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Feeding Steers on Sugar Beet Pulp, Alfalfa Hay and Farm Grains.

By W. L. Carlyle, C. J. Griffith and A. J. Meyer.

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Feeding Steers on Sugar Beet Pulp, Alfalfa Hay and Farm Grains.

By W. L. CARLYLE, C. J. GRIFFITH and A. J. MEYER.

The data presented in this bulletin is published at this time for the benefit of cattle feeders in those sections of the country where the growing of sugar beets is coming to be a leading industry. For several years past there has been much interest manifested concerning the value of sugar beet pulp as a factor in beef production. The experiment described in the following pages was not intended to, and does not, show the actual feeding value of beet pulp. It does show, however, that this by-product has a considerable value as a feed, and may be made to play a prominent part in economical cattle feeding.

The experiment was made possible through the liberality of the Great Western Sugar Company, of Loveland, Colo., who furnished the cattle, the feed and equipment, and a part of the labor for carrying on the work. The Experiment Station greatly appreciates the kindness and the progressive spirit of Mr. C. K. Boettcher, president of the company, in thus supplying to the Station this means of testing the value of sugar beet pulp combined with alfalfa hay and farm grains as a feed for cattle.

The Station is also indebted to the U. S. Department of Agriculture, through the Bureau of Animal Industry, for financial aid in carrying on this experiment.

The results of this trial are not considered as final or conclusive, but are published in the hope that the data gathered from this initial experiment may be of some benefit to the prospective cattle feeder. Arrangements are already under way for a more complete and elaborate experiment with these feeds during the coming winter, when an effort will be made to determine the actual feeding value of sugar beet pulp as compared with other standard feeds.

The great cattle ranges of the western states have for many years supported large herds of breeding or "she" stock and have grown immense numbers of calves, yearlings, and two and three year old cattle to supply the feed lots of the Middle West, or corn belt, with feeders. Frequently this is a very profitable business for the ranchmen of the West, but at times when corn is a light crop or a partial failure, there is little demand and low prices for feeders and the ranchman must either keep his cattle until a corn crop is assured or sacrifice them at less than cost. In those sections of the West where water can be secured for irrigation purposes, ranchmen have frequently made a success of cattle feeding during the winter months. The alfalfa plant seems to have found in the irrigated sections of this western country its most congenial environment. The yield per acre is large and the quality is usually excellent owing to the fine weather that always prevails during the growing and harvesting seasons. The small grains grown in these regions are also of superb quality. The proximity of the snow capped mountains and the high altitude renders the nights rather cold and the growing season is a comparatively long one, resulting in a very heavy yield of rich and nutritious grains.

During recent years, however, the growth of the beet sugar industry has presented many new problems for solution. Prominent among these are the maintenance of the fertility of the soil, the profitable disposition of the alfalfa crop, which rotates best with the sugar beet crop, and last, and by no means least important, the proper utilization of the beet pulp, a by-product from the sugar-factories. It is estimated that at least 60 per cent. of the total weight of the beet crop, exclusive of the tops, is returned as beet pulp with practically no change in its composition except the extraction of the greater portion of the sugar content of the beet. Since many ranchmen and stockmen of the West are not familiar with the process of sugar making from beets, a few words of explanation as to what beet pulp is, and how it is secured, may be appreciated. When the beets are received at the sugar factory, they are first thoroughly washed and then carried to the slicer where they are cut into small strips about two inches long, one-fourth inch wide, and one-sixteenth inch thick, called "cossettes." They pass directly from the slicer into large tanks where running water extracts the sugar. The pulp, after the extraction process is complete, is drawn from these tanks at the bottom and transferred to a press where all the free moisture is expelled and is then transferred by means of screw carriers to a large flat pit or reservoir outside, termed the "silo." In this pit the pulp is piled ten or twelve feet deep and rapidly forms an air tight crust on the surface which preserves the lower layers per-

