Gilts
		8	2	Barrows
			1	Gilt
3	Molasses rations fed at 90% of Morrison's standards	9	2	Barrows
		10	2	Barrows
		11	2	Gilts
		12	2	Barrows
			1	Gilt
4	Molasses rations fed at 80% of Morrison's standards	13	2	Barrows
		14	2	Barrows
		15	2	Gilts
		16	2	Barrows
			1	Gilt
5	Molasses rations fed at 70% of Morrison's standards	17	2	Barrows
		18	2	Barrows
		19	2	Gilts
		20	2	Barrows
			1	Gilt

to market weight, pigs on treatment 2 were continued on the level of feed allowance recommended by Morrison, while pigs on treatments 3, 4, and 5 had their recommended feed allowance reduced to 90, 80, and 70 percent, respectively. Adjustments in the rations were made weekly for all treatments to keep the intake as close to the above standards as possible.

Average weight of the 45 pigs at the time of allotment was 53.8 pounds.

The molasses rations fed to pigs on treatments 2, 3, 4, and 5 are shown in table 2.

TABLE 2. Rations used in trial 1

FEED INGREDIENTS	RATION 169	RATION 170	RATION 171
	POSTWEANING TO 70 LBS.	70 LBS TO 120 LBS.	120 LBS. TO MARKET WT.
	LB.	LB.	LB.
Alfalfa meal, dehydrated	5.0	5.0	5.0
Cane molasses	15.0	20.0	30.0
Yellow corn, medium ground	31.0	27.5	25.0
Milo, ground	30.0	20.0	15.0
Wheat middlings	—	15.0	15.0
Tuna meal	2.5	1.0	1.0
Meat and bone meal	4.0	3.0	2.5
Soybean oil meal	12.0	8.0	6.0
T.M. salt	0.5	0.5	0.5
Aurco-10	0.25	0.25	0.25
<b>Total</b>	<b>100.25</b>	<b>100.25</b>	<b>100.25</b>
Estimated: Dry matter	86.2	86.4	84.7
Digestible crude protein	12.6	11.0	9.4
Total digestible nutrients	72.8	71.4	68.9

Plus vitamin and methionine supplements at rate of:

Vitamin A acetate (10,000 IU/g.)	40 g./1000 lb. mix
Vitamin D <sub>3</sub> (3,000 IU/g.)	30 g./1000 lb. mix
Vitamin B <sub>12</sub> (700 mg./lb.)	200 g./1000 lb. mix
Choline	40 g./1000 lb. mix
Methionine	303 g./1000 lb. mix

In trial 2, 26 purebred Yorkshire and crossbred pigs were allotted with equal numbers of purebreds and crossbreds per treatment to two treatment groups of 18 pigs consisting of 10 gilts and 8 barrows per treatment as shown in table 3. Pigs on treatment 1 were fed in accordance with Morrison's standards throughout the experiment. Pigs on treatment 2 were fed according to Morrison's standards up to average lot weights of 110 pounds. At this

weight, the daily feed allowance was limited to 5 pounds per pig divided equally between morning and afternoon feedings. The feed was placed on the floor instead of the troughs to insure access to feed by all pigs in each pen with minimum interference from domineering individuals.

**TABLE 3. Allotment of pigs to treatments by lot, trial 2**

NO.	TREATMENT	LOT NO.	PIGS IN LOT	SEX
1	Control	1	5	Gilts
		2	4	Barrows
		3	5	Gilts
		4	4	Barrows
2	Restricted	5	4	Barrows
		6	5	Gilts
		7	5	Gilts
		8	4	Barrows

Average weight of the 36 pigs at the time of allotment was 57.4 pounds. Table 4 shows the rations fed to the pigs in trial 2.

**TABLE 4. Rations used in trial 2**

FEED INGREDIENTS	RATION 164	RATION 165	RATION 166
	POSTWEANING TO 75 LBS.	75 LBS. TO 110 LBS.	110 LBS. TO MARKET WT.
	LB.	LB.	LB.
Alfalfa meal, dehydrated	5.0	5.0	5.0
Cane molasses	15.0	20.0	30.0
Yellow corn, medium ground	20.0	—	—
Barley, ground	11.0	27.5	25.0
Milo, ground	30.0	20.0	15.0
Wheat middlings	—	15.0	15.0
Tuna meal	2.5	1.0	1.0
Meat and bone meal	4.0	3.0	2.5
Soybean oil meal	12.0	8.0	6.0
T.M. salt	0.5	0.5	0.5
Aureo-10	0.25	0.1	0.1
<b>Total</b>	<b>100.25</b>	<b>100.1</b>	<b>100.1</b>
Estimated: Dry matter	86.2	86.4	84.7
Digestible crude protein	12.4	11.0	9.4
Total digestible nutrients	72.8	71.4	68.9

Pigs on both trials were weighed once weekly. Individual off test weights were taken as close to 170 pounds as possible, and at this time the pigs were sent to slaughter.

