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EXPERIMENT IN PIG-FEEDING

SHORTS-BRAN, AND CORN MEAL AND POTATOES AS A FOOD FOR YOUNG PIGS

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FEEDING EXPERIMENT.

Shorts-Bran and Corn Meal Compared, as Food for Young Pigs.

The original idea of the experiment, the subject-matter of this article, was that two equal lots of young pigs should be fed in such manner as best to show the influences of common nitrogenous and carbonaceous foods

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upon both quality and quantity of the meat produced. In truth, the experiment just concluded is, in its essential features, with the single exception (the age of the pigs), a repetition of that made by me one year ago, (see Report of Secretary State Board of Agriculture for April, 1889,) in which only matured hogs were employed. In that experiment five hogs were given an exclusive diet of shorts and bran in equal parts, while five others received corn meal alone, containing about one-half the nitrogen of shorts-bran.

The results of careful slaughtering and subsequent examination showed no perceptible difference in the amount of lean meat in the two sets, or in its arrangement with the fat (marbling), although the general character of the meat of the corn-fed pigs was clearly better than that made from shorts-bran. The corn-fed series made a quicker, larger and more profitable gain of fatter meat than the others; their bones were as strong, and in the amount of blood and development of vital organs they were at least equal in all respects to the lot fed bran-shorts.

#### PLAN OF THE EXPERIMENT.

The experiment herein detailed was planned as follows:

1st. Ten *young* pigs, uniform in character, thrifty and vigorous, should be used.

2d. These to be fed in two equal sets — one receiving shorts and bran combined in definite proportions; the others corn meal alone or in combination with condimentary and other foods likely to add to the palatableness of the corn without increasing the proportion of nitrogen in the total feed.

#### CHARACTER OF THE PIGS.

The ten (10) pigs employed in this experiment were all purely-bred pedigree Berkshire of the highest breeding. Their ages, sex, and, to some extent, relationship, are shown in the subjoined groupings.

The pigs having a common date of farrowing are of course of the same litter:

- No. 1. Sow,
- “ 3. Sow,
- “ 5. Sow,           Farrowed March 28, 1889.
- “ 6. Sow,
- “ 10. Sow,
- “ 2. Sow,
- “ 4. Barrow,       Farrowed April 8, 1889.
- “ 9. Barrow,
- “ 7. Sow,           Farrowed April 28, 1889.
- “ 8. Sow,

The litters of March 28th and April 28th had a common sire, while the dams of the three (3) litters were closely related.

From weaning-time to the time of the commencement of the experiment, the pigs were fed on shorts, bran, milk and corn in no very definite proportions. All were healthy, vigorous and well grown when put into the experiment pens.

DETAILS OF THE EXPERIMENT.

As in all previous pig-feeding experiments made in this department, each pig was given the exclusive use of a pen, an arrangement absolutely necessary to a knowledge of the behavior of individual animals. The pens, however, were only in use during the night-time. It seemed to us in the outset essential that these young and growing pigs should have every inducement to take ample exercise. To accomplish this, it was necessary that they should consort freely and have abundant range.

While in the outset the carrying out of this plan seemed beset with practical difficulties, these quickly vanished when brought to the test of experience. The practice was to gather the pigs to their several pens in the evening, where they were fed and allowed to remain over night. In the morning all were fed and afterwards driven promiscuously into a yard, a half-acre or more in extent, where they remained until evening. No difficulty was experienced in identifying each pig by punch-marks and nicks made in their ears. At first, extra help was required to drive the animals to the piggery, and in assigning each to its proper quarters; but this difficulty was not lasting. The animals, as evening approached, came regularly to the piggery, where it was an easy task for one man to assign each pig to its own pen.

THE FEED AND FEEDING.

As before intimated, pens 1 to 5 inclusive, were fed shorts-bran — always cooked in equal proportions — and pens 6 to 10 inclusive, cooked corn meal with certain variations and additions to be noticed hereafter. The addition of bran to the shorts doubtless made a more appetizing and easily-digestible food than shorts or bran alone would, and seemed to warrant an addition to the corn meal of the second set.