fectly. Any surplus water is drawn off through the drains provided and the pulp instead of deteriorating in palatability and feeding value, is actually improved in these respects after being siloed for several months. At the close of this experiment, the freshly uncovered pulp was sweet and pleasant to the taste and presented an odor almost identical with freshly pulped beets. At this time it appeared much drier than earlier in the season and the cattle appeared to be fonder of it, though they would not consume it in such large quantities. In some of the factories the pulp is carried from the building by flushing with water through elevated sluice boxes. From the past season's experience, it is apparent that this is a very objectionable practice on the part of the sugar companies and should not be followed when the pulp is desired for feeding purposes. From the six sugar factories operating in Northern Colorado during the season of 1903, there was produced at least two hundred and twenty-five thousand tons of beet pulp, all of which was available for stock feeding purposes. The area from which the beets were grown is all contained in three adjoining counties, and there were at least three hundred thousand tons of alfalfa grown in these same counties last year. These figures give some idea of the possibilities there are for successful meat production in this region.

THE OBJECT OF THE EXPERIMENT.

This experiment was undertaken for the purpose of determining:

First.—If beet pulp in combination with alfalfa hay is a suitable food for fattening steers.

Second.—If under ordinary conditions it would be profitable to feed grain in addition to the pulp and alfalfa hay.

Third.—Which grains can be fed to the greater advantage, corn or the home grown grains, barley and oats combined.

In addition to the above, it was desired to learn what effect, if any, the various rations fed would have upon the meat produced, as it was considered by many that an exclusive ration of pulp and alfalfa hay would not produce a good quality of edible meat.

PLAN OF EXPERIMENT.

In planning the experiment, it was decided that all the conditions surrounding it should be as nearly similar as possible to the practices of the cattle feeders in this section. The cattle selected for the experiment were purchased on the open market at Denver in October, and consisted of 150 head of two year old grade Shorthorn and Hereford steers. They had all been bred by one man and had been given the same care and feed from birth

until purchased. The price paid was $2.85 per hundred weight, which was low, as the cattle were a fair average lot of feeders. The entire lot of cattle were fed together on pulp and hay for several weeks prior to the beginning of the experiment for the purpose of getting them accustomed to the feed. No shelter of any kind was provided for the cattle during the entire feeding period. The hay was fed from the ground, the animals securing it by passing their heads through a rack made of poles, which prevented waste from trampling. The pulp and grain were fed from long flat boxes or "bunks" set up from the ground on legs. The enclosing and division fences were constructed of posts and barbed wire.

On December 19, the 150 head of cattle were divided as equally as possible into three groups of 50 each. General conformation, breed characteristics, as well as size and weight were made the basis for this division.

In table 1 is given the weights of the steers in each lot when the experiment was started, from which it may be seen that the steers were not better than a good average bunch of feeders.

TABLE I. GIVING INITIAL WEIGHT OF STEERS.

	LOT I.	LOT II.	LOT III.
Total	45,880	44,960	45,278
Average	917.6	899.2	905.6

Feeds and Feeding.—The steers in each lot were given all the alfalfa hay and beet pulp they would consume without excessive waste. In addition, Lot 1 was fed a light ration of ground barley and ground oats, two parts by weight of barley to one of oats. Lot II was fed the same amount of ground corn as Lot I received of barley and oats. No grain of any kind was fed to the steers in Lot III during the experiment. A large wagon scale was provided for weighing the steers each week and also for weighing the hay and beet pulp to each lot. The grain was weighed out each day, as fed, from a small platform scale.

The grain supplied was much below the average as it was purchased from time to time from the local mills and varied greatly in quality. The barley and oats were particularly noteworthy in this respect as they frequently contained a large percentage of wild oats. This was unavoidable, as we could not control the purchase of the grain. At different times as the experiment progressed, new lots of hay were purchased for each lot of cattle, so that no attempt was made at such times to keep a record of the daily consumption of hay by each lot, the total weight being charged to each lot and the average amount eaten daily and weekly calculated therefrom.

DISCUSSION OF RESULTS.

