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SWINE FEEDING IN COLORADO.

BEET PULP AND SUGAR BEETS FOR FATTENING
HOGS.

HOME GROWN GRAINS VS. CORN FOR FATTENING
HOGS.

OTHER TRIALS WITH CORN, BARLEY, ALFALFA
AND BEETS.

—BY—

B. C. BUFFUM and C. J. GRIFFITH.



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SWINE FEEDING IN COLORADO.

- (a) BEET PULP AND SUGAR BEETS FOR FATTENING HOGS.
 - (b) HOME-GROWN GRAINS *vs.* CORN FOR FATTENING HOGS.
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BY B. C. BUFFUM AND C. J. GRIFFITH.*

The general conclusions which may be drawn from the experimental investigations reported in this bulletin will be found in condensed form on the last pages, and we suggest that the busy man who is willing to accept our testimony may profitably omit the reading of all intermediate material, except the pictures.

The last enumeration of hogs in Colorado (1901) credited the state with 101,198 head. There are, according to the census, 2,273,968 acres of land irrigated, and the farms and ranches number 24,700.

The scarcity of swine in the state is due largely to the system of farming in vogue which allows a great majority of the stock raised on ranches to run at large on the range in the mountains or on the plains a large part of the year, keeping them on the ranch only during the cold months. This system reduces the expense of raising stock to a minimum. Every animal that can be spared from the ranch is thus grazed on lands that cannot be farmed and consequently have a small value. Outside of the dairies there are not a great many cows milked. The total number of cows in the state is about 20,157, according to the 1900 census report. The milk cows and the work horses constitute the ranch live stock during the greater part of the year. Then, too, there are not a great number of cattle fattened in the state and so there is not the demand for hogs to follow the cattle in the feed lots.

A third reason is the lack of information among our farmers of the feeding value of our home-grown grains for

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fattening hogs. Corn is not grown to any extent in Colorado, except for fodder, and it is entirely reasonable that it will never be grown extensively because of existing climatic conditions. There is an occasional farmer that raises some corn each year, but they are mostly in favored localities where the nights are warmer than our average condition. It will follow then that our steers will continue to be shipped to the corn belt states to be fattened, and the demand for hogs to follow cattle in the feed lots will be small.

Will it then pay to raise and fatten hogs for market in Colorado? If it will pay, will it pay better than some occupation to which our farmers have access at present? Let us look first at the products of the farming or ranching communities. In the Cache la Poudre, Big Thompson, St. Vrain and South Platte Valleys, which constitute the irrigated section of northeastern Colorado, alfalfa is the principal product grown. Wheat comes next, with oats and potatoes following in succession. The raising of sugar beets is assuming remarkable proportions and may eclipse some of the former products in acreage and importance. The cultivating and harvesting of these crops occupy the summer months. Lamb feeding is the principal winter occupation and assumes larger and larger proportions each year, as it affords profitable disposition for the immense quantities of alfalfa raised, and earns a large percent for the skill of the feeder and the capital invested. Cattle raising is the chief agricultural industry of the whole state, and together with the raising of horses and sheep, doubtless must ever be foremost, because of the many million acres of semi-arid plains that grow nutritious native grasses, and which do not produce a paying crop under cultivation. Then there is the vast mountain region that supports on its precipitous slopes sleek cattle, horses and sheep. Together these two ranges maintain, according to the last statistics, 1,333,202 cattle; 236,546 horses, and 2,044,814 sheep. As stated before, this stock is kept on the ranches only about two months each year, and it is only those that have the best of care that remain that long where there is shelter and hay. So this class of stock would not interfere with hog raising in the least, and hog raising and lamb feeding would be mutually beneficial. The time spent in caring for a bunch of hogs would not interfere with the farming operations any more than it does in other places.

The one consideration then should be whether capital invested in hogs would yield as good returns as invested elsewhere on the farm. This may be judged, in part

at least, by the results of these experiments. We must decide whether we have forage crops and grains to properly raise and fatten hogs, or whether it would be advisable to ship in such foods.

Unlike lambs, hogs will not consume a large amount of rough forage and make as profitable a gain therefrom, but they must be fed a more concentrated or less bulky ration. The stomach of the sheep holds only 30 to 34 quarts, while the stomach of the hog holds from 7 to 9 quarts. Under our conditions profitable lamb feeding and profitable hog feeding must be different questions carried out along different lines. Lambs naturally fit into our system of farming to use up the surplus alfalfa hay. Unless we can feed home grown products to hogs with profit they will not fit into our conditions in the same way, though our pasture conditions for them are ideal.

ALFALFA FOR PASTURE.

It is essential in raising hogs to have some pasture grass for them. Especially is this true of the brood sows and the young pigs which need not only the green feed but the exercise and sunshine out of doors. Alfalfa fulfills this requirement admirably, as it makes a forage which is perfectly safe for hogs to pasture, is nutritious, palatable, grows early in the spring and late in the fall. Alfalfa produces more green forage per acre than any other forage used for hog pasture in the central west. Colorado is credited with 799,611 acres of this crop. It is essential to every ranch where mixed farming is carried on. Alfalfa is grown to such an extent in the state that any farmer or stockman could spare a few acres for hog pasture. The value of an acre of alfalfa throughout the season for laying on pork has not been reported from any station, but long experience has taught practical hog raisers that a little corn or a small amount of other grain, together with good alfalfa pasture, will give excellent returns. Alfalfa alone seems to supply little more than a maintenance ration, but as such is very valuable.

BET PULP.

With the growth of the sugar beet industry and the building of factories for the manufacture of beet sugar, within the state, an important by-product, beet pulp, has been added to the list of foods available to stock feeders. Pulp is made by cutting sugar beets up into shreds about one-half the size of an ordinary lead pencil in order to extract the sweet juices from them by allowing the mass of shredded

beet to soak in a constantly moving bath of hot water until the sugar is dissolved out. Thus the pulp comes in contact with no chemicals whatever to impair its healthfulness as a food product. Any unhealthful property that the pulp might have must therefore be laid to outside contamination or other causes, and not to any process in the manufacture of sugar from the beets. After coming out of the hot water bath, the pulp is run into an immense vat or storage silo for future disposition.

The purchase price of pulp in this state is 35 to 50 cents per ton at the factory and a lower price than this is often made to farmers who furnish beets.

Beets produce approximately fifty percent of their weight of pulp, and in some places an amount of pulp is given back corresponding to the amount of beets furnished. Extravagant prices have been paid for pulp in some instances. A note published in one of the eastern farm papers quoted a price per ton obtained for pulp one dollar in excess of the price paid originally for the beets. Where the pulp has to be shipped from the factory for a short distance an additional sum, say fifty cents per ton, would have to be added to the price to pay freight. Then there is the hauling of it from the car, which makes another item of expense of say 25 cents per ton if the distance is two miles or less. This makes the total expense 75 cents per ton plus the price of the pulp at the factory. This would make the total cost, within a reasonable distance of the factory, \$1.25 per ton for wet pulp. The loss of water will cause continual shrinkage. The amount of shrinkage cannot be estimated, but will depend largely upon whether the pulp has been pressed at the factory, or whether it is obtained from the discharge pipe or taken from the silo where it has drained for a greater or less length of time.