Knowing the keen liking of swine for animal food of all kinds, an addition of five per cent. (5%) of tallow was made to every feed of corn given in the course of the experiment.

Later on, (September 24th—November 5th,) the corn-fed pigs were given equal parts of corn and potatoes. From the first the feed of both series was thoroughly cooked to the condition of a mush or pudding, as the case might be. Occasionally the feed was given in a raw state, but in every case of the use of raw feed the failure in the appetites of the pigs became so quickly apparent that the trial was never persisted in beyond a few days or a week at furthest. These subsidiary trials, the use of fat, raw food and cooking, had but one object: to put the food in such shape as to secure for it the *largest possible consumption* by the pigs.

Although I have no facts more accurate than those coming as matters of

experience and general observation, it seems clear now that every variation in the foods, beyond the use of fats and cooking, was attended by a loss. The potatoes were of undoubted value, considered either as an appetizer or true food.

The mixture of shorts and bran was evidently much more satisfactory to the pigs than either taken alone. When clear shorts was used cooked, the result was a sticky, pasty mess that seemed much less satisfactory to the pigs than when bran and shorts in equal portions were employed. Clear bran again, used only a few days, excited the disgust of the pigs to such an extent that it was quickly discontinued. In the tables following, no attempt has been made to indicate the variations made from the conventional feed, as stated above, except in the case of potatoes; the figures in *bold-faced type* refer to the mixture consisting of equal parts, by weight, of corn meal and potatoes.

The feed was cooked as needed at intervals of two or more days, depending somewhat upon the state of the weather as to temperature.

A given amount of food was weighed out, and this was cooked with water sufficient to make a "mush" of the desired consistency (five parts of water to one of meal or shorts-bran). The pigs were fed at morning and evening, great pains having been taken to give each animal all that he would eat without waste. Water was supplied by the brook which ran through the yards occupied by the pigs every day of the experiment. It is a plain inference from the condition of the pens occupied by the two sets, that the shorts-bran series drank greatly more water than their fellows of the other lot: the gutters from the pens occupied by the former flowing almost steadily, while those of the latter were as constantly dry. In this respect the experiment tallies exactly with that of one year ago. Both lots received whatever salt they required, and an abundance of cob-charcoal — of which they were greedy consumers — was regularly supplied them.

The following table, taken from the Annual Report of the Connecticut Experiment Station for 1887, sufficiently indicates the nature of the foods used in this experiment:

	Total dry matter.	Albuminoids or protein.	Crude fat.	Nitrogen, free extract.	Fiber.	Ash.
"Western corn".....	80.90	8.30	3.70	66.00	1.75	1.20
Shorts.....	87.26	13.83	4.14	57.59	7.45	4.25
Bran.....	87.62	15.36	3.83	53.50	9.34	5.59
Potatoes.....	21.90	2.19	.10	18.19	.54	.88

It is plain from this tabular statement that for equal amounts of feed consumed in the two sets, the corn-fed pigs got less than one-half of the nitrogen contained in the food of the companion lot.

The subjoined tables give the essential facts of the experiment in statistical form. The figures indicating quantities, refer to pounds and decimals thereof in every case:

TABLE NO. 1.

SHOWING THE WEEKLY GAIN AND WEIGHT OF EACH PIG AT BEGINNING OF EXPERIMENT AND AT ITS CLOSE; GAIN OF EACH PIG, AND TOTAL GAIN; GAIN PER CWT. OF EACH PIG, AND AVERAGE GAIN PER CWT.

