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RATION EXPERIMENTS WITH SWINE, 1906--1908

BY

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RATION EXPERIMENTS WITH SWINE, 1906--1908

W. L. CARLYLE *and* G. E. MORTON

INTRODUCTION

This bulletin records two experiments, the first conducted during the winter of 1906-07, and the second during the winter of 1907-08. Both experiments were planned to discover what protein feeds would prove most economical when fed with barley and with corn. These two grains are the most available and commonly used of any of the feeds used in this State, with the possible exception of field peas. But neither corn nor barley is an economical feed for hogs when fed alone. This is now recognized in the corn belt, after much experimental work by the various experiment stations. Our problem, therefore, is to find what available feeds may be used in this State to best advantage for supplementing these grains.

THE FEEDS SELECTED.

Alfalfa hay, wheat, field peas, wheat shorts, and packing house tankage were the feeds selected because of their availability throughout the State. Wheat shorts consist of the finer particles of bran and a portion of the kernel within the bran. They contain more starch and less crude fibre than bran, and are less bulky. Selected tankage, a packing house product, is made from residue meat scraps, and has a large percentage of protein.

1906--1907 EXPERIMENTS

Ten lots of ten head each were fed. The pigs averaged from 66 to 70 pounds each when they were put on feed. They were Poland China grades, about six or seven months old, bought in the country surrounding Fort Collins. They were very small for their age but of good enough breeding to show fair returns for feed. They were uniform in breeding, age and condition. At the close of thirteen weeks feeding, the lots ranged from an average weight of 154 pounds per head to 200 pounds per head.

The following table gives the results:

TABLE A.

FEED FOR GAIN AND COST OF GAIN, 1906-07

(Ten head in pen.)

PEN NO.	RATION	Gain per Head 13 Weeks. Lbs.	POUNDS FEED FOR 100 POUNDS GAIN				*Cost of Feed for 100 lbs. of Gain	Standing of Lots
			Grain	Hay	Tankage	Beets		
I.	Barley; alfalfa hay at pleasure	107	508	75	...	...	$5.27	5 and 6
II.	Corn; alfalfa hay at pleasure	115	508	76	...	...	$5.27	
III.	Barley and corn, equal parts; alfalfa hay at pleasure	131	435	67	...	...	$4.52	1
IV.	Barley one part; wheat one part	115	476	..	...	...	$5.95	7
V.	Barley one part; peas one part	111	482	..	...	...	$7.23	10
VI.	Barley one part; shorts one part	117	457	..	...	...	$4.57	2
VII.	Barley ten parts; tankage one part	130	405	..	46	...	$4.97	4
VIII.	Corn ten parts; tankage one part	142	386	..	42	...	$4.70	3
IX.	Barley; beets at pleasure	94	475	..	...	478	$5.95	8
X.	Corn; beets at pleasure	86	544	..	...	498	$6.69	9

* Note—Prices of feeds figured as follows:
Grain, one cent per pound, except wheat 1½ cent and peas 2 cents.
Tankage, at $40.00 per ton.
Beets, at $5.00 per ton.
Alfalfa, at $5.00 per ton.

POUNDS FEED FOR ONE HUNDRED POUNDS GAIN.

The number of pounds of feed required to produce one hundred pounds of gain in live weight is the point of chief interest to the feeder, and it is probably the best comparative method of stating our results from the experiment. So we depend upon this column chiefly for our conclusions.

SUGAR BEETS WITH GRAIN.

Lots IX and X were fed sugar beets with barley and with corn respectively. It will be noticed that each of these lots consumed about as much grain for each one hundred pounds of gain as did the lots fed grain alone, and in addition they consumed about as much beets as grain, making the ration very expensive. Practically no returns were secured from the beets. It is true that these lots ate about one-fifth less grain during the entire period of feeding than the lots not fed beets; but they also gained very much less in live weight as the foregoing Table "A" shows. They gained only 94 and 86 pounds per head in thirteen weeks, whereas the other lots gained 107 to 142 pounds per head in the same length of time.

And it must be remembered that the beets were not forced

upon the pigs by withholding the grain. The beets were supplied as the pigs desired them. Evidently they relished the succulent feed, and ate enough of it so that they had not the capacity for a quantity of grain sufficient to produce a large gain in live weight.

These results with beets were so marked that it was not thought necessary to duplicate this portion of the experiment another season. And we believe that the conclusion is warranted that for light weight fattening pigs, weighing from 60 to 160 pounds, sugar beets are not an economical fattening feed in connection with grain, when they constitute about half the ration by weight—in this instance all the beets which the pigs would voluntarily eat.

ALFALFA HAY WITH GRAIN.

Lots I, II and III were fed alfalfa hay and grain. Of these, lot III, fed equal parts of barley and corn, did the best, making the heaviest gains, and requiring the least amount of feed for one hundred pounds gain. This lot, in fact, made the best showing of any in the experiment, and figuring the price of the various feeds upon any reasonable basis, the cost of producing pork with this ration of corn, barley, and alfalfa hay, was less than with any other ration used in the experiment.