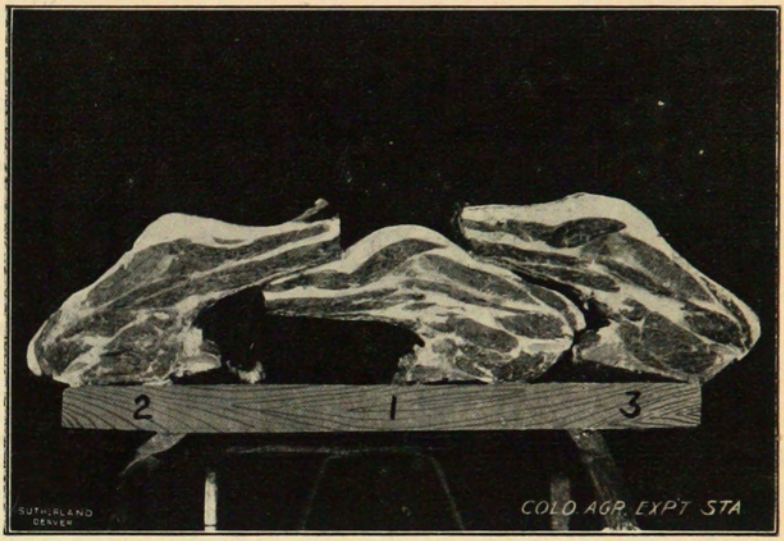
In the accompanying table is given the detailed data of the weight of steers, the amount of the different feeds consumed and the gains made by each lot in one and five week periods, and for the entire period of twenty-five weeks.

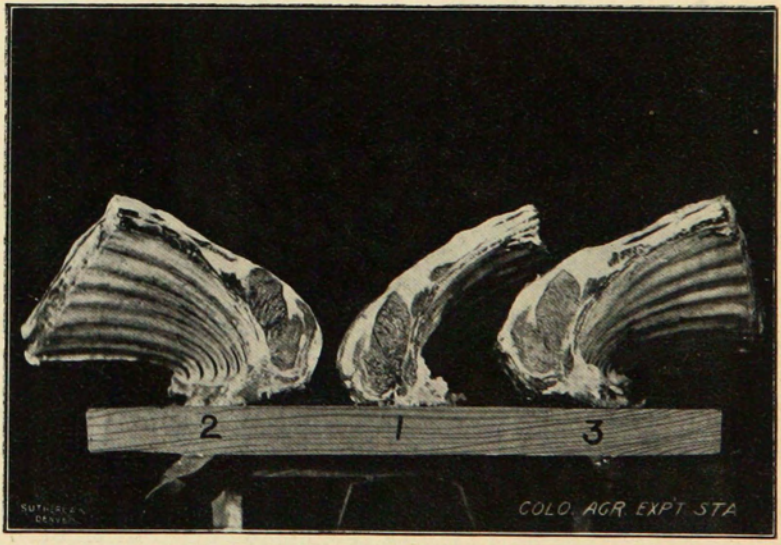
A study of the contents of this table and the summary as given in Table III, reveals some interesting features. It will be observed that after the first seven weeks of feeding, there was a marked falling off in the amount of pulp consumed by the steers in Lots I and II that were receiving grain, and that this decrease continued until the close of the experiment, while the steers in Lot III, that received no grain, continued to eat approximately the same amount of pulp throughout the experiment, until the last four weeks, when they also ate perceptibly less. The steers in each of the lots ate about the same amount of pulp for the first seven weeks of the experiment. This may be accounted for from the fact that the amount of grain received daily by each steer was so small at the beginning of the experiment that it had no appreciable effect upon the appetite for the other feeds. The steers in Lots I and II received two pounds of grain per day each, for the first two weeks, after which time this quantity was increased at the rate of one-half pound per week until they were receiving on an average six pounds each daily. This continued until the 13th week of the experiment, when they were fed seven pounds each daily for one week until the 22d week, when they had eight pounds, and from that time until the close of the experiment they had ten pounds each daily.