	FEED: SHORTS-BRAN (lbs.).						FEED: CORN MEAL (lbs.).					
	No.1...	No.2...	No.3...	No.4...	No.5...	Total...	No.6...	No.7...	No.8...	No.9...	No.10...	Total...
Wgt. of pig at beginning of exp., Aug. 13, 1889.....	76	66	64	50	83	339	78	60	47	52	108	345
Gain Aug. 19..	10	6	11	5	7	39	8	6	6	6	7	33
“ “ 26..	3	4	3	4	8	22	7	2	3	1	4	17
“ Sept. 2..	10	10	7	9	12	48	3	6	4	8	11	32
“ “ 9..	2	5	7	5	2	21	10	1	2	3	6	22
“ “ 16..	14	11	11	9	11	56	6	5	9	6	4	30
“ “ 23..	3	2	7	10	9	31	5	6	1	7	12	31
“ “ 30..	5	9	10	6	8	38	2	7	9	7	8	33
“ Oct. 7..	17	13	14	10	15	69	10	7	17	12	8	54
“ “ 14..	3	4	3	9	7	26	10	6	0	10	10	36
“ “ 21..	7	10	17	9	14	57	12	9	7	2	13	43
“ “ 28..	22	16	13	16	21	88	18	10	10	21	19	78
“ Nov. 4..	9	9	7	9	10	44	10	8	6	7	15	46
“ “ 11..	14	15	18	15	21	83	10	5	8	9	3	35
“ “ 18..	12	2	8	6	6	34	11	13	2	5	17	48
“ “ 25..	18	16	12	11	17	74	14	12	10	10	13	59
Weight at end of experiment.....	225	198	212	183	251	1069	214	163	141	166	258	942
Gain.....	149	132	148	133	168	730	136	103	94	114	150	597
Gain per cwt..	196.0	200.0	231.2	266.0	202.4	.....	174.2	171.6	197.8	219.2	148.1	.....
Average gain per cwt.....	215.3						173.0					

TABLE NO. 2.  
 SHOWING THE FEED CONSUMED EACH WEEK BY EACH PIG, AND THE TOTALS FOR EACH PIG AND SET.  
 (The figures in bold-faced type stand for a mixture of feed, consisting of corn meal and potatoes in equal parts.)

	FEED (lbs.): SHORTS-BRAN.						FEED (lbs.): { CORN MEAL, CORN MEAL AND POTATOES.					
	No. 1...	No. 2...	No. 3...	No. 4...	No. 5...	Total...	No. 6...	No. 7...	No. 8...	No. 9...	No. 10...	Total...
1st week..	20½	16	21½	15½	27½	101	22	13½	13½	14	24½	87½
2d " ..	29	21½	28	21	33½	133	27½	12	11	12½	29	92
3d " ..	30	28	28	26	35	147	30	17	14	17	30	108
4th " ..	34	31½	33	30½	36	165	26½	18	14½	18	34	111
5th " ..	35	32	35	32	38	172	28	17½	15	17½	32	110
6th " ..	28	28	27	32	33	148	20	16	18	20	32	106
7th " ..	43	43	43	38	48	215	<b>42</b>	<b>32</b>	<b>32</b>	<b>36</b>	<b>48</b>	<b>190</b>
8th " ..	49	49	49	48	54	249	<b>55</b>	<b>42</b>	<b>41</b>	<b>49</b>	<b>61</b>	<b>248</b>
9th " ..	36	38	38	39	44	195	<b>67</b>	<b>54</b>	<b>50</b>	<b>57</b>	<b>70</b>	<b>298</b>
10th " ..	54	51	50	53	63	271	<b>63</b>	<b>46</b>	<b>44</b>	<b>62</b>	<b>76</b>	<b>291</b>
11th " ..	55	55	55	55	68	288	<b>67</b>	<b>58</b>	<b>58</b>	<b>66</b>	<b>91</b>	<b>340</b>
12th " ..	62	62	62	62	77	325	<b>77</b>	<b>63</b>	<b>61</b>	<b>72</b>	<b>100</b>	<b>373</b>
13th " ..	69	63	69	68	86	355	47	38	38	43	54	220
14th " ..	64	59	64	60	79	326	42	37	29	40	61	209
15th " ..	64	53	64	54	77	312	41	41	30	38	57	207
Feed consum'd by each pig...	672½	630	666½	634	799	.....	655	505	469	562	799½	.....
Feed consum'd by each set.	3,402						2,990½					

TABLE NO. 3.