Lot I, fed barley and alfalfa hay; and lot II, fed corn and alfalfa hay, came out almost equally well, although lot II showed slightly greater gains than lot I. Neither barley and alfalfa hay nor corn and alfalfa hay gave such good results as corn, barley and alfalfa hay, being surpassed in amount of gain produced and in economy of ration, by several rations in the experiment.

COST OF FEED AND STANDING OF LOTS.

In the foregoing Table "A" a column is given showing the cost of the rations with the feeds figured at given prices. One cent per pound will approximate the market prices of barley, corn, and shorts, and is a convenient round number from which an advance or lowering of prices may easily be computed. Peas and wheat are ordinarily higher in price and therefore are figured at two cents and one and a half cents respectively. In looking down the column showing the standing of lots, a series of numbers are found showing the relative order of the rations according to their economy. This column is given only for the purpose of facilitating the finding of the most economical rations.

BARLEY AND WHEAT SHORTS.

It will be seen that after the barley, corn and alfalfa ration, the barley and shorts ration, half and half, was the most economical. There was so little difference, however, in the economy of these two rations that one cannot say either proved better than the other. The

barley, corn and alfalfa lot required 435 pounds of grain and 67 pounds of hay for 100 pounds gain; while the barley and shorts lot required 457 pounds of grain for 100 pounds gain. Both rations were very satisfactory.

GRAIN AND TANKAGE.

Lots VII and VIII were fed barley and tankage, and corn and tankage respectively, ten pounds of grain being fed for each pound of tankage. The corn and tankage produced slightly better results than barley and tankage, and both rations were good, coming next to lots III and VI in point of economy.

BARLEY AND WHEAT, EQUAL PARTS.

This ration gave good gains, and required only 476 pounds of feed for 100 pounds gain in live weight. But with wheat at any ordinary figure, the cost of the ration is high. If cheap wheat can be gotten—that is, wheat at the price of corn or barley, the wheat and barley ration will prove a satisfactory one. Barley offsets the tendency towards production of soft and flabby flesh which wheat favors, and the two together give good gains.

BARLEY AND PEAS, EQUAL PARTS.

This ration is not equal in production of gain to any of the other rations except the beet rations, and one alfalfa hay ration. Also, the amount of feed required for gain was 482 pounds—considerably greater than that required by the other rations in which grain or grain by products only were fed. And since peas are ordinarily higher in price than corn or the small grains, the ration does not prove economical.

This, of course, does not mean that a ration of barley fed to swine hogging off peas in the field might not prove economical. These results apply only to threshed peas when fed with barley to hogs that are confined to feed yards.

The following Table "B" gives the digestible nutrients required for one hundred pounds of gain in live weight. The nutritive ratio shows the proportion of protein to carbo-hydrates and fat in each ration; for example with Lot I, the nutritive ratio is 7.8; that is, there was one pound of protein to every 7.8 pounds of carbo-hydrates and fat in the ration.

TABLE B. (See Table F, in Appendix)

DIGESTIBLE NUTRIENTS REQUIRED FOR 100 LBS. GAIN, ALL PENS

PEN NO.	TOTAL GAIN (Lbs.)	POUNDS OF DIGESTIBLE NUTRIENTS REQUIRED FOR 100 LBS. GAIN			NUTRITIVE RATIO
		Protein	Carbo-Hydrates	Ether Extract	
I.	1066	49.51	377.49	9.01	7.8
II.	1145	49.25	366.41	22.18	7.9
III.	1303	42.64	319.42	13.42	7.81
IV.	1153	43.19	328.10	8.08	8.05
V.	1112	62.41	252.43	5.86	4.27
VI.	1168	46.40	273.63	12.65	6.55
VII.	1299	52.19	281.60	12.76	5.98
VIII.	1417	41.78	259.84	21.99	6.40
IX.	940	63.09	690.21	8.98	11.28
X.	863	69.29	741.13	24.36	11.54

1907--1908 EXPERIMENT

Six lots with eight head in each lot were fed during this experiment. They were fed during the same season of the year and were the same class of hogs and of about the same weight as those described in the previous experiment. The experiment lasted fifteen weeks—two weeks longer than the previous winter's experiment. The pigs were of uniform breeding, age, and condition.

The most promising rations, as shown by the previous winter's feeding, were tried again and selected tankage was tried with various grains.

TABLE I.

FEED FOR GAIN AND COST OF GAIN

(Eight pigs in each pen)

PEN NO.	RATION	AV. GAIN PER HEAD, 15 WEEKS. LBS.	POUNDS OF FEED FOR 100 POUNDS GAIN			*COST OF 100 LBS. GAIN	STANDING OF LOTS
			Grain	Tankage	Hay		
1.	Barley three parts, corn three parts, alfalfa hay at pleasure.	116	496	..	56	$5.10	4
2.	Barley three parts, corn three parts, tankage one part	171	338	56	..	$4.50	1
3.	Barley six parts, tankage one part	158	367	61	..	$4.89	3
4.	Corn six parts, tankage one part	164	353	59	..	$4.71	2
5.	Durum wheat six parts, tankage one part	161	360	60	..	$6.60	6
6.	Durum wheat three parts, corn three parts, tankage one part.	173	334	56	..	$5.30	5

* Note—Prices of feed figured as follows:
Corn and barley at one cent per pound.
Wheat at one and one-half cent per pound.
Tankage at $40.00 per ton, (two cents per lb.).
Alfalfa at $5.00 per ton.