It is interesting to note in the case of Lots I and II receiving grain, that while the amount of pulp consumed daily diminished with an increase in the grain ration, the average daily consumption of hay remained fairly constant throughout the experiment, while there was a constant increase in the amount of hay consumed by Lot III that received no grain. It seems hardly credible that the steers in Lot III should consume approximately 60 per cent more of hay in the last five weeks of the experiment than they did in the first five weeks. Another striking feature of this table will be noted in the fact that while the amount of grain fed daily to the steers in Lots I and II was increased from week to week, there was no constant or corresponding increase in the rate of gain. Contrary to what might have been expected, there was not any appreciable increase in the rate of gain in Lots I and II with an increase in the amount of grain fed. While the average rate of gain increased somewhat after the first five-week period, when more grain was fed, yet it cannot be attributed to the increase in amount of grain fed, since the steers in Lot III that re-

TABLE II. GIVING FEEDS AND GAIN OF EACH LOT OF STEERS BY WEEKS AND IN FIVE WEEK PERIODS.

Week	FEED CONSUMED								GAIN		
	Lot I 50 Steers			Lot II 50 Steers			Lot III 50 Steers		Lot I	Lot II	Lot III
	Pulp	Hay	Barley & Oats	Pulp	Hay.	Corn	Pulp	Hay.			
	lbs	lbs	lbs	lbs	lbs	lbs	lbs.	lbs	lbs	lbs	lbs
First	58478	3693	700	57671	4288	700	58438	4037	-120	-495	-400
Second	63440	2305	700	63440	2040	700	63440	2245	305	875	875
Third	51476	3790	875	51496	3450	875	51791	3450	1615	1090	1030
Fourth	55568	3760	1050	55568	3555	1050	55568	3515	615	795	520
Fifth	47236	4385	1225	47236	4335	1225	47236	4345	90	330	525
Total	**276198**	**17933**	**4550**	**275411**	**17668**	**4550**	**276473**	**17592**	**3035**	**2795**	**2550**
Sixth	41356	3835	1400	41066	3605	1400	41836	4430	270	760	860
Seventh	39833	3535	1575	39833	3415	1575	39833	4100	770	480	50
Eighth	34182	3829	1750	33552	3463	1750	35132	3549	1165	1035	505
Ninth	37705	3825	1925	36112	4137	1925	41090	3823	425	690	470
Tenth	36061	3825	2100	38691	4137	2100	43411	3823	1620	1705	590
Total	**189137**	**18349**	**8750**	**189854**	**18757**	**8750**	**201302**	**19725**	**4250**	**4685**	**2475**
Eleventh	35561	3825	2100	36516	4137	2100	40596	3823	1445	860	1380
Twelfth	33133	3825	2100	34295	4137	2100	42004	3823			
Thirteenth	29755	3826	2450	31414	3901	2450	41191	4352	-645	475	755
Fourteenth	26276	3827	2800	28583	3666	2800	39777	4880	1300	1470	175
Fifteenth	21439	3827	2800	27594	3666	2800	42239	4880	920	315	510
Total	**146164**	**19130**	**12250**	**158352**	**19507**	**12250**	**206407**	**21758**	**3020**	**3020**	**2820**
Sixteenth	23555	3827	2800	29660	3666	2800	39425	4880	-150	795	415
Seventeenth	27690	3827	2800	27170	3666	2800	37460	4880	1695	900	825
Eighteenth	25670	3827	2800	26100	3666	2800	39170	4880	1650	1690	1110
Nineteenth	29170	3827	2800	29920	3666	2800	43575	4880	90	10	25
Twentieth	25025	3784	2800	28755	3826	2800	46235	4873	-930	15	-620
Total	**132110**	**19092**	**14000**	**138605**	**18490**	**14000**	**205765**	**23893**	**2335**	**3440**	**1755**
Twenty-first	24915	3502	2800	28888	3736	2800	42351	4134	1145	900	1410
Twenty-second	22910	3700	3150	25223	4767	3150	40065	5648	955	-315	400
Twenty-third	17525	3700	3500	17995	4767	3500	34000	5648	940	1670	430
Twenty-fourth	14570	3700	3500	15115	4767	3500	32445	5648	260	320	160
Twenty-fifth	15520	3700	3500	16255	4767	3500	34345	5648	645	875	1655
Tota	**96440**	**18302**	**16800**	**102976**	**22804**	**16800**	**186206**	**26726**	**3945**	**3450**	**4095**
Grand Total	**839049**	**92806**	**56350**	**865198**	**97226**	**56350**	**1076153**	**109694**	**16585**	**17490**	**13695**

