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A Comparison of Feeds for Pigs.

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KENTUCKY
Agricultural Experiment Station.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

(150)

Bulletin No. 101.

A Comparison of Feeds for Pigs.

D. W. May.

Of the various feeds for pigs available to the farmers of this country, corn ranks first. It is a crop grown to some extent in all sections, is much relished by pigs, is easily handled and lays on fat rapidly. With these qualifications it is no wonder that it has largely superseded all other feeds and is used to a great extent as the single article of diet in the fattening ration. Not only has it become in most instances the sole feed given to pigs, but it has materially influenced the character of the animal in the corn growing regions.

There is no doubt but that corn fed alone is in a great many instances unprofitable. Investigations have shown not only that pigs make a better gain per pound of feed but that the animals are more thrifty and less liable to disease when fed a combined ration.

In the work herein reported certain feeds were employed which are available to the farmers of this State and which may be used to supplement the corn ration for pigs. Twenty grade Berkshire pigs raised on the Station Farm were divided into five lots of four each. The animals were from the litters of three sows of very similar breeding and were by the same sire. They were a very uniform lot of pigs and were divided into lots of nearly equal weights. They had been wintered on corn and at the beginning of the experiment were in good flesh. The feeding was carried on in small piggeries with a covered room for sleeping and eating and a small run 8x15 feet. The animals were supplied at all times with water, ashes, coal and salt. A little copperas was occasionally added to the drinking water. The feeding was done twice daily, the animals being given all they would clean up well.

The feeds employed were corn, corn and soy bean silage, soy beans and dried distillery grains. In finishing the hogs there were used hominy meal, skim milk, tankage and cotton seed meal. The first period covered ten weeks and the finishing period three weeks.

The experiment was begun February 14. The feeds used for each lot were as follows:

Lot I. shelled corn.

Lot II. shelled corn and corn and soy bean silage.

Lot III. shelled corn $\frac{2}{3}$, shelled soy beans $\frac{1}{3}$.

Lot IV. shelled corn $\frac{1}{2}$, dried distillery grains $\frac{1}{2}$.

Lot V. shelled corn $\frac{2}{3}$, dried distillery grains $\frac{1}{3}$.

During the first period of ten weeks lot I. was fed shelled corn alone for comparison. This corn grown in the county showed the following by analysis: dry matter 86.50; protein, 10.31; fat, 4.14; carbohydrates, 68.97 per cent. Lot II. was fed as much shelled corn as would be well cleaned up and in addition 10 pounds of corn and soy bean silage. The latter was increased after three weeks to 15 lbs. daily. In several experiments made at the stations it has been found that silage could not be profitably substituted for a part of the grain ration. In the experiment here reported it was not intended to employ silage as a substitute for part of the grain, but to determine its value as an additional or corrective feed. The animals picked out the grain in the silage first and then chewed the remaining portions. The larger part was not swallowed. This silage was made of corn and soy beans, the corn cut when the ears were glazed. The composition of the silage was as follows: dry matter, 33.5; protein, 2.5; fat 1.0; carbohydrates, 18.9 per cent.

The pigs in lot III. were fed shelled corn $\frac{2}{3}$ and shelled soy beans $\frac{1}{3}$. The analysis of the latter was as follows: dry matter, 90.06; protein, 32.44; fat, 19.01; carbohydrates, 28.76 per cent. Taking the average of digestibility the nutritive ratio of this ration was 1:7.1

Lot IV. was fed for six weeks shelled corn ½ and dried distillery grains ½. The latter had the following composition: dry matter, 93.83; protein, 30.81; fat, 11.03; carbohydrates, 37.37 per cent. During the first six weeks the animals made practically no gains. They would first pick out the corn and would eat the distillery grains only as a last resort. During the last four weeks the ration was changed to shelled corn ⅘, distillery grains ⅕. The gains during this period were very satisfactory. The distillery grains employed was composed of the residue of corn and rye from whisky distilleries. The nutritive ratio of the ration fed this lot was 1:5.8 during the first period and 1:8.1 during the second period.

Lot V. was fed throughout the period of ten weeks on shelled corn ⅔. dried distillery grains ⅓. The nutritive ratio of this ration was 1:7.1, the same figure as with lot III.

The pigs were weighed weekly each Friday morning before feeding. The gains per pig are shown in the following table:

GAINS PER WEEK, FIRST PERIOD.

