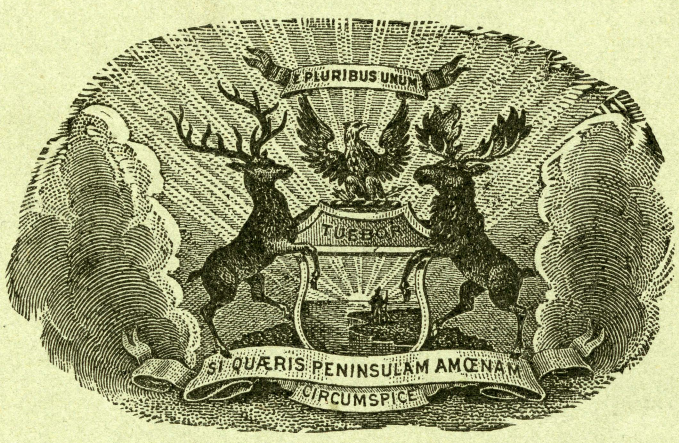
EXPERIMENTS

WITH

ENSILAGE.

MICHIGAN STATE AGRICULTURAL COLLEGE.

1881-82-83.



LANSING:
THORP & GODFREY, STATE PRINTERS AND BINDERS
1886.

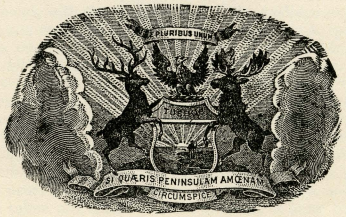
EXPERIMENTS

ON

ENSILAGE.

MICHIGAN STATE AGRICULTURAL COLLEGE.

1881-82-83.



LANSING:
THORP & GODFREY, STATE PRINTERS AND BINDERS
1886.

EXPERIMENTS WITH ENSILAGE,

MADE BY THE FARM DEPARTMENT OF THE MICHIGAN STATE AGRICULTURAL COLLEGE, 1881-2.

The following statements were printed in our report for 1881–2, but as our supply of that issue is exhausted, and frequent inquiries are made for this paper, it seemed best to reprint it this year:

At the last regular session of the Legislature an appropriation was made of one thousand dollars, "for the purpose of conducting experiments with ensilage, for the feeding of animals, the culture of amber cane and new varieties of grain and beet roots, by the farm department of the Agricultural College." The bill was not passed until quite late in the session, being approved June 11, 1881, so that we were somewhat hurried in the preliminary work of preparing the ground and building the silo. As a new grain barn, with high basement walls, was being erected on the farm, we decided to build the silo in one corner of this basement, with the thought that if the ensilage experiment was not satisfactory, the silo could be utilized as a root cellar. A space in the northeast corner was chosen for this purpose, and a wall made, eighteen inches thick, well laid with common field stone and strong mortar. Tiles were laid to carry off water, and the floor was then covered with small stones, bedded in cement, and then cemented, as well as the sides, until all was smooth, and supposed to be air and water tight. The inside measurement of the silo is 14x15 feet, and walls 8 feet high. There is a door four feet wide and six feet high from the silo into the basement, where the ensilage is taken out. Where circumstances will admit, I think the barn basement is the proper place for the silo. It is near the stables where it is to be used, and a door through which it may be taken out, directly to the animals, is more convenient than to lift the ensilage over the top of the wall. Silos can be built in almost any barn in this manner at much less expense than if built separately, as no extra expense for roof is incurred. When filling the silo, matched plank were fitted in the doorway to the basement, and the ensilage packed against these as the filling proceeded. When opened, the ensilage was found to be as perfectly preserved next to these plank as in any other part of the outside of the silo. Matched plank, two inches thick, were used as a cover, care being taken to have them fit closely, but not to bind in the settling.

The items of expense incurred in building the silo are as follows:

Excavation	$10 00
Fifty-six perch of stone, at 75 cents a perch	42 00
Laying stone, at 60 cents a perch	33 60
Ten barrels lime, at $1.10	11 00
Sand	3 40
Four barrels cement, at $1.45	5 80
Grouting bottom, cementing sides, etc	10 00
Doors and frames above	30 00
Plank for covering silo	6 00
	$151 80

CORN-FODDER GROWN FOR ENSILAGE.