The palatability of pulp, when properly handled, is unquestioned. Our experience at this Station is that horses, cattle and sheep, and especially such of these as are used to roots, relish pulp and will eat it greedily. Our pure bred sheep that are kept on the College farm broke through the fence repeatedly to get at a pile of pulp. The horses also were especially fond of it, and while the cattle did not appear so greedy they ate it heartily. A little difficulty was encountered in getting some Mexican lambs, with which we were experimenting, to eat the pulp, but in a few weeks time they were consuming a considerable quantity of it. The hogs used in this experiment acted much the same way, not caring for the pulp and almost absolutely refusing to

eat it for some time. The grain fed was mixed with the pulp and in a few days they were eating the mixed pulp and grain greedily.

The low per cent of nutrients in pulp does not give it a very good recommendation as a food. The composition of Colorado pulp as determined by Dr. Headden, compared with alfalfa, runs thus:

	Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.		
		Protein.	Carbo- hydrates.	Ether Extract.
Beet Pulp.....	10.0	0.38	7.36	.02
Alfalfa.....	91.6	11.00	39.60	1.20

Dr. Headden states that his analyses were made of grated pulp which probably contained a minimum amount of nutrients. The California Experiment Station gives a somewhat higher composition than the foregoing. Analysis quoted from Herbert Myrick's book on "The American Sugar Industry," p. 108.

	Dry Matter.	Digestible Protein.	Digestible Carbohydrates.	Digestible Ether Ext.
Beet Pulp.....	10.0	1.3	6.7	0.4

Taking our own analysis showing the smallest amount of foods in one ton of beet pulp there are 200 pounds of dry matter, of which 7.6 pounds are digestible protein; 147.2 pounds digestible carbohydrates, and 4 pounds digestible ether extract. In alfalfa there are 1832 pounds of dry matter in one ton, of which 220 pounds of protein are digestible and 792 pounds of carbohydrates are digestible, and there are 24 pounds of digestible ether extract. As alfalfa is worth about four times as much as pulp costs laid down on the farm, we readily see that in the matter of composition the pulp makes a poor showing. This is illustrated in the following table of comparative values:

	Dry Matter in 2000 lbs.	Digestible Nutrients in 2000 lbs.		
		Protein.	Carbo- hydrates.	Ether Extract.
One ton Pulp worth \$1.00.....	200	7.6	147.2	0.4
500 lbs. Alfalfa worth \$1.00.....	458	55.0	198.0	6.0

However the feeding value of pulp may not be definitely determined by the percentage composition because the pulp is not used as a basis food but as a condiment or succulent sauce to increase the appetite and aid digestion, and in that respect it may have a value which would make it profitable to feed under certain conditions. If two or even four pounds of pulp per head each day would help the digestion of the other foods fed, or if in a preliminary feeding

period pulp could be used in a ration to put animals in a condition to fatten readily. then it might have a value even in excess of the \$1.00 or \$1.25 per ton. It has been clearly demonstrated that for fattening hogs the corn cob has a value when ground up with corn, because it lightens the meal in the stomach and thus makes it more digestible. It is not beyond the range of possibility that pulp may serve this same purpose in a region where ear corn is uncommon, and at the same time furnish some nutrients in the ration.

KEEPING QUALITY OF PULP.

There are various methods for the preservation of pulp. In some parts of Utah where rock salt is plentiful, large pits are dug in the ground and quantities of salt are thrown into the pulp when it is being put into this pit, which, it is claimed, makes a splendid silo. When the pulp is exposed to the weather the top layer dries out and the pulp further down forms a thick pasty layer five or six inches deep. This layer excludes the air and keeps the pulp fresh and sweet. During this experiment we had pulp in piles on the ground from the first of January until late in June. It was preserved in an unfermented, or only slightly fermented, condition until the early part of June, when warm weather came on. When it is desirable to keep pulp no longer in the season than this, it is just as well to pile it on the ground. If it is to be kept through the summer, most any form of silo is efficient, and in deep piles it has been known to keep two or three years.

SUGAR BEETS.

A conservative estimate of the sugar beets grown in the state this year (1902) for the factories would be 35,000 acres. This will yield approximately 350,000 tons of sugar beets which, if made into sugar, will give more than 150,000 tons of pulp. Besides this there is a large acreage being grown for feed. Numerous requests have been received by this department asking for information of the feeding value of sugar beets for all kinds of live stock. Reports have come in of feeders paying more for sugar beets than is paid by the factories. Large quantities have been fed the last two years with evidently good results, and in many places feeders have made special arrangements for sugar beets for their stock the coming season.

There is no question about the feeding value of these beets for stock-cattle, sheep and hogs, to maintain health,

thrift and breeding qualities; but their value when used as the basis of a fattening ration is not so well determined. As this is the way they are being used in this state, several experiments with beets were planned to determine whether or not they can be made a part of a fattening ration with profit. Many farmers have reported feeding them alone to hogs with good results, but the chemical composition of sugar beets is prima facia evidence that hogs cannot make good and profitable gains when fed on beets alone, because there is not sustenance enough in the amount of them a hog can eat and digest, to do much more than maintain the animal at a constant weight. According to feeding standards, a hog weighing 200 pounds to make the best gain, needs digestible nutrients as shown in the following table:

	Digestible	Digestible	Digestible
	Protein.	Carbohydrates.	Ether Ext.
Standard for 200 lb. hog	6.4 lbs.	4.8 lbs.	0.1 lbs.
	Dry Matter.		

CHEMICAL COMPOSITION OF SUGAR BEETS.—POUNDS IN 100.

Dry Matter.	Digestible Protein.	Digestible Carbohydrates.	Digestible Ether Extract.
20.0	1.135	16.007	0.051.

In 25 pounds of sugar beets there would be digestible nutrients as follows:

Sugar Beets } 25 lbs.	Dry Matter.	Digestible Protein.	Digestible Carbohydrates.	Digestible Ether Extract.
	5.0	0.284	4.002	0.013

Twelve and a half pounds was all we could get a hundred-pound hog to eat in one day during the experiment. By comparison it will be seen how far short of the standard 25 pounds of beets would be for a two hundred-pound hog, were it possible to get him to eat that amount. However, if beets could be made to take the place of some grain in the fattening ration supplying them might be of advantage.

HOME GROWN GRAIN VS. CORN.

By home grown grains is meant wheat, barley, oats, and such other small grains as are grown in Colorado. It would be hard to give an intelligent estimate of the amount of corn that is annually shipped into the state for feeding purposes. Feeders have frequently resorted to home grown grains during periods of high prices of corn. It is a common custom to trade wheat and barley off for corn. Even this last winter when wheat was \$1.00 per hundred pounds, and at one time as low as 90 cents per hundred, feeders

hauled in wheat and took home corn at \$1.30 per hundred. Barley was selling at about the same figure as wheat. The acreage of wheat as given in the government reports for 1900, was estimated at 318,899 acres; barley, 12,672 acres, oats, 99,768 acres; rye, 2,350 acres. The combined yield of these four grains for that year approximated 11,000,000 bushels.