Carcass weights and measurements were taken on the warm carcasses. Length of carcass was obtained by measuring the distance from the anterior edge of the aitch bone to the anterior edge of the first rib at its junction with the vertebra. Carcass backfat is expressed as the mean of three measurements taken opposite the first rib, the last rib, and last lumbar vertebra. A tracing of the perimeter of the *longissimus dorsi* muscle between the 10th and 11th rib was made and the area of the muscle was measured with the aid of a ¼-inch grid.

## RESULTS

Summaries of feedlot performance for trial 1 are presented in table 5.

The results of trial 1 are presented in table 5 and indicate that pigs on restricted feed intake require a longer feeding period to attain market weight. Pigs on the molasses rations restricted to 70 percent of Morrison's standard required 13.4 days longer to reach market weight than pigs fed the commercial control ration.

Average daily gain tended to decrease with decreased feed allowance. The average daily gains ranged from 1.41 pounds for pigs on the commercial control rations to a low of 1.22 pounds for those on the 70 percent restricted molasses rations.

Feed conversion was best for pigs on the commercial control rations and poorest for those on molasses rations fed according to Morrison's standards. There was a trend toward increased efficiency of feed conversion as the level of molasses ration allowance was decreased.

The average dressing percentage of all animals on experiment was 77.8. The average carcass backfat thickness was 1.20 inches and average carcass length was 29.3 inches. Area of the *longissimus dorsi* muscle averaged 3.24 square inches. None of the differences between treatment means for the foregoing carcass traits were statistically significant.

Comparisons of certain carcass traits between gilts and barrows are reported in table 7. Dressing percentages for gilts and barrows were 78.0 and 77.6 respectively. Average carcass length was 29.4 inches for gilts and 29.2 inches for barrows. Analysis of variance indicated no statistical significance in the differences between means for these traits. Carcasses from barrows had a thicker backfat and smaller area of *longissimus dorsi* muscle than gilts ( $P < .01$ ).

TABLE 5. Means and standard deviations of feedlot performance traits, trial 1

TREATMENT	1		2		3		4		5		TOTAL	
	COMMERCIAL CONTROL		MOLASSES RATION PER MORRISON STANDARD		MOLASSES RATION AT 90% OF MORRISON STANDARD		MOLASSES RATION AT 80% OF MORRISON STANDARD		MOLASSES RATION AT 70% OF MORRISON STANDARD		MEAN S.D.	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
No. of pigs	9		9		8*		9		9		9	
Av. initial wt.	54.9	12.1	57.7	17.3	53.0	15.4	55.0	16.1	53.1	13.0	54.8	14.3
Av. final wt.	171.2	4.2	171.9	3.8	170.2	2.8	169.8	3.3	169.6	4.0	170.6	3.6
Av. gain	116.3	12.4	114.3	19.4	117.2	15.7	114.8	14.4	116.5	13.8	115.8	14.6
Days on test	82.2	16.0	86.7	26.5	86.2	21.2	90.6	28.8	95.6	20.0	88.3	22.4
Av. daily gain	1.44	0.19	1.38	0.26	1.41	0.27	1.33	0.23	1.25	0.22	1.36	0.23
Feed per pound gain	4.02		4.52		4.30		4.34		4.17		4.27	

\*One pig taken off experiment after 7 weeks due to illness.