The land upon which the fodder corn grew is a sandy loam—sand predominating. It had grown a corn crop the previous year, and was clean, but not sufficiently fertilized to produce a large crop. It was put in good condition to receive the seed, and drills marked three and one-half feet apart June 11th the plat of 1¾ acres was planted with the Hathaway dent corn—the variety grown upon the farm for some years. Corn was dropped in the drills and covered by hand, at the rate of one and one-half bushels to the acre. I think less seed would have given a larger yield, as it was too thick to make a large growth. The corn came up well and grew very rapidly, receiving three cultivations and being kept free from weeds. In August the severe drouth began to tell upon its growth—the leaves and some of the stalks turning yellow, occasioned by the dry weather and the crowded state of the plants. But few ears formed. I quote from our field notes: July 21st—The ensilage corn is rolling considerably. July 28th—The ensilage corn has been at a stand-still for a week, on account of the extreme dry weather. August 8th—The ensilage corn has been shortened a good deal by the dry weather. August 18th—Continued rains. The ensilage corn, though cut short, seems to be making some growth at present. August 26th—The ensilage corn is again nearly at a stand-still, owing to the dry weather. That the dry weather shortened the crop was plainly evident.

FILLING THE SILO.

We began cutting the corn and filling the silo on Monday, Sept. 13th. The most of the stalks were green and full of juice at this time. On some parts of the plot some stalks were browned and the lower leaves dried, but to no great extent. A two-horse tread-power and our ordinary stalk-cutter, made at Fulton, N. Y., were used. A one-horse cart, and a double team and wagon drew the corn to the silo, which was only a few rods distant. The work was mainly done by students, who only work three hours in the afternoon, and so no full day's work was performed. On Wednesday, the 15th, it rained, and the cut fodder was somewhat wet, and some corn was cut while the water was dripping from it. On Thursday, the 16th, we finished the cutting. The corn, cut in pieces about one-half inch in length, was run directly to the silo, where it was spread and tramped down as compactly as possible. Nothing was mixed with the fodder, and no other crop but corn was put in the silo. We cut at the rate of two tons an hour, I think, and we found the tread-power to answer a very good purpose. With a large machine more power would be needed, but twenty tons a day works it up quite as rapidly as most farmers will desire. Farmers

will, I think, find any good power cutter will do as well, perhaps, as some of the more recently patented machines known as ensilage cutters. The stalks were not weighed when put in, but we have weighed the ensilage as it was taken from the silo, and it weighed out 40,000 pounds in round numbers, or between ten and eleven tons to the acre. This yield is a very fair one, when the condition of the land and season are taken into account; but I have no doubt that it might be trebled, perhaps more, under the most favorable conditions.

COVERING THE SILO.

The ensilage having been carefully leveled, so that the pressure should be equal, the planks, two inches thick and eight inches wide, were nicely fitted as the covering proceeded, care being taken that there should be no danger of binding at the ends, as the settling continued. It was then weighted immediately with stones, at the rate of nine hundred pounds to the square yard.

Various means for securing the desired pressure for the ensilage have been suggested, but it seems quite probable that weights of stone, wood, bags of grain, or boxes of earth will be found after all most desirable, as such pressure is constant and needs no watching, while a screw-power neglected, or forgotten, will be quite likely to result in failure The labor of putting on the stones and taking them off is no great item in the account. The stones we used had to be drawn a short distance, and three boys with a one-horse cart weighted the silo in four hours.

COST OF RAISING CORN AND PUTTING SAME IN SILO.

Plowing and harrowing 1¾ acres	$3 00
Marking and planting	2 74
Three bushels seed, at $1 00	3 00
Cultivating three times	2 50
300 hours student labor, at 8 cents	24 00
37½ hours team labor, at 1 shilling	4 69
15 hours men's labor, at 1 shilling	1 88
	$41 81

This makes the entire cost of growing corn and placing in silo $2.09 per ton. This amount also includes the time of getting the horse-power from a neighboring farm and returning the same, and some allowance must be made for delays that were unavoidable in work with which none of us were familiar.

There was no outward sign of any change going on within the silo. Only a temporary roof was over it for some time, and on one or two occasions it was left in such shape as to receive some rain. On December 15th the silo was opened. The ensilage was found to be nicely preserved. There was no mould next to the plank or sides worth mentioning, and there has not been one per cent of waste.