SHOWING THE COST, IN POUNDS OF FEED, OF ONE POUND OF INCREASE WITH EACH PIG EACH WEEK OF THE EXPERIMENT; AND THE LIKE COST OF THREE GROUPS OF EACH SET, AND BOTH SETS. (The figures in bold-faced type stand for a mixture of feed, consisting of corn meal and potatoes in equal parts.)

	FEED (lbs.): SHORTS-BRAN.					Average feed for 1 lb. of increase of three groups...	FEED (lbs.): { CORN MEAL. CORN MEAL AND POTATOES.					Average feed for 1 lb. of increase of three groups...
	No. 1.....	No. 2.....	No. 3.....	No. 4.....	No. 5.....		No. 6.....	No. 7.....	No. 8.....	No. 9.....	No. 10.....	
1st week ....	2.05	2.66	1.95	4.20	3.92	3.99	2.75	2.25	2.25	2.33	3.50	3.72
2d " ....	9.66	5.37	9.33	6.50	4.18		3.92	6.00	3.66	12.50	7.25	
3d " ....	3.00	2.80	4.06	3.43	2.91		10.00	2.83	3.50	2.12	2.72	
4th " ....	17.00	6.30	4.71	6.40	1.80		2.65	18.00	7.25	6.00	5.66	
5th " ....	2.50	2.90	3.18	3.55	3.43		4.66	3.50	1.66	2.91	8.00	
6th " ....	9.33	14.00	3.85	3.20	3.74	4.79	4.00	2.66	18.00	2.85	2.66	6.00
7th " ....	8.26	4.81	4.30	6.33	6.00		2.10	4.57	3.55	5.14	6.00	
8th " ....	2.88	3.76	3.50	4.80	3.60		5.50	6.00	2.41	4.08	7.62	
9th " ....	12.00	9.50	1.26	4.33	6.28		6.70	9.00	No Gain.	5.70	7.00	
10th " ....	7.77	5.10	2.94	5.88	4.50		5.25	5.11	6.28	31.00	5.84	
11th " ....	2.50	3.44	4.23	3.43	3.23	5.25	3.72	5.80	5.80	3.14	6.66	4.47
12th " ....	6.88	6.88	8.85	6.88	7.77		7.70	7.87	10.16	10.17	18.00	
13th " ....	4.92	4.20	3.83	4.53	4.09		4.70	7.60	4.75	4.77	1.80	
14th " ....	5.33	29.50	8.00	10.00	13.16		3.54	2.84	14.50	8.00	3.58	
15th " ....	3.55	3.31	5.33	4.90	4.52		2.92	3.41	3.00	3.80	4.38	
Am't of feed for 1 lb. of increase of each pig.....	4.51	4.77	4.50	4.76	4.16		4.81	4.90	5.04	4.93	5.33	
Average amount of feed for 1 lb. of increase.....	4.66						5.00					



SUMMARY,  
 SHOWING THE GENERAL RESULTS OBTAINED IN THE TWO SERIES.

	Total feed. (lbs.)	Average daily feed per pig. (lbs.)	Average daily gain per pig. (lbs.)	Feed con- sumed for each pound of increase. (lbs.)	Total gain. (lbs.)	Gain per cwt. of pig. (lbs.)
Pens 1, 2, 3, 4, and 5— Feed: Shorts-bran . . .	3,402	6.48	1.39	4.66	730	215.33
Pens 6, 7, 8, 9, and 10— Corn meal . . .	1,250½	3.96	0.97	4.08	597	173.62
Feed: { Corn meal . . .	870	4.14	1.38	6.00		
and Potatoes . . .	870	4.14				

The results obtained with the young pigs employed in this experiment are in striking contrast in many respects with those obtained a year ago with mature hogs fed and treated in all essential respects as the subjects of the experiment under consideration have been. We reported of the experiment of a year ago, that "The corn-fed lot ate the largest daily ration (by 11½ per cent., nearly), made the largest average daily gain (by 9 per cent., nearly), and the largest gain per cwt. of pig (by 10 per cent., nearly); but the amount of food required to make a pound of increase was less (by nearly 2 per cent.) with the shorts-bran-fed series than with the pigs fed corn alone."