TABLE 6. Influence of treatments on certain carcass traits, trial 1

NO.	TREATMENT	NO. OF CARCASSES	SHRUNK	WARM	DRESSING	CARCASS	CARCASS	AREA
			WT. <sup>1</sup> LB.	CARCASS WT. LB.	PERCENT <sup>2</sup> %	BACKFAT IN.	LENGTH IN.	OF 1. DORSI SQ. IN.
1	Commercial control	9	159.6	126.3	79.1	1.29	28.8	3.24
2	Molasses ration per Morrison standard	8 <sup>3</sup>	158.3	122.5	77.4	1.15	29.4	3.21
3	Molasses ration at 90% of Morrison standard	8 <sup>4</sup>	158.6	123.8	78.0	1.27	29.6	3.58
4	Molasses ration at 80% of Morrison standard	9	156.9	120.7	76.9	1.11	29.4	3.06
5	Molasses ration at 70% of Morrison standard	9	157.4	121.8	76.6	1.17	29.2	3.17
	All carcasses	43	158.2	123.0	77.8	1.20	29.3	3.24

<sup>1</sup> Refers to live weight of pig after an overnight holding period without access to feed and water following termination of trial.

<sup>2</sup> Expressed as a ratio of warm carcass weight to shrunk weight.

<sup>3</sup> Data on one pig missing.

<sup>4</sup> One pig eliminated during trial due to illness.

TABLE 7. Relationship of sex and certain carcass traits, trial 1

CARCASS TRAITS	BARROWS	GILTS
Number of carcasses	28	15
Dressing percent	77.6	78.0
Carcass backfat, in.	1.25	1.11**
Carcass length, in.	29.2	29.4
Area of 1. <i>dorsi</i> , sq. in.	3.06	3.58**

\*\*Highly significant difference ( $P < 0.01$ ).

In trial 2 restriction of feed intake was accomplished by feeding a constant level of 5 pounds per pig per day after the experimental pigs had reached an average weight of 110 pounds.

Results on feedlot performance for trial 2 are summarized in table 8.

Pigs on the control ration gained faster and reached market weight approximately 7 days earlier than those on restricted feeding. The difference between treatment means for average daily gains was highly significant statistically. Difference in feed required for 100 pounds of gain between treatments was small and not significant.

TABLE 8. Means and standard deviations of feedlot performance traits, trial 2

TREATMENT LOT. NO. NUMBER OF PIGS SEX	CONTROL													
	1 5 GILTS			2 4 BARROWS			3 5 GILTS			4 4 BARROWS			TOTAL	
	MEAN	S.D.		MEAN	S.D.		MEAN	S.D.		MEAN	S.D.		MEAN	S.D.
Av. initial wt.	62.8	6.6		48.4	11.8		55.7	7.7		53.1	11.8		55.5	10.1
Av. final wt.	171.5	6.0		171.8	6.8		170.6	3.3		172.6	2.6		171.6	4.6
Av. gain	108.7	10.1		123.4	16.9		114.9	10.6		119.5	14.2		116.1	13.0
Av. days on test	61.6	5.9		73.5	13.4		79.8	16.9		77.0	18.1		72.7	14.8
Av. daily gain	1.77	0.11		1.69	0.09		1.48	0.21		1.60	0.33		1.63	0.19
Feed per pound gain	3.36			3.75			3.39			3.73			3.56	

  

TREATMENT LOT. NO. NUMBER OF PIGS SEX	RESTRICTED													
	5 4 BARROWS			6 5 GILTS			7 5 GILTS			8 4 BARROWS			TOTAL	
	MEAN	S.D.		MEAN	S.D.		MEAN	S.D.		MEAN	S.D.		MEAN	S.D.
Av. initial wt.	47.6	6.2		62.5	10.7		71.1	22.1		52.1	15.7		59.3	16.7
Av. final wt.	168.4	2.6		168.7	3.4		169.8	3.0		169.5	2.1		169.1	2.7
Av. gain	120.8	6.8		106.2	13.9		98.7	23.4		117.4	16.0		109.8	17.6
Av. days on test	82.2	8.8		79.8	13.6		72.6	24.0		84.0	24.9		79.3	18.0
Av. daily gain	1.48	0.12		1.34	0.07		1.39	0.15		1.47	0.33		1.41**	0.18
Feed per pound gain	3.46			3.50			3.56			3.35			3.47	

\*\*Highly significant difference between means ( $P < 0.01$ ).

TABLE 9. Carcass data, trial 2

TREATMENT	NO. OF PIGS	SHRUNK	WARM	DRESS-	NO. OF	CARCASS	CARCASS	AREA OF
		WT.	CARCASS	ING PER-	CAR-	BACKFAT	LENGTH	<i>I. DORSI</i>
		LB.	WT.	CENT	CASSES	IN.	IN.	SQ. IN.
Control	18	160.6	128.3	79.9	17 <sup>1</sup>	1.25	29.1	3.60
Restricted	18	157.4	126.5	81.0	18	1.11**	29.1	3.69
All carcasses	36	159.0	127.4	80.1	25	1.18	29.1	3.64

\*\*Highly significant difference between treatments ( $P < 0.01$ )

<sup>1</sup>One barrow carcass condemned for sex odor.