The thorough exclusion of the air is the secret of its preservation. It matters but little what materials are used for the silo—lumber, stone, or merely pits—if the air is only excluded the fodder will be preserved. Many farmers at the institutes during the winter have inquired, "How do you get the ensilage from the silo?" and so I refer to it here. The stones were thrown back from

five of the plank next the basement door, the plank removed, and this section was cut down with a hay-knife and taken out with a four-tined fork and placed in baskets to be taken to the stable. After this section had been disposed of the process was repeated, only taking off the cover as needed (another advantage in weighting in this way). The process is similar to cutting down a hay-mow.

Not one of the least important considerations of ensilage is the fact that so large an amount of it can be packed in a comparatively small space. A cubic foot of ensilage from our silo will weigh 35 pounds. From 5 to 6 per cent of the live weight of the animal will be a daily ration, or from 50 to 75 pounds for an ordinary cow. It is thus an easy matter to compute the number of cubic feet necessary to contain the food for a certain number of animals. The silo at the college is 14x15 feet inside the walls and 8 feet high, containing 1,680 cubic feet. Allowing 40 pounds to the cubic foot, we have a capacity for almost 39 tons of ensilage, or enough to feed five cows for 200 days a daily ration of 60 pounds each. When we take into the account the large weights that can be packed in a small silo it seems that this promises to be the most economical method of providing shelter for fodder—no small item to farmers who are not well supplied with buildings.

The ensilage was slightly acid in taste, quite brown in color when first take from the silo, but after exposure to the air a short time, regained largely its fresh, green appearance. The cattle, from the start, with a few exceptions, ate it with avidity.

An analysis, made at the New Jersey Experimental Station by Prof. Neale, is herewith given :

Loss at 100° C.	82.27
Protein	1.63
Fat	.76
Fiber	4.72
Ash	1.94
Carbhydrates	8 68
	100.00

The analysis will be found, with several others, in the report of Prof. Cook, director of the New Jersey Experimental Station, to which I refer elsewhere.

FEEDING ENSILAGE.

Object of the Experiment.

The aim of the experiment was to determine the comparative value of ensilage, as a cattle food, for the production of milk, flesh and growth.

With this aim in view, the ensilage was fed in place of roots, and as a full or partial substitute for the dry, rough feeds. A reference to the accompanying table will show the different proportions and combinations in which the ensilage was fed.

ANIMALS CHOSEN FOR THE EXPERIMENT.

Four lots of cattle were selected from the college herd Dec. 1, 1881.

Lot I consisted of two milch cows, Ayrshire and Shorthorn, that had dropped first calves early in September of the same year.

Lot II was composed of two steers, Devon and Ayrshire, of nearly the same age and weight. The Devon was in rather better flesh than the other.

Lot III had two large, dry cows, Shorthorns, very nearly alike as to weight, time of calf, condition of health, and feeding qualities.

Lot IV was made up of three bull calves, all Shorthorns, which were very even as to weight, condition of flesh, and age.

PREVIOUS TREATMENT OF THE ANIMALS.

Owing to the late growth of grass and the mild fall weather, the cows and steers had been turned out to pasture during the day and stabled only at night. They had been fed dry cut cornstalks once and meal twice daily. The three bull calves had been kept in stalls for a month previous to the experiment, and had received a good hay and meal ration.

During the month of November all the animals selected for the experiment had lost weight, except the bull calf "No. 9" of the table, and he had gained nothing.

Nos. 3, 5, and 6 of the table were in good flesh—not fat—and the rest were in thrifty condition, though in rather thin flesh.

TREATMENT DURING THE EXPERIMENT.

During the experiment all the animals were fed regularly three times daily at 6:30 A. M., noon, and 5 P. M. They were watered in the stall at 8 A. M., and again just before feeding at night. The milking was done just before the regular morning and evening feedings.

The animals were well groomed daily with card and brush. Every day, from 10 A. M, till noon, the cattle were turned into yards sheltered on the north and west. While in the yard they again had access to water. At this time also, each day, the stalls were well cleaned and littered. The cattle were salted twice each week. They were weighed on putting up, and regularly once each week thereafter at 4 P. M.

The cattle were attended throughout the experiment by one man, and especial pains were taken to secure regularity and uniformity in everything pertaining to the feed and care of the animals.

FEED AND FEEDING NOTES.

The rough feed was all cut into one-fourth to one-half inch lengths by a power cutter. The cornstalks were not very good, owing to bad weather while curing. The hay (timothy and clover, one-half each) and oat straw were of first quality. The meal, fed to the cows and steers, had 14 parts corn meal, 4 parts oat meal, and 9 parts wheat bran, by weight. That fed to the bull calves, and also to the Ayrshire steer, during the last six weeks of the experiment, was composed of one-third oat meal, one-third oil meal, and one-third wheat bran, by weight.