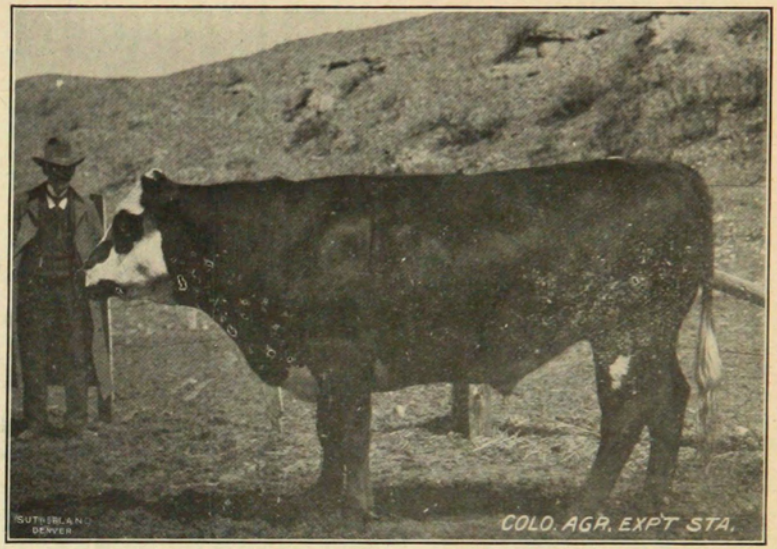




Photograph reproductions of cuts of beef from three representative steers, one from each of the lots as numbered in the reproductions.

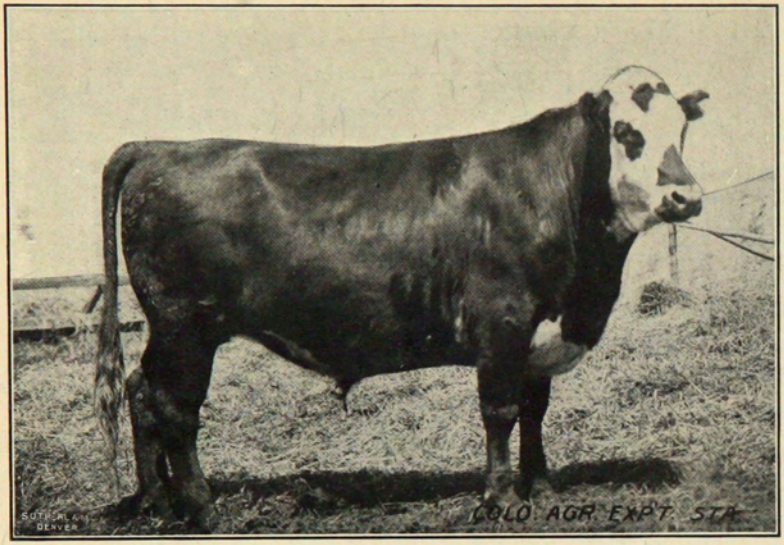
Photograph reproduction of representative steer from Lot I fed upon Alfalfa Hay, Beet Pulp, and Ground Barley and Oats.

Photograph reproduction of steers in Lot I fed upon Alfalfa Hay, Beet Pulp, and Ground Barley and Oats.



Photograph reproduction of representative steer from Lot II fed upon Alfalfa Hay, Beet Pulp and Ground Corn.

Photograph reproduction of steers in Lot II fed upon Alfalfa Hay, Beet Pulp and Ground Corn.