DURUM WHEAT, CORN, AND SELECTED TANKAGE.

Lots 5 and 6 were fed rations containing these grains. Lot 5, which received six pounds of durum wheat to every pound of tankage, made a very good gain in weight, and required only about an average amount of feed to produce 100 pounds gain, so that if the prices of these feeds were not considered the ration would be pronounced a good one. Both feeds are expensive, however, and consequently the cost of gain is too high.

Lot 6, fed durum wheat, three pounds, corn, three pounds, and tankage, one pound, made the best gains of any lot, gaining an average of eleven and one-half pounds per head each week. These required less feed for gain than any of the other lots. If durum wheat can be obtained at the price of corn, this ration will prove very economical.

BARLEY, CORN, ALFALFA HAY.

This ration proved very satisfactory the previous winter, but did not show quite so great economy in the present experiment. The amount of feed required for gain was somewhat greater than the previous winter, and the gains made were less than those made by the other lots in this experiment. This might be accounted for by a difference in the quality of the hays. At any rate, in this instance, the barley, corn, hay ration proved more costly than barley and tankage; corn and tankage; or barley, corn and tankage; although at a cost of $5.10 for each hundred pounds gain, it is still a very good ration.

BARLEY, CORN AND SELECTED TANKAGE.

This ration, with the feeds in the proportion of 3 : 3 : 1, gave the best results of any tried in this experiment. The gain made was eleven and two-fifths pounds per head each week. The amount of feed required for gain was only 336 pounds of grain and 56 pounds of tankage, and the cost was $4.50 for each hundred pounds gain. This cost was practically the same as that for the corn, barley, and alfalfa lot and for the barley and shorts lot of the previous year.

CORN AND TANKAGE, AND BARLEY AND TANKAGE.

The corn and tankage ration was not quite as economical as the barley, corn, and tankage; but was slightly better than the barley and tankage, the cost of 100 pounds gain for the three lots being $4.71, $4.50 and $4.89. All three of these rations were satisfactory and economical.

It will be seen from the following table that the tankage and the wheat rations all supplied a large proportion of protein, while the alfalfa ration apparently did not. It is probable, however, that the alfalfa rations actually furnished a larger percentage of protein than the tables show, because the pigs eat only the leaves and finer

stems of the hay, while the entire amount of hay is necessarily charged up to them.

TABLE II. (See Table VI in Appendix)

DIGESTIBLE NUTRIENTS REQUIRED FOR 100 LBS. GAIN, ALL PENS

PEN NO.	Total Gain in 15 Weeks lbs.	DIGESTIBLE NUTRIENTS, POUNDS			Nutritive Ratio
		Protein	Carbo-Hydrates	Ether Extracts	
1.	931	45.86	355.86	15.13	8.1
2.	1368	51.32	231.97	17.33	5.33
3.	1260	55.79	255.89	14.05	5.19
4.	1309	53.55	238.50	22.63	5.47
5.	1286	62.75	251.79	13.77	4.54
6.	1383	54.52	229.93	17.14	4.97

CONCLUSIONS.

Sugar Beets.—For light weight fattening pigs, weighing from 60 to 160 pounds, sugar beets are not an economical fattening feed in connection with grain, when they constitute approximately one-half of the ration by weight. Our experience indicates that when such pigs are fed beets at pleasure, they will eat the beets and grain in about equal proportions by weight.

Alfalfa Hay.—Where a good quality of leafy alfalfa hay may be had at reasonable cost, and other protein feeds are difficult to obtain or are high in price, the alfalfa hay may be used to supplement grain feed for fattening pigs. It should not be fed with the grain, but should be put in specially constructed racks where the pigs may go to it at pleasure. Mixed grains, with alfalfa hay will give better results than a single grain with hay as a rule.

Barley and Shorts.—Two home grown feeds that can be secured almost anywhere in the State. They make a first class ration when fed together. The millers of Colorado do not ordinarily separate shorts from bran, but will usually do so upon request, at a price about ten cents per hundred in advance of the price of bran.

Barley and Wheat.—Another home grown combination that gives good results. Where a sufficient yield of durum wheat can be secured on the dry lands of the State, this ration will prove particularly well suited to those regions.

Barley and Peas.—Field peas, threshed, are more expensive than a number of other high protein feeds, so that it is well to confine pea feeding to the hogging off of field peas.

Selected Tankage.—This is a very high protein feed containing over 40% of protein; so that only a small quantity of it is necessary with grain. It proved satisfactory when fed either in the proportion of one-eleventh of the ration, or one-seventh of the

ration. With grain at one cent per pound and tankage at two cents per pound, the grain and tankage ration, with the grain forming five-sixths to nine-tenths of the ration, will cost from about $4.50 to $5.25 for each 100 pounds gain upon fattening pigs under two hundred pounds live weight.

What Selected Tankage Is.—The following description of the manufacture of Digester Tankage by Swift & Co., of Chicago, under date of Oct. 3, 1908, gives a good general idea of the methods used in the manufacture of selected tankage for feeding purposes. Such tankage does not contain any part of the animal carcasses condemned because of disease, and if any disease germs should find their way in with foreign matter they would be destroyed by the cooking process with live steam under pressure.