	Feb 14	Feb 21	Feb 28	Mar 7	Mar 14	Mar 21	Mar 28	Apr 4	Apr 11	Apr 18	Apr 25
Lot I.	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
1	173	172	187	192	202	211	222	227	234	242	253
2	133	132	138	136	139	142	145	144	146	152	157
3	97	100	106	106	111	117	123	127	135	143	149
4	154	156	164	167	169	180	185	181	190	194	195
	557	560	595	601	621	650	675	679	705	731	754
Net Gain.		3	35	6	20	29	25	4	26	26	23
Lot II.											
5	136	138	145	146	153	160	165	172	174	178	183
6	147	151	155	164	172	182	184	195	200	209	215
7	142	144	147	151	157	168	175	173	184	191	192
8	113	118	126	133	142	152	159	166	173	181	190
	538	551	573	594	624	662	683	706	731	759	780
Net Gain.		13	22	21	30	38	21	23	26	28	21
Lot III.											
9	133	135	142	147	157	170	176	185	193	202	204
10	125	124	134	138	146	161	169	172	186	192	197
11	157	162	174	187	205	215	226	232	242	252	259
12	153	155	164	172	183	197	207	210	223	233	234
	568	576	614	644	691	743	778	799	844	879	894
Net Gain.		8	38	30	47	52	35	21	45	35	15
Lot IV.											
13	179	174	179	181	184	192	193	202	209	219	228
14	138	136	138	137	138	138	137	144	150	155	158
15	150	151	153	154	156	161	159	169	175	182	188
16	96	91	94	94	98	97	97	104	111	119	125
	563	552	564	566	576	588	586	619	645	675	699
Net Gain.		-*11	12	2	10	12	-*2	33	26	30	24
Lot V.											
17	142	142	146	149	151	155	162	164	170	177	181
18	110	108	115	119	122	127	134	139	147	153	160
19	135	136	137	148	143	146	151	151	159	164	168
20	170	172	177	181	185	190	198	203	213	222	225
	557	558	575	597	601	618	645	657	689	716	734
Net Gain.		1	17	22	4	17	27	12	32	27	18

* Loss.

The following table shows the feed consumed by each lot per week; the gain per lot per week; the average gain per pig and the amount of food consumed per pound of gain.

FOOD CONSUMED AND GAIN PER WEEK.

	LOT I.		LOT II.			LOT III.			LOT IV.			LOT V.		
	Food Consumed	Gain	Food Consumed		Gain	Food Consumed		Gain	Food Consumed		Gain	Food Consumed		Gain
	Corn.		Corn.	Silage.		Corn.	Soy Beans		Corn	Distillery Grains		Corn	Distillery Grains	
1902 Feb. 21	lbs 89	lbs 3	lbs 88	lbs 70	lbs 13	lbs 56	lbs 27	lbs 8	lbs 35	lbs 35	lbs *11	lbs 49	lbs 25	lbs 1
Feb. 28.	110	35	102	70	22	71	35	38	27	27	12	59	30	17
Mar. 7.	116	6	125	105	21	87	43	30	31½	31½	2	64	32	22
Mar. 14.	126	20	128	105	30	97	49	47	33	33	10	67	34	4
Mar. 21.	120	29	132	105	38	106	53	52	37½	37½	12	59	29	17
Mar. 28.	121	25	134	105	21	99	49	35	35	35	*2	75	37	27
Apr. 4.	117	4	145	105	23	104	52	21	87	22	33	77	38	12
Apr. 11.	119	26	139	105	26	101	51	45	97	24	26	76	38	32
Apr. 18.	123	26	129	105	28	113	56	35	103	26	30	89	45	27
Apr. 25.	116	23	121	105	21	92	46	15	109	27	24	81	40	18
Total feed and gain.	1157	197	1243	980	243	926	461	326	595	298	136	696	348	177

* Loss.

AVERAGE DAILY GAIN AND POUNDS FOOD PER POUND GAIN.

	Lot I.		Lot II.		Lot III		Lot IV.		Lot V.	
	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.
First six weeks,	.70	5.78	.86	4.89*	1.25	3.68	.14	1730	.52	6.36
Total ten weeks	.70	5.87	.87	5.12*	1.16	4.25	1.00	4.38	.63	5.90

*Exclusive of silage.