Photograph reproduction of representative steer from Lot III fed upon Alfalfa Hay and Beet Pulp.

Photograph reproduction of steers in Lot III fed upon Alfalfa Hay and Beet Pulp.

ceived no grain also increased in rate of gain in approximately the same proportion as did the steers in the lots receiving an increase of grain feed from week to week. So far as can be determined from the data obtained, the increase in amount of grain consumed from week to week after the first five weeks of the experiment resulted only in a slight decrease in the amount of pulp consumed and in maintaining a constant consumption of hay, while the steers receiving no grain increased in their consumption of hay.

It is difficult to understand why an average daily grain ration of 9.6 lbs. fed to a group of fifty steers, in conjunction with beet pulp and hay *ad libitum*, as was the case in the fifth five-weeks, would not result in a greater gain than an average daily grain ration of five pounds per day with pulp and hay *ad libitum*, as was the case in the second five-week period. The only conclusion that can be drawn from this data would seem to be that with an abundance of beet pulp and alfalfa hay at prevailing prices, a grain ration of five pounds of either corn or barley and oats will result in a greater gain in the early part of a feeding period than will be produced with a much larger average grain ration toward the close of such period. It should be stated, however, that the steers in all of the lots were transferred from one feed yard to another one six miles distant in the early part of the twelfth week of the experiment, which no doubt accounts in a large measure for the small gains made by all the steers during the third five-week period. Reference to Table II will show that in the case of Lot I, the 50 steers actually lost an average of approximately 13 pounds each on two weeks feed as a result of the change while the steers in Lot II made a comparatively small gain for this same period. While this transfer from one set of yards to another was absolutely necessary owing to the conditions under which the experiment was conducted, and was much to be regretted since it had such a marked effect upon the steers, yet it serves to show how exceedingly important it is to have feeding cattle remain in their accustomed environment. The result in this case on one lot of 50 steers was a direct loss of two full weeks feed and 645 pounds of live weight.

The average amount of the different kinds of feed consumed daily by each steer is shown in Table III. This data has been averaged for each five-week period and for the whole 25 weeks over which the experiment extended.

It will be seen that in the two lots of steers that were fed grain, each steer ate on the average 98 pounds of pulp and about 11 pounds of hay daily, while the steers in Lot III that had no grain, ate on the average, 123 pounds of pulp and 12.5 pounds of hay daily.

TABLE III.

AVERAGE AMOUNT IN POUNDS OF FEED CONSUMED AND GAINS MADE BY EACH STEER DAILY IN THE DIFFERENT LOTS IN FIVE WEEK PERIODS.

FIVE WEEK PERIOD	AVERAGE AMOUNT OF FEED CONSUMED.								AVERAGE GAIN		
	Lot I.			Lot II.			Lot III.		Lot I	Lot II.	Lot III
	Pulp	Hay	Oats and Barley	Pulp	Hay.	Corn	Pulp	Hay			
First	157.8	10.2	2.6	157.4	10.1	2.6	158.0	10.1	1.73	1.60	1.46
Second	108.1	10.5	5.0	108.5	10.7	5.0	115.0	11.3	2.43	2.68	1.41
Third	83.5	10.9	7.0	90.5	11.1	7.0	118.0	12.4	1.73	1.78	1.61
Fourth	75.5	10.9	8.0	79.2	10.6	8.0	117.6	13.6	1.33	1.97	1.00
Fifth	54.5	10.5	9.6	58.8	13.0	9.6	106.4	15.3	2.55	1.97	2.84
Average for entire period	95.9	10.6	6.44	98.9	11.1	6.44	123.0	12.5	1.9	2.0	1.57

TABLE IV.

GIVING AVERAGE AMOUNT IN POUNDS OF FEED REQUIRED BY THE STEERS IN EACH LOT FOR ONE POUND OF LIVE WEIGHT GAIN.