It is a well known fact that under irrigation the small grains produce plumper, larger kernels giving greater weight per bushel, and that the chemical composition differs widely from that of grains grown under rainfall conditions. Repeated feeding experiments in other states have shown wheat to be fully equal to corn for fattening hogs, and barley to be worth about 8 percent less than wheat or corn. Prof. W. W. Cooke, formerly of this Station, made an extensive and exhaustive experiment comparing barley and corn, both whole and ground, for fattening hogs, with the following results:

	No. Tests.	Av. Weight at Beginning.	Average Daily Gain.	Average Daily Feed.		Food per lb. of Growth.	
				Grain lbs.	Skim Milk qts.	Grain lbs.	Skim Milk qts.
Whole Corn.....	6	71	0.39	2.0	0.7	7.0	1.1
Ground Corn.....	5	60	0.46	2.4	1.0	5.4	1.1
Whole Bald Barley.....	8	88	0.58	2.3	1.2	5.0	1.3
Ground Bald Barley.....	5	67	0.74	2.4	0.8	3.6	0.8
Whole Common Barley.....	4	68	0.49	2.3	0.5	5.4	0.7
Ground Common Barley.....	4	47	0.70	2.4	1.1	4.3	1.1
Ground Corn and Barley.....	4	50	0.77	2.1	1.0	4.1	0.8

This experiment shows the superiority of irrigation grown barley over rainfall corn and thus over rainfall grown barley.

The average price of corn in Colorado for the past ten years has been 80.5 cents per hundred pounds; wheat 99.5 cents; barley 55.1 cents. An average for wheat and barley of 77.3 cents, or 3.2 cents per hundred less than corn. If

then, our home grown grains are worth less money right on our farms than corn in town, and in turn either of them singly will produce more pork per pound than will corn, and when fed mixed are far superior to corn, have we not the solution of the problem of supplying concentrates which will profitably fatten hogs? (In this connection special attention is called to Summary of Lot IV. in the 1902 Experiment, page 22). Together with the alfalfa for forage and the sugar beets and their by-products for roughage, Colorado should become a factor in the production of pork.

OBJECT OF EXPERIMENT IN 1902.

To test the value of pulp and sugar beets when fed with grain; the value of sugar beets alone; and these three compared with corn, wheat and barley, was the purpose of this experiment. It is really a comparison of home grown foods vs. corn and is a continuance of experiments previously carried out with both swine and sheep. It is also important at this time to be able to give something definite about the value of sugar beets and pulp for all classes of stock. There will be in excess of 150,000 tons of beet pulp available for feeding this fall and winter. To be able to utilize this for wintering or fattening stock would add vastly to the live stock industry. So large a subject is this feeding of pulp that this bulletin does not attempt to treat more than partially the utility of pulp for fattening swine.

PLAN OF EXPERIMENT.

Twenty shoats were divided into five lots of four each. Care was taken in selecting the individuals for each lot, that each pen should be as representative as possible for the entire number. Each lot had the same sized pen in the piggery and each had access to the small yards adjoining.

Pigs in Pen I. were fed sugar beets alone.

Pigs in Pen II. were fed beet pulp and ground wheat and barley.

Pigs in Pen III. had shelled corn.

Pigs in Pen IV. were given ground wheat and barley.

Pigs in Pen V. were given sugar beets, ground wheat and barley.

For the pigs in Pen I. the sugar beets were chopped into small pieces and the pigs were given all that they would eat of them. Fresh, clean water was supplied twice daily at feeding time. Besides this, the shoats had access to nothing but the straw used for bedding, except an occasional small quantity of ashes or coal which was supplied to all pens alike. These pigs were fed to see just what hogs

would do on sugar beets alone, because some of our farmers had been doing this and we wished accurate data for a check.

The hogs in Pen II. were fed a large quantity of pulp, especially during the first part of the experiment. It was necessary to mix the grain with the pulp to get the pigs to eat the pulp.

The hogs in Pen III. were fed shelled corn alone, having access to nothing else but the straw used for bedding, besides plenty of water and some coal and ashes. It might have been better to have fed the corn ground, especially as the pigs were young and growing rapidly, and again because ground wheat and barley were fed.

The hogs in Pen IV. were fed equal parts of ground wheat and barley, for comparison with Pen III.

The pigs in Pen V. were fed in all respects like those in Pen II., except that sugar beets were substituted for the pulp. In the results from these two pens, we have a comparison of the value of pulp and the value of sugar beets when fed with grain. Pens II. and V. also may be compared with Pen IV., thus giving the advantage, if any, of feeding pulp or sugar beets with grain for fattening hogs.

The feed given was carefully weighed and any remaining uneaten until the time of the next feeding was weighed back. The hogs were ear-tagged and weighed separately once a week, thus giving the individual differences of those in the same pen. Additional notes were kept as to the general condition of the individual hogs in each lot so that, at the end of the experiment, it would be known whether or not the best results possible had been attained under the conditions. We have been assisted in these experiments by Mr. Fred Bishopp and Mr. W. B. Smith, senior agricultural students, who carried out the feeding as planned and aided in keeping the records.

KIND OF HOGS FED.

The hogs used in this experiment were obtained from the slaughter house yards of wholesale butchers within the city. From appearances the hogs were grade Poland Chinas and Berkshires. From the information that could be gleaned from those in charge, the pigs had been bought from different farmers in the vicinity and had been at the yards only a short time before we obtained possession of them. They were only common scrub shoats and did not show that any special care had been taken of them. They were probably late spring pigs and approximately eight

months of age. Their average weight was close to 100 pounds at the time they were put on the experiment. It was necessary to pay 6 cents a pound which was too high a price for pigs of their weight and breeding.

PULP FED.

The pulp fed was obtained from the Loveland factory of the Great Western Beet Sugar company, whose manager, Mr. A. V. Officer, courteously supplied us a carload for experimental use. Laid down at the College farm it cost us approximately \$1.00 per ton. This pulp was piled out on the ground about January 1, 1902, and was used as it was needed for feeding. The ground on which it was piled had good drainage and the moisture from the pulp drained away as it seeped out. Thus, in a few days time, the pulp was in nice condition, comparatively dry, and was preserved in an unfermented condition much better than some other piles of pulp which we had placed where the moisture did not drain away.

BEETS FED.

The sugar beets used in this experiment were grown upon the College farm, put in a root cellar after digging, and taken out as there was need of them. During the latter days of the experiment, the supply of sugar beets was exhausted and a stock beet was substituted in their stead. They were fed stock beets only about two weeks, the time being so short the final result was probably not changed by the substitution. The beets fed were figured at \$4 per ton. This would be equal to from \$4.50 to \$5 per ton for beets delivered at the factory; first because of the expense of hauling or shipping them to the factory, and second the work and expense of trimming the beets, which would amount to at least 50c per ton.

GRAIN FED.

The wheat and barley fed were also grown upon the College farm. The wheat was of the common Defiance variety and was grown in a field producing 34 bushels per acre. The barley fed was of the common hulled variety and was grown in a field which produced 25 bushels per acre. Together they were rated at \$1 per hundred pounds, which we think is not too low an estimate to put upon these grains, as there was considerable time during the late fall when either wheat or barley could have been purchased below that mark.