"Digester Tankage is made from small scraps of meat trimmed from residues left in tanks after edible lard and tallow have been extracted from the carcass trimmings, and residues incident to the production of meats for human food purposes. These materials are taken only from animals which have been U. S. Government inspected and passed. This meat is a finished product and is a safe feed, absolutely free from diseased germs.

"In the process of manufacture, the materials mentioned are placed in large tanks which are then sealed and the mass subjected to live steam, usually under a pressure of 40 pounds. The cooking process is timed for four to six hours, depending upon the character of materials handled. When the cooking is completed the steam is turned off and tanks allowed to settle. When the liquid fat is found in a layer at the top it is removed. The residues consist of a watery solution, and at the bottom of the tanks a mixture of small pieces of meat and bone. The liquid is drained off to be dried separately and the solid meat—"The Tankage"—allowed to drain; it is then dried in large steam-heated rotary ovens in which a high temperature is maintained. The dried tankage is ground and put through a mill and screened to the desired fineness. It is then packed in 100-pound sacks ready for shipment.

"Digester Tankage has a very uniform composition, guaranteed 60% Protein, 6% Phosphates, and 8% Fat."

Armour Packing Company, of Kansas City, make the following statements under date of October and November, 1908:

"Our guarantee to the State of Kansas regarding meat meal is as follows:

> 'Made from regular run of good conditioned cattle and sheep offal from which oils and greases have been extracted. Sold under guarantee to contain a minimum of sixty per cent (60%) Protein, but will run as high as sixty-five per cent (65%) in certain lots.'

"This means too only the best of the offal, for what is commonly known as "peck" never goes into such tanks, being kept apart, and the residue of "peck" tanks goes to fertilizer only.

"Recent analyses of our Meat Meal show that in addition to 60% proteids, it contains about 13% fat, and 14.5% ash.

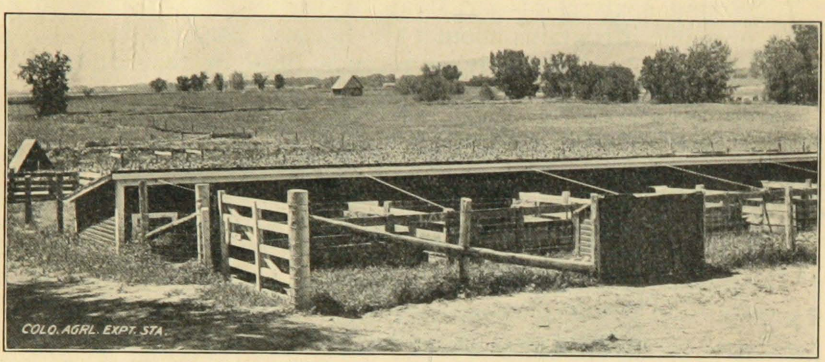
"There is not properly any crude fibre in this, and what foreign matter may get in will not exceed half of one per cent."

The Colorado Packing and Provision Company of Denver, who furnished the selected tankage used in these experiments, have the following to say concerning their product, under date of Oct. 19, 1908:

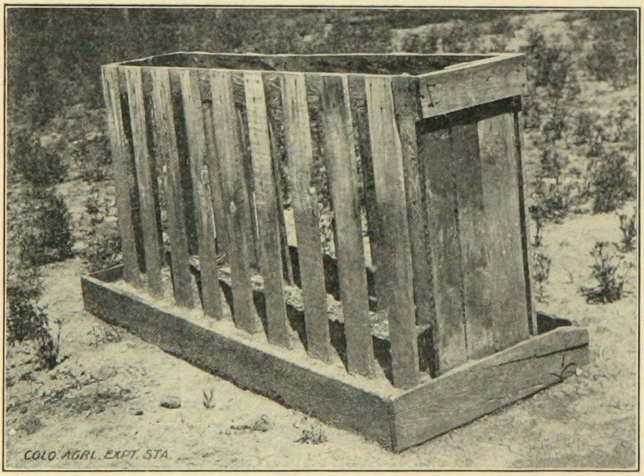
"We will state as near as possible the analysis of our Selected Beef Tankage for stock food:

Water	10%
Protein	55%
Crude Fibre	5%
Free Extract of Nitrogen	7%
Fat	8%
Phosphate of Lime	15%

"This will vary some, as our material is not always uniform, but we will make it as near the above as possible."



SHED AND FEED YARDS USED FOR EXPERIMENTS



RACK FOR FEEDING ALFALFA HAY TO HOGS

APPENDIX

The Tables in the Appendix give the original data of the experiments. The Tables in the body of the bulletin were compiled from these.

WEEKLY DATA, PEN 1. 1906-07
(Ten head in each pen.)

Barley; alfalfa hay at pleasure.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Barley	Alfalfa Hay
Beginning	838	...	...	...	...
1st week	811	—2.7	—2.7	303	144
2nd week	937	126	12.6	390	90
3rd week	1025	88	8.8	406	54
4th week	1102	77	7.7	395	54
5th week	1156	54	5.4	395	76
6th week	1243	87	8.7	445	20
7th week	1390	147	14.7	473	60
8th week	1479	89	8.9	397	60
9th week	1530	51	5.1	430	60
10th week	1522*	102	10.2	420	60
11th week	1573	51	5.1	450	60
12th week	1694	121	12.1	485	20
13th week	1794	100	10.0	445	40
		1066§	106.6	5434	798

* piggy sow, weight 205 lbs., put out; 95lb barrow put in.
§ 956 lbs. plus 110 lbs. lost by exchanging pigs.