The present experiment in its results runs counter to that of one year ago in every one of the above particulars. The shorts-bran-fed pigs ( see summary above ) consumed daily much more than those fed on corn alone, made the largest gain per cwt. of pig; but, again, exactly contradicting the record of one year ago, the amount of feed required to make one pound of increase was smaller where that feed was corn meal than where shorts-bran was used. Even with these young pigs fed for nine ( 9 ) weeks upon an exclusive diet of corn meal, plus five ( 5 ) per cent. of tallow, larger gain was realized than was given by an equal amount of the shorts-bran mixture.

Those people who tell us over and over again, with almost painful iteration, of the dangers that lurk in the shadow of the corn-crib, may study with great advantage the groupings under table No. 2. We here see, in the case of every comparison (see first and third groups) of the pure corn and shorts-bran diet, that in the important particular — the amount of food required to produce a pound of gain — the advantage was in favor of the corn diet, in the one case considerably, and in the other markedly. But the most striking fact is seen in the comparison of the two sets during the time in which one was fed the shorts-bran mixture, and the other equal parts of corn meal and potatoes. Turning to the summary again, we are shown that 8.28 pounds of the mixed corn and potatoes, containing nearly one-half

water, and in dry substance about 5.24 per cent. of albuminoids to about 44 (43.99) per cent. of starch and fat, gave almost exactly the same increase as that yielded by 6.48 pounds of shorts-bran having only 12½ per cent. of water, its dry substance containing 14.59 per cent. of albuminoids to 59.53 per cent. of starch and fat.

What the corn-potatoes mixture should have done to have been only equal, weight for weight of dry substance, to the highly albuminous shorts-bran, may be made clear by a simple computation:

.219 = Dry sub., potatoes. .809 = " " corn. 2) <u>1.028</u> .514 = Dry sub., mixture. .514X8.28 (daily feed of corn and potatoes) = 4.255 = Daily feed of dry sub. .8744X6.48 (daily feed of shorts-bran) = 5.665 = Daily feed of dry sub. 5.665 : 4.255 :: 1.39 : 1.04.		.8726 = Dry sub., shorts. .8762 = " " bran. 2) <u>1.7488</u> .8744 = Dry sub., mixture.
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The reader will remember that the starchy corn-potatoes mixture actually gave 1.34 pounds of increase, instead of the 1.04 pounds it should have given, to have been precisely equal in feeding quality to the shorts-bran.

Much is said by scientific writers in the agricultural publications of the day, of the importance of a ration that is properly "balanced" in its chemical constituents. I have no doubt that a certain considerable latitude in food elements is necessary in particular cases—the food of young and rapidly-growing animals, perhaps—although I am confident that the practical man may generally, with perfect safety, disregard the chemical refinements of the "proper nutritive ration." Profit in the production of the staple results of feeding, the world's supply of meat, milk and its products, wool, and laboring animals, will ever depend, not upon the nice adjustments of chemical elements, but upon practical skill in selecting, preparing and combining foods in such manner as to insure the largest consumption and most complete digestion and assimilation.

APPEARANCE AND BEHAVIOR OF THE PIGS.

The two sets differed in appearance in one particular only: the corn-fed lot had plainly the glossiest and seemingly most abundant hair. So noticeable was the distinction of the two sets in this regard, that the casual help employed in connection with the experiment would pick out the two series without hesitation by this character alone. In respect to feeding and the disposition to exercise, no great difference could be made out.

There were idiosyncrasies as to minor matters in both sets, but the general behavior of the two was strikingly alike. The corn-fed pigs having had a number of minor changes of diet—cooked meal to raw, and cooked meal to cooked shelled corn — always lost in appetite or consuming power with every change.

After the regular diet had been decided upon, no difference could be made out in the appetites or digestion of the pigs of the two sets. As above inti-

mated, the shorts-bran lot evidently drank the most water, as was plainly shown by the almost constant flow from the gutters of the pens occupied by these pigs.