EXPERIMENT OF 1902.

SUGAR BEET PRODUCTS, AND HOME GROWN GRAINS.

On February 19th, twenty hogs were weighed and put upon the experiment. Previous to this time they had been kept together on the same ration for one week. In their drinking water they had been given a weak solution of sulphuric acid to free them from intestinal worms. They had also been sprayed for lice with 3 percent solution of Zenoleum. The pigs at this time were in a healthy, growing condition, and as will be seen in the summary, they averaged approximately 100 pounds each.

Those in Pen I. did not take very readily to the sugar beets and it was evident that they had never been used to a ration with roots in it, but they very soon began to eat the beets heartily.

Those in Pen II. would not touch the pulp fed them for several days. From February 19th to 22d inclusive, the four pigs in this lot were given only 40 pounds of pulp, and eight pounds of this were weighed back as orts which they did not eat.

The pigs in Pens III. and IV. took hold of the food given them readily, as also did those in Pen V., fed with the wheat and barley in addition to the beets. They ate the sugar beets, but apparently did not relish them at first.

Table I. which follows, gives the amount of food fed in periods of one week each for each pen, also the total amount of food eaten by the pigs in each pen. On May 30th, the hogs in Pens I., II., and two from Pen III., were slaughtered. Those remaining were slaughtered on June 6th.

Table I. is of interest as it shows the consumption of food week by week. The pigs were given approximately all they would eat. The pigs in Pen I. ate an increasing amount of sugar beets up to May 3d, within four weeks of the end of the experiment. They seemingly had eaten so many beets during the week ending May 3d that they became tired of them and would not again consume as large amounts.

The pulp fed to the pigs in Pen II. was increased until March 22d, and then decreased because the grain was increased for finishing the pigs and it was thought advisable to cut down the large amount of succulent food.

TABLE I.
FOOD EATEN.

Date.	Pen I	Pen II		Pen III	Pen IV	Pen V	
	Sugar Beets.	Wheat and Barley.	Pulp.	Corn.	Wheat and Barley.	Wheat and Barley.	Sugar Beets.
February 19-22.....	lbs. 117	lbs. 35	lbs. 40	lbs. 48	lbs. 45	lbs. 31	lbs. 28
February 22-March 1.....	230	72	123	89	102	74	57
March 1-8.....	239	70	232	70	123	75	70
March 8-15.....	280	70	285	79	131	98	80
March 15-22.....	287	79	294	98	140	98	94
March 22-29.....	302	90	291	112	149	98	116
March 29-April 5.....	308	84	251	112	154	98	126
April 5-12.....	308	116	168	112	154	98	126
April 12-19.....	324	126	168	112	154	118	126
April 19-26.....	324	126	168	112	154	126	134
April 26-May 3.....	348	126	168	112	154	126	130
May 3-10.....	324	126	172	112	154	126	140
May 10-17.....	264	126	172	112	154	130	100
May 17-24.....	182	126	172	112	154	138	80
May 24-30.....	270	90	120	96	154	126	128
To June 1.....	44	110	104	20
Totals.....	4107	1372	2824	1534	2186	1664	1565

The pigs in Pen III. on corn, and those in Pen IV. on wheat and barley, practically consumed increasing amounts of food up to the end of the experiment and the respective lots practically consumed the same amounts of grain each week for the last nine full weeks. The last four weeks the amount of sugar beets given to those in Pen V. was reduced, but the grain was increased as they would consume it.

Table II. page 17 gives the individual weights each week for all the pigs. The last column gives the total gain of each pig during the experiment and the first column the ear-tag number. Food given each lot is given in Table I. The last weight of each pig, taken May 30th or June 6th, was made after they had been off feed for 24 hours before slaughter, and represents the gain during the last week, less the shrinkage. Pig No. 80, in Pen II, was found to be in pig soon after the feeding began and was left with the lot to see what the final effect would be. She dropped a litter of three pigs March 29th and killed all of them. She was left on feed and made a larger total gain than any other pig in that pen.

Table III. gives the total weekly gains made by the four pigs in each pen and the last column gives the total gain of each lot for the whole period, less the 24 hours shrinkage before slaughter. The minus sign before a number indicates a loss of weight. There is much variation in the gains made week by week, the differences being especially noticeable in Pen I., fed on sugar beets, and in Pen II., given pulp and grain. The gains did not vary so much with the grain rations.

TABLE III.

EXPERIMENT NO. I.—SWINE FEEDING. POUNDS GAIN PER WEEK.

	February 22	March 1	March 8	March 15	March 22	March 29	April 5	April 12	April 19	April 26	May 3	May 10	May 17	May 24	May 30	June 4	Total Gain
Pen I.....	25	-5	-6	6	18	-10	6	4	6	4	-4	19	-11	25	-10		67
Pen II.....	22	8	32	6	62	-1	29	10	39	33	41	40	0	20	11		352
Pen III.....	30	7	-12	30	32	5	35	12	26	21	31	16	16	7	22	7	285
Pen IV.....	29	24	12	51	49	11	55	29	33	29	49	47	37	14	33	-21	481
Pen V.....	16	19	16	26	25	25	34	24	32	32	36	38	39	22	13	-5	392

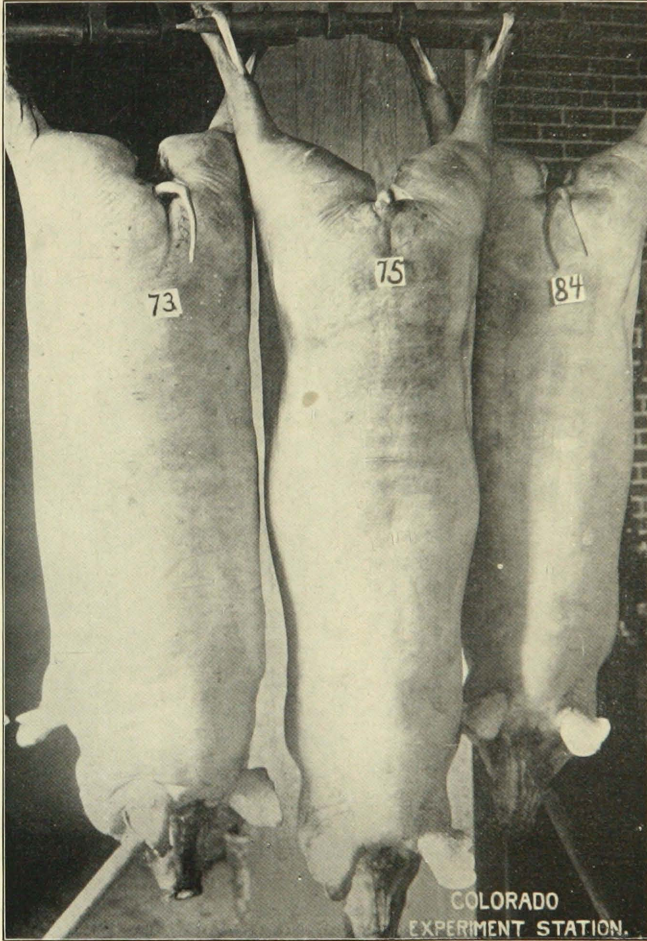


PLATE I.