The results of the experiments tend to show that corn should be supplemented with other feeds to get the best returns. This but bears out the testimony of many trials made at the various experiment stations of the country.

The increased gains made by lot II. over lot I. indicate that silage may under certain conditions be profitably fed to fattening hogs. Previous experiments show that it cannot replace a part of the grain feed, but the experiment under discussion shows its value as an additional feed to the full grain ration. In this connection the writer is under the impression that its value is more through acting as a corrective rather than as an increase of the fattening ration. Comparing the additional gain of lot II. over lot I. we find that 980 pounds of silage represented an increased gain of 46 pounds of pork with an additional consumption of 86 pounds of corn. Deducting the estimated gain from the increased amount of corn consumed a ton of silage represented a gain of 64 pounds of pork. Estimating from the figures of lot I. the amount of corn required to make 64 pounds of pork we find that a ton of silage represented in flesh producing value 375 pounds of corn in the experiment here reported. The relative value of the amounts of the two feeds will of course vary. There was not, however, much difference in the cost of the two in this experiment, but the quicker gains and the general thriftiness of the lot fed silage was of advantage.

The greatest daily gains and the greatest gains per pound of feed were made by lot III. with a ration composed of shelled corn $\frac{2}{3}$ and shelled soy beans $\frac{1}{3}$. The favorable increase in

this lot over lot I. fed corn alone shows the advantage of combining feeds in making the ration for pigs, especially the addition of substances containing more protein than corn. The thriftiness and the fineness of the hair of the pigs in this lot was especially noticeable. The latter at least was due in great measure no doubt to the large oil content of the grains fed. The use of the soy bean in our agriculture cannot be too highly commended. Not only does it prove to be a very efficient feed, but it belongs to the family of plants called legumes and is a splendid crop for improving the fertility of the soil.*

The distillery grains fed to lots IV. and V. was the dried residue from whisky distilleries. The animals did not relish this feed in any amount and would not eat it when there was any corn available. Fed for six weeks in equal amounts with corn the four animals gained only 23 pounds. With corn forming $\frac{2}{3}$ of the ration and the distillery grains $\frac{1}{3}$, the gains were lower than with the other lots. After changing lot IV. to corn $\frac{4}{5}$ and distillery grains $\frac{1}{5}$, the gains were better for the four weeks than with corn alone. This is probably the greatest per cent. in the ration with corn in which distillery grains can be profitably fed to hogs.

At the conclusion of the ten weeks period of feeding reported, the same lots of pigs were used to test the value of certain feeds in finishing for market. The feeds employed were corn, hominy meal (a residue from hominy mills consisting of the germ and husk of corn grains), skim milk, tankage (composed of dried blood, meat scraps and other packing house refuse) and cotton-seed meal. The trial was carried on three weeks. The five lots were fed similar rations except in the case of cotton-seed meal which was varied. This latter feed has been tested by several of the stations and it is well known that its continued use as a feed for pigs will result in the death of the animals. Where fed in small amounts or where alternated with other feeds some experiments have shown that death losses may be avoided. Georgeson, Burtis and Otis (Kansas Bul. 53) fed a ration of $\frac{5}{6}$ corn meal and $\frac{1}{6}$ cotton-seed meal to young pigs. They all died before six weeks had

*See Kentucky Bulletin No. 98.

passed. A ration composed of ¾ corn meal and ¼ cotton-seed meal was fed to two sows. They continued to gain for 45 days and showed no symptoms of disease. Henry (Wisconsin Report 1894) fed four sows ½ pound of cotton-seed meal daily for 35 days without any bad effects. Curtis and Carson (Texas Bul. 21) state that pigs died in from six to eight weeks when fed cotton-seed meal. Emery (North Carolina Bul. 109) fed 1¼ pounds of cotton-seed meal with 2½ pounds of bran in a pig ration for 21 days without bad effects. When the amount of cotton-seed meal was increased to 2 pounds the pigs sickened. The subject deserves further study as cotton seed is a cheap and valuable feed, and a large number of experiments will show to what extent it may be safely used as a part of the ration in feeding pigs. Further experiments are also desirable for determining the danger point of running pigs after steers fed cotton-seed meal. Cotton seed has proven a very efficient feed for cattle and is especially valuable in finishing them for market. The results obtained in the experiment herein reported indicate that it is no less valuable in finishing fattening hogs.