#### POST-MORTEM STUDIES.

All of the pigs were slaughtered November 26th, after a fast of sixteen (16) or more hours, and at once a thorough examination of all the parts of each animal was made. The slaughtering was carefully done by bleeding, and the difference between the weights of the pigs before and after slaughtering is given as the weight of the blood.

After slaughtering and dressing, the thoracic and abdominal viscera were carefully cleaned and the principal parts weighed, together with the fat adherent to the intestines. The result of these weighings is shown in full in tabular form further on. After having been hung up in a cold place until the following day, the carcasses were taken down and cross-sections of each made at the middle loin, and between the sixth and seventh ribs. These sections were at once photographed, and reproductions of these are given hereafter. Each plate exhibits two like sections of two pigs. These pigs were, in the case of each plate, selected because of their resemblances in weight, ripeness and general make-up. The aim was to place side by side pictures of the flesh of those pigs which were nearest alike.

#### CHARACTER OF THE MEAT.

There were several notable differences in the character of the flesh of the two sets. The corn-meal-fed pork was pure white, and firm to the touch, while that from the shorts-bran-fed pigs was in color a dirty yellow, and in texture soft and flabby. In this respect, at least, the result of the experiment under consideration corresponds very closely with that of one year ago. The lean meat of the shorts-bran series was darker than that obtained by the corn-potatoes diet, and of every two animals compared, the proportion of lean meat to fat was clearly greater in the case of those pigs fed shorts-bran. The amount of this increased proportion was usually not large, but in every instance the distinction of the two sets in this respect could be clearly made out. But not only was the *proportion* of lean to fat greatest in the shorts-bran series, but the *actual amount* of lean meat was greater, as was the actual amount of fat in the corn-potatoes series, so far as could be judged by the eye, in every comparison made. Whether this difference is due to the large amount of nitrogen compounds contained by the shorts-bran, according to Professors Sanborn and Henry, or to the increased consumption of food, as would likely be claimed by Mr. Joseph Harris, I am unable to decide. The fact remains, however, that our young pigs gave in this and other important respects very different results from those obtained a year ago with mature hogs. It is to be observed, however, that then the consumption of corn meal was considerably greater than shorts-bran (6243:5597), while in the present instance the amount of shorts-bran used was to the corn-meal-potatoes feed as 3402: 2990½.

TABLE NO. 4.

		Live weight, lbs.	Dressed weight, lbs.	Per cent. of shrinkage.....	Blood, lbs.....	Tongue, oz.....	Heart, oz.....	Lungs, oz.....	Liver, oz.....	Kidneys, oz.....	Spleen, oz.....	Stomach, oz.....	Uters, oz.....	Tenderloin, oz.....	Intestinal fat, oz.	Leaf lard, oz.....
SERIES I.	No. 1...	215	171	20	5	8	10	14½	74	12	3	28	18	18	50	116
	No. 2...	202	153	24	5	10	9	14	57	10½	2	25	14	25	24	90
	No. 3...	207	160	22	5	8½	9	13½	80	12½	4	28	18	20	56	99
	Feed: Shorts-bran. No. 4...	187	136	27	4	7	8	14	66½	11	3	23	.....	17	67	89
	No. 5...	242	189	21	6½	10	12	15½	84	14	4½	29	21	25	88	133
Averages.....		210.6	161.8	23	5.1	8.7	9.6	14.3	72.3	11.8	3.3	26.6	17.7	21.0	57	105.4
Average per cwt. dressed pig....		.....	.....	.....	3.15	5.37	5.93	8.83	44.63	7.41	2.04	16.44	10.55	12.97	35.2	65.14
SERIES II.	No. 6...	201	164	18	3	8½	9	17	51	9	3	25	12½	13½	58	127
	No. 7...	163	125	23	4	7	9	14	54	7½	2½	19	13½	17	50	83
	No. 8...	138	107	22	3	6	6½	13	45	6	2½	17	2½	11	50	72
	Feed: Corn meal and potatoes. No. 9...	164	127	23	3	6	7	12	48	9	2½	18½	.....	13	66	114
	No. 10..	251	206	17	4	10½	10	15½	48½	11	4½	24½	12	19	98	153
Averages.....		183.4	145.8	20.6	3.4	7.6	7.9	14.3	49.3	8.5	3	20.8	10.1	14.7	64.4	109.8
Average per cwt. dressed pig....		.....	.....	.....	2.33	5.21	5.41	9.8	33.81	5.83	2.05	14.26	6.72	10.08	44.17	75.3

FEEDING EXPERIMENT.