Representative Carcasses from Lots III, IV and V.

No. 84, Fed Corn.

No. 75, Fed Wheat, Barley and Sugar Beets.

No. 73, Fed Wheat and Barley.

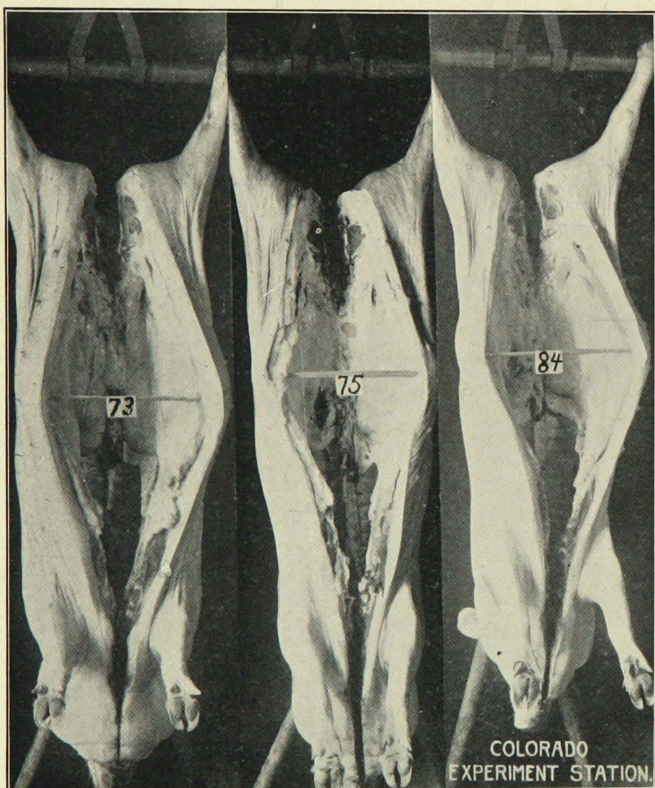


PLATE II.

Representative Carcasses from Lots III, IV and V.

No. 84, Fed Corn.

No. 75, Fed Wheat, Barley and Sugar Beets.

No. 73, Fed Wheat and Barley.

TABLE II.

		February 19	February 22	March 1	March 8	March 15	March 22	March 29	April 5	April 12	April 19	April 26	May 3	May 10	May 17	May 24	May 30	June 6	Total
Pen I	No. Tag 574	110	117	124	112	114	115	115	116	118	119	119	124	122	121	131	128		18
	582	90	100	91	94	94	99	97	96	96	96	99	102	100	97	104	102		12
	181	106	110	108	110	112	118	115	118	118	121	122	124	127	125	130	127		21
	562	95	99	98	99	101	107	102	105	107	109	109	95	115	110	113	111		16
Pen II	80	107	118	121	128	140	158		148	154	163	172	183	191	196	204	207		100
	585	90	96	100	106	108	118	115	129	125	133	139	149	157	162	162	165		75
	577	95	96	95	108	100	118	121	134	140	153	162	174	181	183	190	191		96
	81	95	99	101	106	106	122	121	123	135	144	153	161	179	167	172	176		81
Pen III	77	110	117	117	114	124	131	131	141	145	149	156	159	169	173	174	178		68
	78	90	96	98	96	108	112	116	122	126	133	139	149	147	150	154	159	162	72
	79	90	91	94	91	97	105	108	117	120	128	134	142	147	150	154	159		69
	84	90	106	108	104	111	119	117	127	128	135	137	147	150	156	154	162	166	76
Pen IV.	73	115	120	123	130	143	155	158	170	180	182	193	202	219	230	239	249	241	126
	70	100	109	117	114	127	140	146	157	165	176	180	193	201	210	213	221	218	118
	74	98	104	114	122	132	143	149	166	173	181	194	209	223	230	236	244	239	141
	88	65	74	77	77	92	105	101	116	120	132	133	145	153	163	159	166	161	96
Pen V.	75	108	118	124	126	137	145	149	158	164	176	185	193	206	215	219	225	228	110
	87	95	93	97	99	105	115	116	125	131	139	148	155	161	173	179	183	184	89
	72	95	97	105	109	109	109	123	131	135	144	150	156	159	175	179	175	179	84
	85	105	111	112	120	129	136	142	150	158	161	169	184	200	202	210	217	204	99

FOOD EATEN DAILY.

The average amounts of food eaten per day throughout the experiment for each hog in each pen were as follows:

TABLE IV.
FOOD CONSUMED DURING EXPERIMENT.

	No. of Hogs.	Days Fed.	Average Food per Hog.				Average Weight and Gain per Hog.		
			Corn	Wheat and Barley.	Sugar Beets	Pulp.	Begin-ning.	End.	Gain.
Pen I.....	4	99	lbs.	lbs.	lbs. 1026.75	lbs.	lbs. 100.25	lbs. 117.00	lbs. 16.75
Pen II.....	4	99		343.00		706.00	96.75	184.75	88.00
Pen III.....	4	101	383.50				95.00	166.25	71.25
Pen IV.....	4	104		546.50			94.50	214.75	120.25
Pen V.....	4	104		416.00	391.25		100.75	198.75	98.00

DISCUSSION OF RESULTS.

In Table IV. is given the amount of food consumed, stated in averages for each animal in the different lots, and the average weight and gain of the four pigs in each pen at the beginning and end of the experiment.

TABLE V.
FOOD EATEN DAILY.

	Average Food Per Day.				Gain per Head per Day.
	Sugar Beets.	Wheat and Barley.	Pulp.	Corn.	
Pen I.....	lbs. 10.37	lbs.	lbs.	lbs.	lbs. 0.17
Pen II.....		3.46	7.10		0.89
Pen III.....				3.80	0.70
Pen IV.....		5.25			1.16
Pen V.....	3.76	4.00			0.94

Table V. gives the average food per head eaten daily. The pigs in Pen I. ate 1,026.75 pounds of sugar beets, or 10.37 pounds per day, on which they made average total gains of

16.75 pounds. The pigs in pen V. ate 391.25 pounds of sugar beets, or 3.76 pounds per day, and 416 pounds of grain, or 4 pounds per day, or a total of 807.25 pounds of food, making an average gain of 88 pounds.

The food given to Pen I. did little more than maintain the original weight of the animals, while in Pen V. one-third the amount of beets in addition to four pounds of grain per day produced substantial gains. The pigs in Pen II. ate 706 pounds of beet pulp, or 7 pounds per day, and 343 pounds of grain, or 3.54 pounds per day. The total amount of feed consumed by each pig was 1049 pounds, a little more in weight than was eaten by Pen I. The total gain was 88 pounds, or only ten pounds less than that made in Pen V. on 63 pounds more grain and a little more than one-half the weight of beets, but the ration in Pen V. is appreciably greater in cost than that given in Pen II.