Exact notes of the feed given to each animal were kept, and any feed left in the mangers was also carefully noted and removed before the next feeding.

CONTENTS OF THE TABLE.

The table contains a concise description of each animal, and gives the in-

gredients and exact proportions of the average daily rations. It also presents a full showing, by fortnights, of the feed consumed, gains in weight and the milk yield.

In the column headed "Total Feed Consumed," the decimals are omitted, but the calculations based on this column were made with the *exact* numbers.

The losses in weight were put into the column marked "Gain in Weight," but the minus sign was prefixed in every case, thus (–36).

The two columns headed "Gain per Cent" were calculated as follows: The "gain per cent of live weight" was obtained by dividing the "gain in weight," each fortnight, by the weight of the animal at the beginning of the same fortnight The "gain per cent of feed consumed" was obtained by dividing the "gain in weight," each period, by the "total feed consumed" in the corresponding period. In the fifth fortnight there was a slight gain in the milk yield of both cows. This is indicated in the column marked "pounds shrinkage" by the word "gain" over the proper number.

TABLE *Showing by Fortnights the Results of the Feeding Experiment.*

Description of Animals.				Feed Record.									Weights and Gains.					Milk Yield.		
				Average Daily Ration.																
Number of Lot.	Number of Animal.	Name, Breed, Sex, Age, Etc., of Animals.	No. of Fortnight.	Meal.	Cut Hay.	Cut Corn Stalks.	Cut Oat Straw.	Sliced Rutabagas.	Ensilage.	Full Ration.	Total Feed Consumed.	Weight at Beginning of Fortnight.	Weight at End of Fortnight.	Gain in Weight.	Gain Per Cent of Live Weight.	Gain Per Cent of Feed Consumed.	Total No. of Pounds.	No. of Pounds Shrinkage.	Daily Average.
Lot I.	1	Lulu of Lansing. Ayrshire milch cow. Age 3 yrs. Dropped first calf Sept. 2, 1881.	1	7.	.....	30.	.....	15	.....	52.	728	926	952	26	2.8	3.6	228.5	9.5	16.32
			2	7.	.....	.....	.....	.....	49.	56.	784	952	916	–36	.....	.....	218.5	10.	15.61
			3	7.	.....	.....	.....	.....	.....	56.	784	916	930	14	1.5	1.8	206.5	12.	14.75
			4	7.	.....	.....	.....	.....	65.	72.	1,008	930	957	27	2.9	2.7	192.	14.5	13.71
			5	7.	.....	.....	.....	.....	65.7	72.5	1,015	957	960	3	.3	.3	201.	*9.	14.36
			6	7.	.....	.....	.....	.....	63.7	70.7	990	960	976	16	1.7	1.6	191.	10.	13.64
	2	Hermia 2d. Shorthorn milch cow. Age 3 5-12 years. Dropped first calf Sept. 3, 1881.	1	7.	.....	32.	.....	15	.....	52.	728	1,234	1,212	–22	.....	.....	193.	1.	13.79
			2	7.	.....	.....	.....	.....	59.	66.	924	1,212	1,185	–27	.....	.....	188.	5.	13.43
			3	7.	.....	.....	.....	.....	60.	67.	938	1,185	1,236	51	4.3	5.4	172.5	15.5	12.32
			4	7.	.....	.....	.....	.....	66.5	73.5	1,029	1,236	1,244	8	.6	.8	164.5	8.	11.75
			5	7.	.....	.....	.....	.....	62.	69.	966	1,244	1,268	24	1.9	2.5	172.	*7.5	11.29
			6	7.	.....	.....	.....	.....	62.	69.	966	1,268	1,264	–4	.....	.....	166.	6.	11.86
Lot II.	3	Batavia 2d. Devon steer. Age 1½ years.	1	5.	5.75	9.	.....	.....	.....	19.75	277	740	710	–30	.....	.....			