In table No. IV is exhibited the weights of the principal organs concerned in the functions of nutrition, together with certain special parts, and the live and dressed weights and shrinkage of each pig from the condition of live weight to that salable carcass. The average shrinkage—not given in the table — in the shorts-bran lot was twenty-four (24) and in the lot fed corn-potatoes twenty (20) per cent. Manifestly the differences in weight of the pigs of the same or different series precludes a comparison of individuals. The true statement, therefore, of the development of the organs and parts named in the table, must be sought in the figures following “Average per cwt of dressed pig.” We here see that the differences are generally in favor of the pigs fed shorts-bran, the exceptions to the rule being the lungs, the spleen, and the intestinal and “leaf” lard. In the weight of the blood, the liver, the kidneys, the uterus, the stomach, and the tenderloin, the balance in favor of the shorts-bran lot was considerable. The differences in the two lots in the particulars named may possibly be explained by the difference in the character of the food of the two sets, although to my mind other considerations have influenced this result. Thus the great consumption of water by the first series may be a sufficient explanation of the excess of blood in that class; while the comparatively large amount of food, particularly in *bulk*, used by this set, must have called for increased activity and size in organs like stomach, liver, and kidneys, which are particularly concerned in utilizing it. Whether these suggestions of an explanation are true or not, matters but little; the practical fact remains that the corn-fed series were, to all appearances, in vigor, activity and strength, the equals of their companions of the shorts-bran diet.

#### THE DRY SUBSTANCE OF BOTH COMPARED.

To further test the difference of the meat of the two sets, samples of both were subjected to prolonged drying, with the object of showing the character of the meat from which moisture had been completely removed. Half-pound samples of the lean and fat of each were taken from different parts of each animal. The lean was cut from the loin, the muscles of the back, and the ham; while the fat was obtained from the superficial layer of the back and flank. Each sample, after having been reduced to thin strips, was subjected to prolonged drying in an oven kept at a nearly uniform temperature of 110° Centigrade. This drying process was maintained until the repeated weighings, at considerable intervals of time, showed no diminution in weight, and consequently no loss of moisture in the samples. The drying process was maintained with scarcely an interruption for 150 hours. The result of this drying is shown in the tabular statement on the following page.

TABLE NO. 5

SERIES I: SHORTS-BRAN-FED.	Per cent. of water in lean meat.....	Per cent. of water in fat meat.....	SERIES II: CORN-POTATOES-FED.	Per cent. of water in lean meat.....	Per cent. of water in fat meat.....
No. 1 .....	73	9	No. 6 .....	72	..
No. 2 .....	75	12	No. 7 .....	73	7
No. 3 .....	73	10	No. 8 .....	74	7
No. 4 .....	74	11	No. 9 .....	73	6
No. 5 .....	73	9	No. 10 .....	72	10
Average .....	73 $\frac{3}{8}$	10 $\frac{1}{5}$	Average.....	72 $\frac{4}{5}$	7 $\frac{1}{2}$

We here see that the difference in the character of the lean meat of the two sections was not great, so far as the water it contained is concerned, but the lesson of the table, in so far as it relates to the fat, clearly supports the direct evidence of the senses: it was greatly inferior in the shorts-bran-fed lot to that of the companion series.

STRENGTH OF THE BONES.

The left femur of each pig was removed and subjected to a careful test for strength by Prof. O. P. Hood, of the Department of Mechanics and Engineering. The report of these trials, made by one who I should say knew nothing of the antecedents of the pigs from which the bones had been taken, is given below:

PROF. E. M. SHELTON: I have the honor to submit the following report of a test of the strength of various bones submitted to me.