Pens III. and IV. give us a comparison of the amounts of corn and wheat and barley consumed, with their respective gains. The pigs in Pen III. ate 383.5 pounds of corn, or 3.8 pounds per day, making average gains of 71.25 pounds. In Pen IV. each pig ate 546.5 pounds of grain (equal parts wheat and barley) or 5.25 pounds per day, making average gains of 120.25 pounds.

Wheat and barley is shown to have had a decided advantage over corn in this experiment. When the chemical composition of corn and wheat and barley is taken into account, these results are not surprising. In corn there is not sufficient digestible protein,—or the muscle, blood and bone-building element—in proportion to the carbohydrates—or fat and heat-producing element—for the most economic gain. This porportion of protein to carbohydrates is called "nutritive ratio." For fattening hogs this nutritive ratio should be about 1 to 7 (one part protein to seven carbohydrates), to obtain the best results. In corn this ratio is 1 to 9.7, while in equal parts wheat and barley it is 1 to 7.5. It is usual to feed some substance richer in nitrogen with corn in order to make the ration nearer the correct standard. The fact that wheat and barley mixed in equal parts furnishes a ratio so nearly correct may account for their greater palatability, making the pigs consume so much larger quantities of these grains than they would eat of corn alone, and as would be expected, they made greater gains.

COST AND PROFIT.

The true measure of the efficiency of a food ration for fattening stock is the value of the resulting product after

the cost has been deducted. In Table VI. will be found a comparison of the cost of the food consumed by each animal and the first cost of the feeders and the profit at selling prices of six cents and seven cents per pound. Six cents per pound for the feeders was too high a price in the beginning. Seven cents per pound at the close of the experiment was not too high a price, so our statement of profit based on this buying and selling price is a conservative one. Feeding in small lots and experimentally as we did, makes it impossible to state fairly the cost of the labor used, but this is not necessary in order to make a true comparison of the different foods under investigation. The farmer who has had any experience in feeding swine can estimate this item for himself. The feeding is usually done at a season when the farmer's time, or that of his men, is not considered so valuable, and the pig feeding comes in after hours any way as chores. This is not an attempt to slight or ignore the question of labor at all, for it is a real one, but every farmer must estimate this item of expense for himself. There is no attempt made in this bulletin to show the cost of raising pigs up to the time they weigh 100 pounds. They were bought at 6 cents per pound and the results are figured from that basis. A large profit would be realized on pigs grown to that weight which could be sold at six cents per pound.

The total cost of the food eaten by pigs in Pen I. averaged \$2.05. The total profit on each head at 7 cents was 13 cents, and at 6 cents there was a loss of \$1.04 on each. Although the cost of the food was small, the profits were unsatisfactory because the gain in weight was so small.

Pen V., with a total cost of food of \$4.94 per hog, made a total profit of \$.95 at 6 cents per pound, and at 7 cents per pound a total profit of \$2.93. The pigs in Pen II. ate \$3.78 worth of food per hog and made a total profit of \$1.50 when figured at 6 cents per pound, and \$3.35 at 7 cents per pound.

Pen II did not make as large a total gain by ten pounds per hog as Pen V. (see Table VI), but they did not consume as much grain by 73 pounds for each animal. While the pigs in Pen II. ate more than twice the amount of pulp, the cost of the pulp given each hog was not one-half as much as the cost of the beets given to Pen V. In the total profit then, the extra gain in live weight made by Pen V. was more than balanced by the cheapness of the ration fed to Pen II.

Pen III., with \$4.98 charged against each animal for

corn, made a total profit of \$.95 per hog, figured at 7 cents per pound, and at 6 cents they made a loss of \$.71. The value of the food consumed by Pen IV. was \$5.46 per hog. The total profit at 6 cents was \$1.75 each, and \$3.90 at 7 cents.

TABLE VI.
COST OF FOOD AND TOTAL PROFIT.

	Average Cost of Food Eaten.				Average Total Cost Food Eaten.	First Cost @ 6 cts per lb.	Average Total Profit.	
	Corn @ \$1.30.	Wheat and Barley @ \$1.00.	Sugar Beets @ 20 cts cwt.	Pulp @ 5 cts cwt.			@ 6 cts per lb.	@ 7 cts per lb.
Pen I.....			\$2.05		\$2.05	\$6.01	-\$1.04	\$0.13
Pen II.....		\$3.43		\$0.35	3.78	5.80	1.50	3.35
Pen III.....	\$4.98				4.98	5.70	-0.71	0.95
Pen IV.....		5.46			5.46	5.67	1.75	3.90
Pen V.....		4.16	0.78		4.94	6.04	0.96	2.93

POUNDS OF FOOD AND COST FOR ONE POUND OF GAIN.

Table VII. gives the cost of the average amount of food eaten by each pig, at the current prices for the feeds used, and the actual cost of each pound of gain made during the fattening period. In next to the last column of the table is given the final cost for each pound of dressed pork which shows the amount per pound which would have to be received for the dressed meat in order to merely balance the cost of the food consumed.

TABLE VII.
FOOD FOR ONE POUND GAIN.

	Average Food for One Pound Gain.				Average Cost per pound of Gain.	Average Cost per Pound of Dressed Pork.	Percent of Dressed Meat.
	Corn lbs.	Wheat and Barley lbs.	Sugar Beets lbs.	Pulp lbs.			
Pen I.....			61.3		cts. 12.3	cts. 8.9	77
Pen II.....		3.9		8.	4.3	6.5	80
Pen III.....	5.4				7.	8.	80
Pen IV.....		4.5			4.5	6.1	84
Pen V.....		4.2	4.		5.	6.8	84

While sugar beets cost less per pound than any other food, except pulp, it took 61.3 pounds of beets for each pound of gain made at a cost of over twelve cents. There was a comparatively large amount of waste in the beet fed lot, as they dressed only 77 percent of the live weight.

The pigs in Pen II. ate 3.9 pounds of grain and 8 pounds of beet pulp for each pound of gain. This made the cost of each pound of gain 4.3 cents and the cost of each pound of dressed pork 6.5 cents. They dressed 80 percent of the live weight which is a little better than the beet fed lot and is the same as the corn fed lot.

The pigs in Pen V. which were given the same kind of grain as the pulp fed lot in Pen II. and sugar beets instead of pulp, ate just a little more grain, 4.2 pounds, and one-half the amount of beets, or 4 pounds, compared with 8 pounds of pulp in Pen II. However, each pound of gain cost 5 cents in the beet fed lot and the dressed pork cost 6.8 cents per pound. In this trial, then, the pulp gave a better return in dollars and cents than the sugar beets. It is believed the results would have been still more favorable to the pulp if we had fed only one-half as much, or three and one-half pounds instead of seven pounds, which was consumed per day. The beet fed lot actually ate three and three-fourths pounds of beets per day.

The pigs in Pen III. ate 5.4 pounds of corn for each pound of gain, making the cost of each pound of gain 7 cents, or 8 cents per pound for dressed pork.