WEEKLY DATA, PEN 2. 1906-07
(Ten head in each pen.)

Corn; alfalfa hay at pleasure.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Corn	Alfalfa Hay
Beginning	669	...	...	...	...
1st week	823	154	15.4	303	144
2nd week	896	73	7.3	384	90
3rd week	995	99	9.9	406	54
4th week	1066	71	7.1	420	54
5th week	1125	59	5.9	420	76
6th week	1202	77	7.7	450	60
7th week	1310	108	10.8	483	60
8th week	1393	83	8.3	467	60
9th week	1477	84	8.4	470	60
10th week	1548	71	7.1	440	60
11th week	1622	74	7.4	530	80
12th week	1737	115	11.5	565	40
13th week	1814	77	7.7	475	40
		1145	114.5	5813	878

WEEKLY DATA, PEN 3. 1906-07

(Ten head in each pen.)

Barley and corn, equal parts, and alfalfa hay at pleasure.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.		
				Barley	Corn	Alfalfa Hay
Beginning	688	...	...	...	...	...
1st week	796	108	10.8	152	152	144
2nd week	894	98	9.8	176	176	90
3rd week	992	98	9.8	190	190	54
4th week	1084	92	9.2	189	210	54
5th week	1145	61	6.1	193	210	76
6th week	1230	85	8.5	248	210	60
7th week	1368	138	13.8	230	230	60
8th week	1474	106	10.6	210	210	60
9th week	1549	75	7.5	240	240	60
10th week	1661	112	11.2	220	240	60
11th week	1737	76	7.6	290	280	80
12th week	1868	131	13.1	260	250	40
13th week	1991	123	12.3	240	250	40
		1303	130.3	2838	2848	878

WEEKLY DATA, PEN 4. 1906-07

(Ten head in each pen.)

Barley and wheat, equal parts.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Barley	Wheat
Beginning	671	...	...	...	...
1st week	788	117	11.7	152	152
2nd week	879	91	9.1	187	187
3rd week	970	91	9.1	192	192
4th week	1034	64	6.4	167	208
5th week	1103	69	6.9	193	210
6th week	1193	90	9.0	241	210
7th week	1313	120	12.0	235	210
8th week	1395	82	8.2	191	210
9th week	1460	65	6.5	239	230
10th week	1544	84	8.4	220	210
11th week	1621	77	7.7	250	260
12th week	1729	108	10.8	240	250
13th week	1824	95	9.5	195	250
		1153	115.3	2702	2779

WEEKLY DATA, PEN 5. 1906-07

(Ten head in each pen.)

Barley and peas, equal parts.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Barley	Peas
Beginning	687	...	...	...	...
1st week	812	125	12.5	140	140
2nd week	879	67	6.7	161	161
3rd week	988	109	10.9	180	180
4th week	1062	74	7.4	166	210
5th week	1121	59	5.9	167	210
6th week	1103*	59	5.9	235	210
7th week	1241	138	13.8	249	210
8th week	1333	92	9.2	210	210
9th week	1402	69	6.9	247	230
10th week	1509	107	10.7	246	240
11th week	1588	79	7.9	240	240
12th week	1686	98	9.8	250	250
13th week	1722	36	3.6	182	182
		1112§	111.2	2673	2673

* 147 lb. pig taken out; 70 lb. pig put in.

§ 1035 lbs. plus 77 lbs. lost in exchanging pigs.

WEEKLY DATA, PEN 6. 1906-07

(Ten head in each pen.)

Barley and shorts, equal parts.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Barley	Shorts
Beginning	665	...	...	...	...
1st week	772	107	10.7	152	152
2nd week	873	101	10.1	176	176
3rd week	974	101	10.1	180	180
4th week	1049	75	7.5	210	210
5th week	1138	89	8.9	202	210
6th week	1195	57	5.7	203	210
7th week	1322	127	12.7	194	210
8th week	1396	74	7.4	190	210
9th week	1464	68	6.8	249	210
10th week	1582	118	11.8	222	210
11th week	1619	37	3.7	240	250
12th week	1765	146	14.6	220	210
13th week	1833	68	6.8	230	250
		1168	116.8	2668	2688

WEEKLY DATA, PEN 7. 1906-07
(Ten head in each pen.)

Barley and tankage, nine to one.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Barley	Tankage
Beginning	688	...	...	...	...
1st week	786	98	9.8	252	28
2nd week	898	112	11.2	324	36
3rd week	1035	137	13.7	400	44.4
4th week	1148	113	11.3	389	47.6
5th week	1188	40	4.0	393	50
6th week	1319	131	13.1	426	50
7th week	1430	111	11.1	511	50
8th week	1533	103	10.3	398	50
9th week	1610	77	7.7	433	50
10th week	1721	111	11.1	400	45
11th week	1768	47	4.7	450	45
12th week	1925	157	15.7	495	50
13th week	1987	62	6.2	395	50
		1299	129.9	5266	596

WEEKLY DATA, PEN 8. 1906-07
(Ten head in each pen.)