The bones were all the left femur, with all flesh removed by scraping. The bones were placed on supports four inches apart, and pressure sufficient to break was gradually applied to a point midway between supports. The accompanying table gives the breaking weights:

TABLE NO. 6.

SERIES NO. 1: SHORTS-BRAN-FED.	Weight of bone, ounces .....	Breaking weight, lbs.....	Breaking weight per cwt, dressed pig, lbs.....	SERIES NO. 2: CORN-POTATOES-FED.	Weight of bone, ounces .....	Breaking weight, lbs.....	Breaking weight per cwt, dressed pig, lbs.....
No. 1 .....	5 $\frac{1}{2}$	729	426	No. 6 .....	5 $\frac{1}{2}$	410	250
No. 2 .....	4 $\frac{3}{4}$	422	275	No. 7 .....	5	572	458
No. 3 .....	5 $\frac{1}{2}$	495	309	No. 8 .....	4	441	412
No. 4 .....	5	595	437	No. 9 .....	5	477	375
No. 5 .....	6 $\frac{1}{2}$	651	344	No. 10 .....	7	525	254
Average.....	5 $\frac{3}{5}$	578 $\frac{2}{5}$	357	Average.....	5 $\frac{3}{10}$	485	332

There were two characteristic fractures, but these were not so pronounced as in the set tested by me one year ago. The fractures of Nos. 1, 2 and 4 were nearly square across the bone, with broken surfaces nearly square across the structure of the bone. There were very few cracks in the fractured portions. Nos. 3 and 5 could be described in the same manner, except that the fracture was rougher and showed long cracks on the sides.

These all broke without any previous warning by cracking.

Nos. 6, 7, 8, 9, and 10, invariably cracked when under a strain of from 25 to 130 pounds less than the breaking weight.

No. 6, breaking at 410, showed long cracks on the under side at 280.

Nos. 7, 8, and 9, showed very irregular fractures, having sharp, flinty points, and breaking in a number of small pieces. Nos. 6 and 10 were very irregular, but less flint-like. Nos. 6, 7, 8, 9, 10, all show long cracks on the under side of the bone.

Respectfully submitted.

O. P. HOOD, *Superintendent.*

The facts of this table, and Prof. Hood's report, certainly show no great difference in the character of the bones of the two sets. There is a difference plainly, and that difference, except in the weight of the bones, is in the case of every average made, in favor of the shorts-bran-fed series. It is noteworthy, however, as showing how impartially the excesses over averages are distributed between the two sets, that while the largest force in breaking was required in No. 1 of the shorts-bran lot, the heaviest bone (No. 10), and the bone requiring the largest stress per cwt. of pig (No. 7), were furnished by the second series.

#### THE COOKING TEST.

The meat of the two series received a thorough test by boiling and roasting, and in a less degree by frying. Of the four (4) double roasts tested, two were reported as showing no appreciable difference in texture or flavor; while in the case of two (2), the shorts-bran meat was pronounced distinctly dryer, harder, and more fibrous than that from the other series. The frying revealed in every case reported, a hard toughness in the meat of the shorts-bran lot not noticed in the flesh of the other series.

The peculiar greasiness of the fat of the shorts-bran lot has before been adverted upon. This character was, as might have been expected, brought out with emphasis in boiling. Four pounds of fat "side meat" were taken from each of two pigs (Nos. 5 and 10), typical specimens of the class to which each belonged; and these were subjected to thorough and equal cooking. The four pounds of meat obtained from pig No. 5 shrank to two pounds fifteen ounces, while that from No. 10 only wasted in the pot a half-pound in the course of the boiling. Clearly the meat from corn-potatoes feeding was a much better and more salable article than that yielded by the shorts-bran series.

These are essentially the facts of our experiment; and having faithfully given these, our chief duty is done. Opinions regarding the character and importance of the work, and the weight of evidence upon particular points, may safely be left with the reader.