The pigs in Pen IV. ate only 4.5 pounds of grain composed of equal parts of wheat and barley for each pound of gain, at a cost of 4.5 cents, or of 6.1 cents for each pound of dressed pork. These pigs grew better and dressed better than those fed on corn alone. (See illustration.) This shows that one pound of wheat and barley was equal to 1.2 pounds of corn for making gains, where the corn is fed alone. But since corn cost \$1.30 per hundred pounds while the wheat and barley cost only \$1.00 per hundred pounds, there is even greater difference in the respective values of the dressed pork produced. If wheat and barley were worth \$1.00, then in the light of this experiment the farmer could not afford to pay more than 83.3 cents for corn if he contemplated feeding it alone to swine as is usual. Instead of that, many farmers paid 46 cents to over 50 cents per hundred more for corn than it was worth to them and even sold their other grains to enable them to do it.

Comparing the values of pulp with grain in Pens II. and IV., we see that eight pounds of pulp in Pen II. was made

to take the place of 0.6 pounds of grain in Pen IV. This would give the pulp a value of \$1.50 per ton when wheat and barley were worth \$1.00 per hundred pounds. It was noticed that the pigs given pulp and beets in Pens II. and V. made much larger growth of frame than those in the other pens. This is nicely shown in the photograph here reproduced, of the representative pigs of Pens III., IV. and V., and indicates that such ration given to young pigs during the first feeding period may produce larger ultimate gains and have a greater value than is here indicated where they were also used in the last fattening period.

Comparing the foods given to pigs in Pens IV. and V., it is evident that 4 pounds of sugar beets in Pen V. took the place of 0.3 pounds of grain in Pen IV. This shows the sugar beets to have a value of \$1.50 per ton when mixed with grain for pig feeding, or exactly the same value which we obtained for the pulp. It is not unlikely that different values might have been obtained if different proportions of these foods were given, but we would feel safe in advising any farmer not to pay \$4.50 or \$5.00 per ton for beets for feeding to swine. It is altogether probable that the beets were more valuable than this for sheep and cattle which naturally require a more bulky ration than hogs can profitably use. A bulletin reporting experiments to show the value of beets and pulp when fed to cows has been published, and another reporting experiments with lambs is now ready for press. These publications should be consulted by intending feeders.

PIG FEEDING EXPERIMENTS OF 1900-1901.

ADDING ROUGHAGE OR ROOTS TO A RATION.

An experiment to indicate whether dry alfalfa roughage could be given a place in a ration for swine, was begun on December 1st, 1900. Nine Berkshire pigs were divided into three lots of three each and fed rations of mixed grain, mixed grain and dry alfalfa hay, and mixed grain and sugar beets. The mixed grain consisted approximately of two parts of corn and one of barley. The pigs would not eat the dry alfalfa at first, but they were made to eat it by chopping the hay rather fine and mixing with barley slop.

The pigs were thrifty Berkshires raised on the College farm and were given a value of 4 cents per pound at the beginning of the experiment. The corn was worth 80 cents per hundred pounds and the ground barley \$1.05 per hundred pounds. The pigs were fed 97 days and their value is given at five cents per pound live weight at the end of the fattening period.

Table VIII. gives the kinds of food eaten, the average amount of each food consumed by each pig in the ninety-seven days, the live weight at the beginning and end of the experiment, and the average dressed weight.

TABLE VIII.

AVERAGE FOOD, WEIGHT AND GAIN PER HEAD.

	Average Food Eaten.				Average Weight.			Percent Dressed Weight.
	Corn.	Barley.	Sugar Beets.	Alfalfa.	At Beginning.	At End.	Gain.	
Pen I.....	lbs. 409.50	lbs. 190.70	lbs.	lbs. 55.30	lbs. 162.20	lbs. 272.30	lbs. 101.10	% 86.10
Pen II.....	381.30	173.50			154.70	259.70	105.00	87.40
Pen III.....	350.30	184.30	99.30		148.30	244.70	96.40	87.10

In addition to their grain ration the pigs in Pen I. consumed an average of 55.3 pounds of dry alfalfa hay, a little more than one-half pound per day. They made the best gain but did not dress quite as well as the pigs in the other pens. Those in Pen III. ate approximately one pound of sugar beets apiece per day in addition to the grain ration, but they made the poorest gains.

In Table IX. is given the average food eaten for each pound of gain produced, the average gains made, and the comparative cost and profit. In Pen I. it took 5.44 pounds of grain and .49 pounds of alfalfa to make a pound of gain, and while the pigs in this lot made the best gains on account of the food eaten, it was at a slightly greater cost than where grain was fed alone in Pen II. With the corn and barley mixture it seems that it took a large amount of grain for each pound of gain, not making as good a showing as did wheat and barley in other experiments. While only a small amount of sugar beets was eaten by the pigs in Pen III., adding beets to the ration seemed to produce no beneficial effect. The pigs made smaller gains at greater expense than either of the other lots.

TABLE IX.

FOOD PER POUND OF GAIN, COST AND PROFIT.

	Average Food for One Pound Gain.				Gain per Head per Day.	Cost per Pound of Gain.	Average Cost of Food Eaten.	Average First Cost of Hogs @ 4 cts.	Average Total Profit @ 5 cts.	Average Cost per lb. of Dress'd Pork.
	Corn.	Barley.	Sugar Beets.	Alfalfa.						
Pen I.....	lbs. 3.72	lbs. 1.72	lbs. .	lbs. 0.49	lbs. 1.13	cts. 4.9	\$ 5.40	\$ 6.49	\$ 1.73	cts. 5.10
Pen II.....	3.63	1.65			1.08	4.6	4.86	6.18	1.94	4.90
Pen III....	3.64	1.91	1.03		.99	5.2	5.04	5.93	1.26	5.30

SWINE FEEDING EXPERIMENT OF 1901.

An experiment planned to test the value of shorts when fed with corn and to compare the value of a ration of corn with a combination of wheat, oats and barley with the value of a ration of shorts fed in a like combination. The feeding was done from March 23d to May 31, 1901. Eleven pure bred Berkshire pigs were used in this experiment, averaging about five months of age. The trial was conducted similar in all respects to the other experiments reported in this bulletin. The following foods were fed:

Pen I.—Corn.

Pen II.—Corn and shorts.

Pen III.—Shorts, wheat, oats and barley fed in rotation. Shorts with wheat and oats one day, and with wheat and barley the next, oats and barley the third day and so on.

Pen IV.—Corn, wheat, oats and barley. The corn rotated with two other grains as indicated for pigs in Pen III.

In Pen I. there were two pigs averaging 164.5 pounds. They were two months older than the remaining ones used

in the experiment and weighed a little over sixty pounds over the average in the other pens. The three pigs in each of the remaining pens were quite evenly divided as to age, size, etc.

The following prices were charged in computing the results of the experiment:

Corn, 83 cents per cwt.

Shorts, 75 cents per cwt.

Wheat, 95 cents per cwt.

Oats, \$1.20 per cwt.

Barley, \$1.20 per cwt.

Table X. gives the average food eaten by each animal in the respective pens, the average weight and gain of same, and the percent each dressed.

TABLE X.

AVERAGE FOOD, WEIGHT AND GAIN PER HEAD.