The first week of the finishing period the animals were fed shelled corn and skim milk, the pigs in lots I. and IV. receiving ¼ pound of cotton seed meal per head daily in addition. The second week they were fed hominy meal and tankage the pigs in lots II. and III. receiving ¼ and in lot V, ½ pound each of cotton-seed meal. The third week the ration was made up of shelled corn and tankage, the pigs in lot I. receiving ¼ and those in lot IV. ½ pound of cotton-seed meal per head.

The results are shown in the following tables:

GAINS PER WEEK, FINISHING PERIOD.

		Apr. 25.	May 2.	May 9.	May 16.
LOT I.	1	253	263	275	279
	2	157	171	182	197
	3	149	162	168	176
	4	195	211	223	232
		754	807	848	884
Net gain,			53	41	36
LOT II.	5	183	199	205	211
	6	215	219	230	237
	7	192	212	227	231
	8	190	199	212	221
		780	829	874	900
Net gain,			49	45	26
LOT III.	9	204	220	227	228
	10	197	210	217	225
	11	259	272	281	283
	12	234	245	252	262
		894	947	977	998
Net gain,			53	30	21
LOT IV.	13	228	245	249	259
	14	158	174	184	194
	15	188	209	220	233
	16	125	133	140	153
		699	761	793	839
Net gain,			62	32	46
LOT V.	17	181	197	198	207
	18	160	170	187	200
	19	168	184	199	209
	20	225	235	247	254
		734	786	831	870
Net gain,			52	45	39

Feed Consumed and Gain Per Week.

	LOT I. Feed.				LOT II. Feed.				LOT III. Feed.				LOT IV. Feed.				LOT V. Feed.			
	Corn	Skim Milk.	Cotton Seed Meal.	Gain	Corn	Skim Milk.		Gain	Corn	Skim Milk.		Gain	Corn	Skim Milk.	Cotton Seed Meal.	Gain	Corn	Skim Milk.		Gain
	lbs.	gals.	lbs.	lbs.	lbs.	gals.		lbs	lbs.	gals.		lbs	lbs.	gals.	lbs.	lbs.	lbs.	gals.		lbs.
May 2.	108	35	7	53	120	35		49	150	35		53	134	35	7	62	142	35		52
	Feed.				Feed.				Feed.				Feed.				Feed.			
	Hominy Meal	Tankage.		Gain	Hominy Meal	Tankage.	Cotton Seed Meal.	Gain	Hominy Meal	Tankage	Cotton Seed Meal.	Gain	Hominy Meal	Tankage		Gain	Hominy Meal	Tankage	Cotton Seed Meal.	Gain
	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.
May 9.	121	28		41	122	28	7	45	127	28	7	30	116	28		32	124	28	14	45
	Feed.				Feed.				Feed.				Feed.				Feed.			
	Corn	Tankage	Cotton Seed Meal.	Gain	Corn	Tankage		Gain	Corn	Tankage		Gain	Corn	Tankage	Cotton Seed Meal.	Gain	Corn	Tankage		Gain
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.	lbs	lbs.		lbs.	lbs	lbs	lbs	lbs.	lbs.	lbs.		lbs.
May 16.	144	28	7	36	140	28		26	151	28		21	139	28	14	46	155	28		39

	Total Grain and Tankage. lbs.	Total Gain, lbs.	Pounds of Food per Pound of Gain, lbs.	Daily Average Gain, lbs.
Without Cottonseed Meal In ration	1235	313	3.95	1.40
With Cottonseed Meal in ration	1191	317	3.47	1.62

It will be noticed that in the three weeks feeding the daily gains were greater and at less cost than in the ten preceeding weeks. This is due largely in the writers opinion to the use of skim milk and tankage. Wheeler has shown (N. Y. State Station Bul. 149) that with chickens and ducks much greater gains were made when a part of the ration was animal feed. Watson (N. Y. Cornell Bul. 89) found by feeding meat scraps with corn meal an increased gain of 70 per cent. and a saving in feed of 6 per cent. over corn meal alone. It would appear from these and other experiments that rations composed partly of milk and of tankage, meat scraps, kitchen slops, &c., have a more favorable influence in pork production than rations composed wholly of vegetable substances. The hog being an omnivorous animal we would naturally expect such results.