Corn and tankage, nine to one.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Corn	Tankage
Beginning	686	...	...	...	...
1st week	778	92	9.2	252	28
2nd week	889	111	11.1	324	36
3rd week	1005	116	11.6	400	44.4
4th week	1126	121	12.1	423	47.6
5th week	1190	64	6.4	392	50
6th week	1210*	117	11.7	432	50
7th week	1351	141	14.1	453	50
8th week	1444	93	9.3	362	50
9th week	1516	72	7.2	457	50
10th week	1652	136	13.6	435	45
11th week	1707	55	5.5	495	45
12th week	1869	162	16.2	540	50
13th week	2006	137	13.7	510	50
		1417§	141.7	5475	596

* 162 lb. pig taken out and 65 lb. pig put in.
§ 1320 lbs. plus 97 lbs. lost by exchanging pigs.

WEEKLY DATA, PEN 9. 1906-07

(Ten head in each pen.)

Beets and barley, at pleasure.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Barley	Beets
Beginning	686	...	...	...	...
1st week	737	51	5.1	160	320
2nd week	838	98	9.8	219	438
3rd week	921	86	8.6	320	640
4th week	1006	85	8.5	284	700
5th week	1056	50	5.0	336	350
6th week	1125	69	6.9	408	300
7th week	1205	80	8.0	359	300
8th week	1276	71	7.1	343	300
9th week	1337	61	6.1	373	300
10th week	1403	66	6.6	350	250
11th week	1440	37	3.7	460	250
12th week	1537	97	9.7	460	150
13th week	1626	89	8.9	390	200
		940	94.0	4462	4498

WEEKLY DATA, PEN 10. 1906-07

(Ten head in each pen.)

Beets and corn, at pleasure.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Corn	Beets
Beginning	680	...	...	...	...
1st week	776	96	9.6	160	320
2nd week	848	72	7.2	219	438
3rd week	921	73	7.3	320	640
4th week	981	60	6.0	350	700
5th week	1044	63	6.3	350	150
6th week	1090	46	4.6	400	300
7th week	1158	68	6.8	425	300
8th week	1221	63	6.3	349	300
9th week	1297	76	7.6	426	300
10th week	1351	54	5.4	385	250
11th week	1390	39	3.9	440	250
12th week	1478	88	8.8	440	150
13th week	1543	65	6.5	435	200
		863	86.3	4699	4298

TABLE C.

TOTAL FEED, WEIGHTS AND GAINS, ALL PENS, 1906-07

(13 weeks. 10 pigs in each pen.)

PEN NO.	INITIAL WEIGHT	CLOSING WEIGHT	GAIN	TOTAL FEED CONSUMED								NUTRITIVE RATIO
				Corn	Barley	Shorts	Peas	Wheat	Beets	Tankage	Alfalfa Hay	
I.	838	1794	1066*	....	5434	....	....	....	....	....	798	7.80
II.	669	1814	1145	5813	....	....	....	....	....	....	878	7.90
III.	688	1991	1303	2848	2838	....	....	....	....	....	878	7.81
IV.	671	1824	1153	....	2702	....	....	2779	....	....	....	8.05
V.	687	1722	1112§	....	2673	....	2673	....	....	....	....	4.27
VI.	665	1833	1168	....	2668	2688	....	....	....	....	....	6.55
VII.	688	1987	1299	....	5266	....	....	....	....	596	....	5.98
VIII.	686	2006	1417‡	5475	....	....	....	....	....	596	....	6.40
IX.	686	1626	940	....	4462	....	....	....	4498	....	....	11.25
X.	680	1543	863	4699	....	....	....	....	4298	....	....	11.54

* 110 lbs. credit. See weekly data.
§ 77 lbs. credit. See weekly data.
‡ 97 lbs. credit. See weekly data.

TABLE D.

ANALYSES OF FEEDS, 1906-07

	Dry Matter	Protein	Crude Fibre	Nitrogen Free Extract	Ether Extract
3. Barley	93.465	11.372	7.795	70.713	1.95
3. Peas	93.325	21.743	3.580	63.822	1.345
1. Alfalfa Hay	93.39	16.11	37.24	28.90	1.18
2. Sugar Beets	98.338	8.578	8.515	75.398	0.378
3. Denver Tankage	97.265	46.744	2.730	7.308	13.078
4. Swift's Tankage	93.75	42.15	6.95	15.50	16.30
4. Armour's Tankage	90.95	39.10	10.90	8.60	11.70

1. Analysis obtained from Colorado Bulletin No. 35, page 31.
2. Analysis obtained from Colorado Bulletin No. 46, page 37.
3. Analysis by Douglas of C. A. C.
4. Analysis from Iowa Bulletin No. 65, (1902). Given for comparison.

TABLE E.