			2	4.5	6.5	.....	.....	.....	21.5	32.5	455	710	760	50	7.	11.			
			3	5.	7.5	.....	.....	.....	26.21	38.71	542	760	778	18	2.4	3.3			
			4	.....	.....	.....	.....	.....	36.25	36.25	508	778	776	–2	.....	.....			
			5	.....	.....	.....	.....	.....	41.82	41.82	585	776	760	–16	.....	.....			
			6	.....	.....	.....	.....	.....	39.25	39.25	550	760	746	–14	.....	.....			
	4	Scott. Ayrshire steer. Age 1½ years.	1	5.	5.75	9.	.....	.....	.....	19.75	277	680	700	20	2.9	7.2			
			2	4.5	6.25	.....	.....	.....	19.	29.75	417	700	736	36	5.1	8.6			
			3	5.	7.21	.....	.....	.....	23.14	35.39	495	736	756	20	2.7	4.			
			4	3.	.....	.....	.....	.....	37.29	40.29	564	756	767	11	1.5	1.9			
			5	3.	.....	.....	.....	.....	44.82	47.82	669	767	774	7	.9	1.			
			6	3.	.....	.....	.....	.....	44.43	47.82	669	774	780	6	.8	.9			
Lot III.	5	Bonny Red Rose 2d. Shorthorn dry cow. Age 7 1-12 years. 4 months with calf.	1	3.5	7.5	11.5	9.5	15	.....	47.	658	1,516	1,530	14	.9	2.1			
			2	3.25	6.25	9.5	8.5	.....	15.	42.5	595	1,530	1,552	22	1.4	3.6			
			3	3.5	7.5	8.86	8.92	.....	15.	43.78	613	1,552	1,570	18	1.2	2.9			
			4	3.5	.....	.....	.....	.....	73.43	76.93	1,077	1,570	1,594	24	1.5	2.2			
			5	3.5	.....	.....	.....	.....	84.18	87.68	1,228	1,594	1,630	36	2.3	2.9			
			6	3.5	.....	.....	.....	.....	78.50	82.	1,148	1,630	1,636	6	.4	.5			
	6	Crystal Queen 9th. Shorthorn dry cow. Age 5 5-12 years. 5 months with calf.	1	3.5	7.5	10.5	11.5	15	.....	48.	462	1,492	1,530	38	2.5	8.2			
			2	3.25	6.25	9.5	10.	.....	13.5	42.5	595	1,530	1,536	6	.4	1.			
			3	3.5	7.5	8.42	9.28	.....	15.	43.7	612	1,530	1,594	58	3.8	9.5			
			4	3.5	27.75	.....	.....	.....	.....	31.25	438	1,594	1,605	11	.7	2.5			
			5	3.5	24.78	.....	.....	.....	.....	28.28	396	1,605	1,630	25	1.6	6.3			
			6	3.5	23.25	.....	.....	.....	.....	26.75	375	1,630	1,646	16	1.	4.3			
Lot IV.	7	Helianthus. Shorthorn bull calf. Age 1 year.	1	5.5	12.5	.....	.....	13	.....	31.	434	598	650	52	8.7	12.			
			2	5.63	6.38	.....	.....	.....	23.	35.01	490	650	678	28	4.3	5.7			
			3	5.28	6.78	.....	.....	.....	27.57	39.63	555	678	726	48	7.1	8.7			
			4	5.	6.5	.....	.....	.....	29.42	40.92	573	726	758	32	4.4	5.6			
			5	5.	6.39	.....	.....	.....	29.96	41.35	579	758	802	44	5.8	7.6			
			6	5.79	7.29	.....	.....	.....	30.	43.08	603	802	848	46	5.7	7.6			
	8	Horatio. Shorth'n bull calf. Age 11-12 years.	1	5.5	9.	.....	.....	14.5	.....	29.	406	508	540	32	6.3	7.9			
			2	5.63	5.	.....	.....	.....	24.50	35.13	493	540	568	28	5.2	5.7			
			3	6.	5.78	.....	.....	.....	27.50	37.28	522	568	616	48	8.5	9.2			
			4	6.	3.82	.....	.....	.....	28.92	38.74	542	616	650	34	5.5	6.3			
			5	6.	4.79	.....	.....	.....	29.82	40.61	569	650	688	38	5.8	6.7			
			6	6.	5.36	.....	.....	.....	29.79	41.15	576	688	720	32	4.7	5.6			
	9	Hamlet. Shorth'n bull calf. Age 9-12 years.	1	5.5	8.13	.....	.....	14.5	.....	28.13	394	490	528	38	7.8	9.6			
			2	5.63	4.	.....	.....	.....	24.50	34.13	478	528	560	32	6.1	6.7			
			3	6.	3.5	.....	.....	.....	27.35	36.85	516	560	600	40	7.1	7.8			
			4	6.	3.32	.....	.....	.....	29.50	38.82	543	600	631	31	5.2	5.7			
			5	6.	3.46	.....	.....	.....	29.75	39.21	549	631	676	45	7.1	8.2			
			6	6.	4.39	.....	.....	.....	29.82	40.21	563	676	708	32	4.7	5.7			

*Gain.