Summary of carcass data for trial 2 is shown in table 9. Carcass backfat was reduced ( $P < 0.01$ ) on restricted feeding. Carcass length was the same for both treatments. Carcass yield and area of *longissimus dorsi* muscle were slightly larger for pigs on restricted feeding but the differences were not significant.

Table 10 gives the means for the carcass traits by sex. Carcass backfat was thicker for barrows than for gilts but gilts had longer carcasses. These sex differences between barrows and gilts for these traits were statistically significant ( $P < .05$ ). Gilts had larger *longissimus dorsi* areas than barrows ( $P < .01$ ).

This study indicates that restriction of feed intake of swine fed molasses rations does not markedly improve carcass length, backfat thickness, or area of *longissimus dorsi* muscle. Feed efficiency was slightly improved but the time required to finish hogs was increased.

Because market hogs are slaughtered at lighter weights in Hawaii than on the mainland United States, it would appear that maintaining a herd of meatier hogs and finishing them on full feed offers a greater advantage in producing a good quality carcass than attempting to achieve the same objective by feed restriction.

TABLE 10. Relationship of sex and carcass traits, trial 2

CARCASS TRAITS	BARROWS	GILTS
Number of carcasses	15	20
Dressing percent	80.0	80.2
Carcass backfat, in.	1.24	1.14*
Carcass length, in	28.82	29.35*
Area of <i>I. dorsi</i> , sq. in.	3.32	3.88**

\*Significant difference ( $P < 0.05$ )

\*\*Highly significant difference ( $P < 0.01$ )

## SUMMARY

Two feeding trials were conducted to study the effects of restricted feed intake on growth and certain carcass characteristics.

In trial 1, 45 pigs were allotted to five treatment groups of 9 pigs each at an average initial weight of 43.8 pounds. The control group was fed a commercial feed mixture in accordance with the manufacturer's direction for the entire feeding period. Pigs on the four experimental treatments were fed molasses rations according to Morrison's standards up to an average lot weight of 120 pounds. Thereafter, four graded levels of feed intake were put into effect—100 percent, 90 percent, 80 percent, and 70 percent of Morrison's standards. Individual off-test weight was at the weight closest to 170 pounds. The pigs were slaughtered and measurements of weight, carcass length, average backfat thickness, and area of *longissimus dorsi* muscle were taken on the warm carcasses.

As the levels of feed intake were lowered, the time to reach market weight was increased, average daily gains were decreased, and feed efficiency was increased.

In trial 1, analysis of variance indicated no statistically significant differences between treatment means for dressing percentage, carcass backfat thickness, carcass length, and area of *longissimus dorsi* muscle.

A comparison of carcass data between barrows and gilts indicated that carcass backfat was less and carcass length and area of *longissimus dorsi* muscle were greater for gilts. The differences of 0.14 inch less backfat thickness for gilts and 0.52 square inch greater *longissimus dorsi* muscle area were both highly significant.

In trial 2, 36 pigs with average weight of 57.4 pounds were allotted equally to two treatment groups. Molasses rations were used for both control and experimental groups in this trial. Pigs on control treatment were fed according to Morrison's standards throughout the experiment. Those on the experimental treatment were fed according to Morrison's standard up to average lot weights of 110 pounds. After this weight, feed intake was restricted to 5 pounds per pig daily until termination at individual off-test weights of 170 pounds. The pigs were slaughtered and carcass weight and data were taken under conditions similar to that in trial 1.

The pigs on the constant level of feeding took longer to reach market weights, had an improved efficiency of feed conversion, a lower average daily gain, less backfat thickness, and slightly larger area of *longissimus dorsi* muscle. Differences between means of average daily gain and backfat thickness were highly significant ( $P < 0.01$ ). Other differences were statistically non-significant.

When carcass data between barrows and gilts were compared, backfat thickness was greater for barrows and carcass length and area of *longissimus dorsi* were greater for gilts. Differences in carcass backfat and carcass length were significant ( $P < 0.05$ ) and that of area of *longissimus dorsi* was highly significant ( $P < 0.01$ ).

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