	Pulp	Hay	Barley-Oats	Corn
Lot I	50.59	5.59	3.39	
Lot II	49.46	5.55		3.22
Lot III	78.58	8.01		

In table IV, which shows the average amount of feed required by the steers in each lot for one pound of gain in live weight, it will be noticed in the case of Lot III that seventy-eight and one-half pounds of pulp and eight pounds of alfalfa hay were required to produce one pound of live weight gain on a bunch of 50 two-year old steers. In Lot I, three and thirty-nine one hundredths pounds of barley and oats fed in the ration of this bunch of steers was equivalent to, or took the place of, twenty-seven and ninety-nine one-hundredths pounds of pulp and two and forty-two one hundredths pounds of hay. The result in Lot II was almost the same, except that it required slightly less of corn to replace approximately the same amount of pulp and hay.

The whole one hundred and fifty head of steers were disposed of to the Western Packing Company of Denver, at a flat price. The steers were weighed in the usual manner at the feed yards before shipping, and were weighed again at the yards in Denver after a short rest with hay and water supplied. In order to obtain the difference in the market value of each lot of steers as they ap-

peared when on the market, three of the leading buyers in the yards kindly consented to place a price upon each lot. It will be seen in the summary table that the steers in Lot III fed upon pulp and hay, shrank appreciably more in shipping than either of the grain fed lots. It will also be noted that the steers in Lot II fed upon ground corn in addition to the pulp and hay were valued at ten cents per hundred more than the lot fed upon barley and oats with pulp and hay, and forty-five cents more per hundred than the lot fed pulp and hay alone. It is only fair to state that the gentlemen placing a value on the steers were not informed as to the character of the feed given to any of the steers and consequently could not be even suspected of bias.

TABLE V.

GIVING SUMMARY OF DATA FOR THE AVERAGE OF THE STEERS IN EACH LOT.

	Lot I. Barley & Oats.	Lot II Corn	Lot III Pulp
Weight at beginning of experiment	917.60	899.20	905.60
Value at 3 cents per pound	$ 27.52	$ 26.98	$ 27.16
Cost of feed for entire period	$ 21.65	$ 20.68	$ 10.87
Cost of feed for 100 lbs gain	$ 6.53	$ 5.93	$ 3.79
Cost of labor involved	$ 3.50	$ 3.50	$ 3.50
Weight of finished steers at feed lot	1,249.30	1,248.00	1,189.50
Sale weight of steers	1,213.60	1,216.90	1,149.40
Shrinkage in shipping (lbs.)	35.70	31.10	40.10
Shrinkage in shipping, (per cent)	2.86	2.49	3.71
Selling price per hundred pounds	$ 5.50	$ 5.60	$ 5.15
Value at selling price	$ 66.75	$ 68.15	$ 59.19
Cost of marketing	$ 1.53	$ 1.54	$ 1.46
Net profit	$ 12.55	$15.45	$ 16.20

RESULTS OF SLAUGHTER TEST.

A very thorough slaughter test was made of each lot of steers at the packing plant, the result of which is summarized in Table VI. In this data, it will be noticed that the caul fat of the lot of steers fed upon barley and oats was noticeably heavier than either of the other lots, while the lot fed upon pulp and hay had appreciably less of internal fat than the steers fed upon corn.

Some data was collected as to the size and condition of the livers, as it was thought that this organ might indicate something of the physical condition of the animals in the different lots. From the data presented, however, it will be noted that there was no appreciable difference in either the size or condition of this organ in the different lots of steers.

When taken to the cooling rooms, the dressed carcasses of the different steers were carefully weighed and the weight recorded; after hanging in the cooling room for several days, the time varying somewhat with the different carcasses but no differ-

ence being made in those from the different lots, it was found that the average amount of shrinkage on each carcass of the steers in Lot I was 15.8 lbs., in Lot II, 17.1 lbs., and in Lot III, 14.6 lbs. These figures were somewhat surprising as it was expected that the carcasses of the steers that had not been fed any grain would shrink more in cooling than those fed a grain ration in addition to the pulp and hay.

TABLE VI.