* PERCENTAGE DIGESTIBLE NUTRIENTS IN FEEDS, 1906-07

	DIGESTIBLE NUTRIENTS			
	Dry Matter	Protein	Carbo-Hydrates	Ether Extract
Corn	89.1	7.9	66.7	4.3
Wheat	89.5	10.2	69.2	1.7
Barley	80.4	7.96	68.9	1.7
Peas	81.2	18.0	36.1	0.74
Shorts	88.2	12.2	50.0	3.8
‡Denver Tankage	90.4	43.5	5.0	12.8
Alfalfa Hay	56.03	11.92	35.09	0.46
§Sugar Beets	87.5	5.3	75.9	0.19

* Co-efficients taken from "Feeds & Feeding," by Henry.

‡ Percentages (Meat Scrap), "Feeds & Feeding," by Henry. Carbo-Hydrates estimated at 50%.

§ Percentage of crude fibre and ether extract digestible estimated at 50%.

TABLE F. (Compiled from preceding tables.)

FEED AND DIGESTIBLE NUTRIENTS CONSUMED BY ALL PENS. 13 WEEKS, 1906-07

PEN NO.	TOTAL FEED				TOTAL DIGESTIBLE NUTRIENTS			
	Total Grain	Hay	Beets	Tankage	Protein	Carbo-Hydrates	Ether Extract	Nutritive Ratio
I	5434	798	....	...	528	4024	96.0	7.8
II	5813	878	....	...	564	4185	254.0	7.9
III	5686	878	....	...	556	4162	174.9	7.81
IV	5481	...	....	...	498	3785	93.2	8.05
V	5346	...	....	...	694	2807	65.2	4.27
VI	5376	...	....	...	542	3196	147.8	6.55
VII	5266	...	....	596	678	3658	165.8	5.98
VIII	5475	...	....	596	692	3682	311.7	6.40
IX	4462	...	4498	...	593	6488	84.4	11.28
X	4699	...	4298	...	598	6396	210.2	11.54

WEEKLY DATA, PEN 1. 1907-08

(Eight head in pen.)

Ration: Barley 3 parts, corn 3 parts, alfalfa hay at pleasure.

	Weight Lbs.	Gain Lbs.	Average Gain per head Lbs.	FEED LBS.		
				Barley	Corn	Alfalfa Hay
Beginning	484	...	...	..	..	..
1st week	543	59	7.38	83	83	28
2nd week	610	67	8.38	105	105	34
3rd week	666	56	7.00	117	117	39
4th week	745	79	9.88	132	132	44
5th week	793	48	6.00	143	143	47
6th week	850	57	7.13	143	143	40
7th week	921	71	8.88	150	150	42
8th week	972	51	6.38	150	150	36
9th week	1034	62	7.75	162	162	40
10th week	1101	67	8.38	162	162	30
11th week	1152	51	6.38	172	172	34
12th week	1200	48	6.00	195	195	30
13th week	1280	80	10.00	195	195	28
14th week	1368	88	11.00	200	200	25
15th week	1415	47	5.88	200	200	22
		931	116.00	2309	2309	519

WEEKLY DATA, PEN 2. 1907-08

(Eight head in pen.)

Ration: Barley 3 parts, corn 3 parts, tankage 1 part.

	WEIGHT LBS.	GAIN LBS.	AVERAGE GAIN PER HEAD LBS.	FEED LBS.		
				Barley	Corn	Tankage
Beginning	487	...	....	...	...	..
1st week	520	33	4.13	83	83	28
2nd week	634	114	14.25	105	105	34
3rd week	700	66	8.25	117	117	39
4th week	775	75	9.38	132	132	47
5th week	850	75	9.38	143	143	47
6th week	962	112	14.00	144	144	48
7th week	1081	119	14.88	150	150	50
8th week	1158	77	9.63	150	150	50
9th week	1262	104	13.00	162	162	54
10th week	1376	114	14.25	162	162	54
11th week	1475	99	12.38	172	172	57
12th week	1569	94	11.75	195	195	65
13th week	1660	91	11.38	195	195	65
14th week	1752	92	11.50	198	198	66
15th week	1855	103	12.88	204	204	68
		1368	171.00	2312	2312	769

WEEKLY DATA, PEN 3. 1907-08

(Eight head in pen.)

Ration: Barley 6 parts, tankage 1 part.

	WEIGHT LBS.	GAIN LBS.	AVG. GAIN PER HEAD LBS.	FEED LBS.	
				Barley	Tankage
Beginning	485	...	....	...	..
1st week	531	46	5.75	166	28
2nd week	636	105	13.13	210	34
3rd week	696	60	7.50	234	39
4th week	775	79	9.88	264	44
5th week	852	77	9.63	286	47
6th week	920	68	8.50	288	48
7th week	1027	107	13.38	300	50
8th week	1100	73	9.13	300	50
9th week	1222	122	15.25	324	54
10th week	1319	97	12.13	324	54
11th week	1400	81	10.13	344	57
12th week	1470	70	8.75	390	65
13th week	1578	108	13.50	390	65
14th week	1672	94	11.75	396	66
15th week	1745	73	9.13	408	68
		1260	158.00	4624	769

WEEKLY DATA, PEN 4. 1907-08

(Eight head in pen.)

Ration: Corn 6 parts, tankage 1 part.