	Average Food Eaten.					Average Weight.			Percent Dressed Weight.
	Corn.	Shorts.	Wheat.	Oats.	Barley.	At Beginning.	At End.	Gain.	
Pen I.....	lbs. 423.25	lbs.	lbs.	lbs.	lbs.	lbs. 164.50	lbs. 230.00	lbs. 65.50	78.60
Pen II.....	227.00	221.66				104.00	177.60	72.30	77.40
Pen III.....		226.50	76.50	73.60	75.50	112.50	188.20	88.20	81.60
Pen IV.....	208.60		72.30	68.50	68.30	98.00	185.30	85.60	79.20

TABLE XI.

FOOD FOR ONE POUND GAIN, COST AND PROFIT.

	Average Food for One Pound of Gain.					Gain per head per day	Cost per pound of grain.	Av. cost of food eaten.	Av. 1st cost of hogs @ 4 cts.	Av. total profit @ 5 cts.	Av. cost per lb. of dressed pork
	Corn.	Shorts.	Wheat.	Oats.	Barley.						
Pen I.	lbs. 6.43	lbs.	lbs.	lbs.	lbs.	lbs. .98	cts. 5.30	\$ 3.51	\$ 6.58	\$ 1.41	cts. 4.03
Pen II.	3.08	3.01				1.11	4.80	3.54	4.16	1.18	4.33
Pen III.		2.61	0.88	0.85	0.87	1.31	4.70	4.22	4.50	0.69	4.20
Pen IV.	2.43		0.84	0.80	0.80	1.27	4.70	4.06	3.92	1.19	4.35

Table XI. gives the details of the food eaten for each pound of gain and cost and the profit. The results corres-

pond with those reported on other experiments in this bulletin, in showing that corn alone is not a balanced ration and does not produce the gains that result from feeding other grains with or without corn. This is not so apparent at first from this table as it is after carefully studying the conditions and results.

The pigs in Pen I. were older and larger than those in the other pens. It took 6.43 pounds of corn to produce a pound of gain and their average gain per day was only .98 pounds, compared with much larger gains in the other pens. The cost per pound of gain is high, but the apparent profit and cost per pound of dressed meat is low. This is because they were 64 pounds heavier than the other pigs and at the increase of one cent per pound this weight makes the apparent profit 64 cents higher than it should be when compared with the smaller pigs in the other pens. The real profit in such comparison would be 97 cents instead of \$1.41 as actually shown in the table. The cost of one pound of dressed meat figured on the basis of these smaller 100 pound pigs in the other lots, would be 5.77 cents instead of 4.03 cents, and the corn ration would be the most expensive one in this series. This shows the fallacy of figuring all of the pigs at the same price at the beginning of the experiment, regardless of size and age, and illustrates the advantage of selecting larger animals for feeding. With this understanding it appears that mixed grain was superior in every case to corn alone.

The gains per day increased with the increase in the variety of food eaten, and the amount of grain for each pound of gain decreased with the same condition. In Pen I. it took 6.43 pounds of corn for each pound of gain; in Pen II. 6.09 pounds of corn and shorts per pound of gain; in Pen III. 5.31 pounds of mixed grain per pound of gain. In Pen IV. 4.87 pounds mixed grain per pound of gain. Comparing Pens III. and IV. gives an idea of the comparative value of corn and wheat shorts. It took more shorts with other grains in Pen III. to produce a pound of gain than it did corn with other grains in Pen IV. and although the shorts were figured at a less price than corn, the total profit from the pen is less than—approximately one-half—that in Pen IV.

It is likely that the ration given in Pen III is as much too narrow as the corn ration in Pen I. is too wide. The nutritive ratio of corn is about 1:9.4, and of the ratio in Pen III. is 1:5.9. The nutritive ratio called for in the German feeding standard for fattening hogs is 1:7. The nutritive

ratio of the ration given Pen II. is 1:6.3 and that supplied Pen IV. is 1:8.1. The best gains, and for the least amount of food, were made in Pen IV. This study is interesting when compared with the wheat and barley ration fed in the first experiment reported in this bulletin. Equal parts of wheat and barley have a nutritive ratio very near the German standard and have produced the best results for us. Other factors probably influence the effect of a ration as much as will small differences in the ratio. The cost and profit is influenced by the prices of the different grains so it is not so good a measure of the actual fattening quality of the mixtures.

The results in Pen IV. show that 4.87 pounds of grain used was worth as much as 6.43 pounds of corn in Pen I. This grain mixture consisted of 2.44 pounds of wheat, oats and barley, equal parts, and 2.43 pounds of corn. Then if corn is worth 83 cents per hundred pounds, the wheat, oats and barley to mix with it in this fattening ration were worth \$1.36 per hundred. At the present prices farmers could not afford to feed corn at all and it would be better to eliminate the oats from the ration, feeding wheat and barley as indicated in the first experiment reported in this bulletin. All these experiments show the advantage of our home grown grains in unmistakable terms.

GENERAL CONCLUSIONS.

The salient points shown in the series of pig feeding experiments reported in this bulletin are briefly:

1. Home grown grains fed in proper proportion to balance the ration are more valuable than corn.
2. A well balanced ration gives better returns in every case than a poorly balanced ration, and a mixture of grains is better than a single grain fed alone.
3. Sugar beets for swine feeding were unprofitable with us, either fed alone or in combination with grain. Green pasture would probably serve the purpose of furnishing succulent food for growing pigs at less expense.
4. Sugar beets are little more than a maintenance ration when fed alone to hogs.
5. Sugar beets and sugar beet pulp proved equally valuable in our experiments and because of its cheapness and effect on growth we believe pulp may be profitable to feed to growing pigs in connection with a grain ration, or during the first part of a fattening period.

6. These experiments indicate that sugar beets may have a value of about \$1.50 per ton when fed to hogs in combination with grain.
7. Beet pulp gave a return of \$1.50 per ton when fed in combination with grain.
8. Sugar beet pulp served the same purpose in our hog rations as did sugar beets and at less expense.
9. It was necessary to mix beet pulp with grain in order to educate the pigs to eat it. We would not recommend feeding more than two pounds of pulp to a pound of grain in a ration for pigs which are from 100 to 200 pounds in weight.
10. Our trials indicate that pigs take some of the nutritive property from beets, but their principal use, as well as that of pulp, seems to be mechanical.
11. Dry alfalfa hay as roughage, may be made use of by the growing pigs. In our trials the pigs ate more grain and made more gain than on a similar grain ration minus the alfalfa.
12. Comparing our results with pig feeding experiments in other states, indicates that our small grains, more especially our barley and wheat, are worth more compared with corn than similar grains raised under rainfall conditions.
13. Mixed wheat and barley ground together make a well balanced ration for pigs and one upon which they will make better growth and gain than they will on a ration composed of corn alone. The farmer in Colorado cannot ordinarily afford to sell his home grown grain and purchase corn for fattening hogs. Wheat and barley in equal parts were worth 17 percent more than corn fed alone.
14. If wheat and barley are worth \$1.00 per 100 pounds, corn is worth only 83.3 cents, but many farmers sold their home grown grains for \$1.00 to purchase corn at \$1.30.
15. There is enough food at home, including grain, alfalfa pasture, by-products of dairies and beet sugar factories, to make swine growing and fattening a profitable industry on Colorado farms.