GIVING DATA FROM SLAUGHTER TEST.

	Lot 1 Barley & Oats	Lot II Corn	Lot III Pulp
Average weight of caul fat	19.2 lbs	17.5 lbs	15.1 lbs
Average weight of livers	12.8 lbs	12.6 lbs	12.7 lbs
Numbers of diseased livers	4	3	2
Average shrinkage on each carcass in cooler	15.8 lbs	17.1 lbs	14.6 lbs
Average percentage of shrinkage in cooler.	2.11	2.19	2.11

Before the steers were slaughtered, a representative steer from each lot was selected by the three buyers in the yards and the carcasses of these three animals were reserved for a thorough demonstration test on the block where the various wholesale cuts could be compared with a similar cut from each of the other carcases. Photographs of these cuts were also taken and are reproduced in these pages, from which it will be seen that there was no appreciable difference in the quality or grade of the meat from each of the representative carcasses. Cooking tests were also conducted and if any choice was made by the various parties eating the meats, it was invariably in favor of that produced from pulp and hay alone. As a last and final test, a loin roast from the carcass of the steer representing the pulp and hay fed lot was served to Secretary James Wilson, of the U. S. Department of Agriculture, and a party of his friends in Denver. The Secretary, in response to a request for his opinion of this roast, wrote the following communication which needs no explanation:

"WASHINGTON, D. C., August 15, 1904.

PROF. W. L. CARLYLE,
Fort Collins, Colo.

Dear Sir:—

Replying to yours of the 6th, I have to say that I have inspected and eaten of the beef fed with alfalfa and beet pulp at the Colorado Experiment Station, Fort Collins, Colo. It was of superior quality, indicating that the Mountain states will have no difficulty in finishing cattle with their own forage plants, and making their own meats.

Yours very truly,

JAMES WILSON,
Secretary."

SUGGESTIONS TO FEEDERS.

In feeding pulp, absolute cleanliness should be observed. The pulp should be fed in troughs or "bunks" provided for the purpose. Only such an amount of pulp should be fed at one time as the cattle will clean up with reasonable waste, and the bunks should be cleaned out daily. Unless this be done, the bunks will gradually become filled with frozen pulp in cold weather, and with foul and decaying pulp during warm weather.

Pulp which has been "nosed" about and breathed upon for some time will usually be refused by the cattle. To avoid the possibility of waste on this account, and to insure profitable gains, feed often and in small quantities. It is folly to place a large quantity of pulp into the feed troughs with the intention of having a single feed last the greater part of a day. The inevitable result of such a course is to throw some of the cattle off their feed causing an unreasonable and unwarranted waste of pulp.

Pulp should never be fed late in the afternoon during cold weather. The cattle generally refuse to eat after nightfall and whatever remains in the bunks freezes before morning and occasions no little difficulty in removing it before the fresh pulp is placed before the cattle.

Pulp has a laxative tendency. On this account it is well to feed good alfalfa hay of the first cutting with the pulp where it is convenient to do so. The later cuttings of hay are more apt to encourage scouring and bloat, although where care and judgment are exercised this condition can be largely avoided regardless of which cutting of hay is used.

The feed racks for hay and bunks for pulp should be near together so that the steers will have to travel but a few steps in passing from one feed to another.

Cattle seem to be particularly fond of well-cured pulp from the silo, preferring this to fresh pulp. In order to secure the pulp in its best form, it is desirable to have it placed in the silo fresh from the factory and later transferred direct from the silo to the feeding troughs. After fermentation has once begun, exposure to the air in handling causes the pulp to deteriorate rapidly in quality. Cattle relish it less after a continual exposure to the air, and reject a larger per cent than they would in the case of pulp direct from the silo.

On account of the uniform mildness of the weather during the experiment, there was no noticeable variation in the amount of pulp eaten, or resulting gains, that could in any case be attributed to climatic conditions. It is very probable, however, that during a period of severe cold weather, pulp would prove a rather unsatisfactory feed, since it is not in any sense a heat generating food.