The results with the cotton-seed meal indicate a very favorable influence of this feed in finishing hogs for market. Such results are obtained by feeding cotton-seed meal to beeves and this practice is very extensively followed. The feeding of cotton-seed meal to calves and young pigs has usually resulted in the death of the animals. From the results of recent experiments it would appear that limited amounts of cotton seed meal may for short periods be profitably fed to grown pigs. The limit of safety is not yet clearly defined. The feeder is advised, from the present knowledge of the subject, not to go beyond the limits shown to be safe by experiments made at the experiment stations. Further studies will result in more closely determining the amount of cotton seed meal which may be safely fed to matured pigs.

Summary.

The results of these experiments like those of several previously made indicate that in feeding pigs corn should be combined with other feeds to get the best returns.

Experiments indicate that silage cannot be profitably substituted for a part of the grain ration with pigs. In this experiment it was fed in addition with some profit, giving quicker gains and keeping the animals in better condition.

Soy beans made an excellent pig feed mixed with corn in the proportion of 1:2. Being rich in protein it is recommended as an especially efficient addition to the ration when corn composes the larger part.

Dried distillery grains proved to be a poor pig feed except in small proportions. When fed as $\frac{1}{3}$ or $\frac{1}{2}$ of the ration with corn it was unprofitable. Where it composed $\frac{1}{5}$ of the ration very good returns were obtained.

Cotton seed meal may be profitably used to finish hogs for market. In such cases it may be safely fed in quantities of $\frac{1}{2}$ pound per pig daily and then omitted during periods of alternate weeks.

The writer is under obligations to Dr. A. M. Peter of this Station for the following report of the results of analyses of feeds used in the foregoing experiments:

No. 9785.—Shelled corn, sample taken from a lot in use at the Station Farm.

Analysis.	As Received Per Cent.	Calculated Water-Free. Per Cent.
Water	13.50	.....
Ash	1.38	1.6
Protein	10.31	11.9
Fiber	1.70	2.0
Nitrogen-free extract	68.97	79.7
Fat	4.14	4.8
	100.00	100.0

No. 9782.—Dried distiller's grains; sample taken from a lot obtained of W. A. Gaines & Co., Kentucky Distilleries & Warehouse Co., Frankfort, Ky.

Analysis.	As Received. Per Cent.	Calculated Water-Free. Per Cent.
Water	6.17	.....
Ash	1.69	1.8
Protein	30.81	32.8
Fiber	12.94	13.8
Nitrogen-free extract	37.37	39.9
Fat	11.03	11.7
	100.00	100.0

No. 9784.—Soy beans (shelled beans); sample from a lot in use at the Station Farm.

Analysis.	As Received. Per Cent.	Calculated Water-Free. Per Cent.
Water	9.94	.....
Ash	5.60	6.2
Protein	32.44	36.0
Fiber	4.25	4.7
Nitrogen-free extract	28.76	32.0
Fat	19.01	21.1
	100.00	100.0
Albuminoids, Stutzer method	31.00	34.4

No. 9538–Corn and soy bean ensilage from the Station silo; sample taken March 11th.

Analysis.	Fresh Material. Per Cent.	Calculated Water-Free. Per Cent.
Water	66.5	.....
Ash	2.1	6.3
Protein	2.5	7.6
Fiber	9.0	26.8
Nitrogen-free extract	18.9	56.2
Fat	1.0	3.1
	100.0	100.0
Potash	0.4	1.24
Phosphoric acid	0.3	1.00
Nitrogen	0.4	1.21
Albuminoids, Stutzer method	1.8	
Protein equival't of the NH4 salts	0.2	
Amids, &c., by difference	0.5	

		In the Fresh Materfal. Per Cent.
Protein soluble in cold water	Albuminoid	0.25
	Amid, &c	1.05
Protein equivalent of the NH4 salts		0.20
Protein insoluble in cold water		1.00
Total protein		2.50

Acidity, calculated as lactic acid 0.2 per cent,

No. 7648—Hominy meal from a lot bought of Henry Heile & Sons, Cincinnati, O.

Analysis.	As Received. Per Cent,	Calculated Water-Free. Per Cent.
Water	7.73	.....
Ash	2 46	2.67
Protein	10.72	11.62
Fiber	4.17	4.51
Nitrogen-free extract	67.50	73.16
Fat	7.42	8.04
	100.00	100.00