	Weight Lbs.	Gain Lbs.	Average Gain Per Head Lbs.	FEED LBS.	
				Corn	Tankage
Beginning	486	...	....	...	..
1st week	510	24	3.00	166	28
2nd week	600	90	11.25	210	34
3rd week	679	79	9.88	234	39
4th week	736	57	7.13	264	44
5th week	826	90	11.25	286	47
6th week	922	96	12.00	288	48
7th week	1026	104	13.00	300	50
8th week	1112	86	10.75	300	50
9th week	1219	107	13.38	324	54
10th week	1332	113	14.13	324	54
11th week	1425	93	11.63	344	57
12th week	1510	85	10.63	390	65
13th week	1617	107	13.38	390	65
14th week	1704	87	10.88	396	66
15th week	1795	91	11.38	408	68
		1309	164.00	4624	769

WEEKLY DATA, PEN 5. 1907-08

(Eight head in pen.)

Ration: Durum wheat 6 parts, tankage 1 part.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.	
				Durum Wheat	Tankage
Beginning	484	...	....	...	..
1st week	515	31	3.88	166	28
2nd week	598	83	10.38	210	34
3rd week	692	94	11.75	234	39
4th week	760	68	8.50	264	44
5th week	856	96	12.00	286	47
6th week	892	36	4.50	288	48
7th week	1013	121	15.13	300	50
8th week	1123	110	13.75	300	50
9th week	1218	95	11.88	324	54
10th week	1315	97	12.13	324	54
11th week	1433	118	14.75	344	57
12th week	1492	59	7.38	390	65
13th week	1602	110	13.75	390	65
14th week	1673	71	8.88	396	66
15th week	1770	97	12.13	408	68
		1286	161.00	4624	769

WEEKLY DATA, PEN 6. 1907-08

(Eight head in pen.)

Ration: Durum wheat 3 parts, corn 3 parts, tankage 1 part.

	Weight Lbs.	Gain Lbs.	Average Gain per Head Lbs.	FEED LBS.		
				Durum Wheat	Corn	Tankage
Beginning	487	...	....	...	...	..
1st week	533	46	5.75	83	83	28
2nd week	606	73	9.13	105	105	34
3rd week	692	86	10.75	117	117	39
4th week	767	75	9.38	132	132	44
5th week	857	90	11.25	143	143	47
6th week	950	93	11.63	144	144	48
7th week	1066	116	14.50	150	150	50
8th week	1158	92	11.50	150	150	50
9th week	1262	104	13.00	162	162	54
10th week	1370	108	13.50	162	162	54
11th week	1469	99	12.38	172	172	57
12th week	1552	83	10.38	195	195	65
13th week	1644	92	11.50	195	195	65
14th week	1768	124	15.50	198	198	66
15th week	1870	102	12.75	204	204	68
		1383	173.00	2312	2312	769

TABLE III.

TOTAL FEED, WEIGHTS AND GAINS, ALL PENS 1907-08

(15 weeks, 8 pigs in each lot.)

PEN NO.	Weight at Beginning	Weight at Close	Gain in Weight	TOTAL FEED CONSUMED					Nutritive Ratio
				Barley	Corn	Durum Wheat	Tankage	Alfalfa Hay	
I.	484	1415	931	2309	2309	....	...	519	8.10
II.	487	1855	1368	2312	2312	....	769	...	5.33
III.	485	1745	1260	4624	....	....	769	...	5.19
IV.	486	1795	1309	....	4624	....	769	...	5.47
V.	484	1770	1286	....	....	4624	769	...	4.54
VI.	487	1870	1383	....	2312	2312	769	...	4.97

TABLE IV.

ANALYSES OF FEEDS, 1907-1908

	Dry Matter	Protein	Crude Fibre	Nitro-Free Extract	Ether Extract
Barley	93.465	11.372	7.795	70.713	1.95
Durum Wheat	90.189	10.394	2.746	71.185	2.217
Selected Tankage.....	97.265	46.744	2.730	7.308	13.078
Alfalfa Hay.....	93.39	16.11	37.24	28.90	1.18

TABLE V.

PERCENTAGE DIGESTIBLE NUTRIENTS IN FEEDS, 1907-1908 *

	Dry Matter	Protein	Carbo-Hydrates	Ether Extract
Barley	80.4	7.96	68.9	1.7
Corn §	89.1	7.9	66.7	4.3
Durum Wheat	89.5	10.2	69.2	1.7
Selected Tankage †	90.4	43.5	5.0	12.8
Alfalfa Hay	56.03	11.92	35.09	0.46

* Coefficients obtained from Henry's "Feeds and Feeding."
§ Coefficients used from common wheat.
‡ Percentages used from meat scraps.

TABLE VI. (Compiled from preceding tables.)

FEED AND DIGESTIBLE NUTRIENTS CONSUMED, 1907-1908

(All pens, 15 weeks.)

PEN NO.	TOTAL FEED			TOTAL DIGESTIBLE NUTRIENTS			
	Total Grain	Hay	Tankage	Protein	Carbo-Hydrates	Ether Extract	Nutritive Ratio
I.	4618	519	..	427	3313	140.90	8.10
II.	4624	...	769	702	3173	237.14	5.33
III.	4624	...	769	703	3224	177.03	5.19
IV.	4624	...	769	701	3122	297.25	5.47
V.	4624	...	769	807	3238	177.04	4.54
VI.	4624	...	769	754	3180	237.04	4.97