Comparisons Based on the Table.

1. *By Lots:*

LOT I.

During the first fortnight this lot had a daily ration of 14 pounds meal, 62 pounds dry cornstalks, and 30 pounds roots—a full ration. During the second and third fortnights, the daily ration was 14 pounds of meal as before, and 109 pounds ensilage—a full ration during the second fortnight, but the cows would have eaten more ensilage during the third, had it been given them. During the fourth, fifth, and sixth fortnights the daily ration was again 14 pounds meal, and 129 pounds ensilage—a full ration.

Here are the results:

Periods Compared.	Average Gain in Weight Per Fortnight.	Average Milk Yield Per Fortnight.	Daily Average Yield of Milk.
	lbs.	lbs.	lbs.
First fortnight	4.	421.50	30.107
Second and third fortnight	1.	392.75	28.054
Fourth, fifth and sixth fortnight	24.66	362.17	25.869

Although the 92 pounds of roots and fodder had been entirely substituted by 109 pounds ensilage,—little more than pound for pound,—the returns of the second and third fortnights are little below the first; and when the ensilage is increased during the next three fortnights to 129 pounds,—less than 1½ pounds ensilage to one pound of fodder and roots,—the results are considerably better than during the first period. Of course, in interpreting the results of the above feeding, the natural shrinkage in milk yield must be taken into account. That the above shrinkages are not great, the following comparison will clearly show. Stewart Queen,—the only other cow that became fresh at the same time of year,—dropped her first calf Aug. 28, 1881. This cow had all the dry cut cornstalks she would eat, a little hay occasionally, a meal ration, richer, but a little lighter than that of Lot I, and, during February, a peck of roots daily.

Here are the figures:

Animals Compared.	Weight Dec. 1st, 1881.	Weight Feb. 23, 1882.	Gain in Weight.	Loss in Weight.	Daily Average Dec. 1–15.	Daily Average Feb. 1–23.	Per Cent of Shrinkage.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Stewart Queen	1,040	1,000		40	9.71	8.15	16.07
Lot I—average of two cows	1,080	1,120	40		15.05	12.67	15.81

Stewart Queen is 3½ years old, and Nos. 1 and 2 of Lot I, 3 and 3 5–12 years respectively. It will be seen at once, from the above figures, that the cows in Lot I not only, gave, on the average, about 5 pounds more milk daily apiece, but their per cent of shrinkage is *less* than that of Stewart Queen. Nor is this all; for the cows of Lot I gain 40 pounds in weight apiece, while the other cow *loses* 40 pounds. A reference to the table will show, too, that the gain in weight of this lot was almost wholly upon the meal and ensilage ration.

LOT II.

The effect of ensilage in the mixed ration of this lot is very marked. For the sake of perspicuity the feed and returns are given side by side.

Period.	Feed Consumed Daily.	Gain in Weight per fortnight.	Loss in Weight per fortnight.
First fortnight	Meal, 10 lbs.; hay, 11⅛ lbs.; cornstalks, 18 lbs		10 lbs.
Second and third fortnights—average	Meal, 9⅛ lbs.; hay, 13 7-10 lbs.; ensilage, 44 9-10 lbs.	62 lbs.	

The ration of this lot was a full one during all the time covered by the above comparison; that is, the animals had all the rough feed they would eat.

LOT III.

This lot, of two dry cows, had 7 pounds meal, 15 pounds hay, 22 pounds cornstalks, 21 pounds oat straw, and 30 pounds roots, daily, for the first two weeks. The gain in weight during this time was 52 pounds.

During the second and third fortnights, the daily ration of this lot was 6¾ pounds meal, 13¾ pounds hay, 18¼ pounds each of cornstalks and oat straw, and 30 pounds ensilage. In other words the ensilage was substituted for roots, pound for pound, while the dry feed ingredients of the ration were cut down a little, to get the cows to eat the full allowance of ensilage. Again the gain in weight was 52 pounds each fortnight. This lot and also lot II were divided at the end of third fortnight. They will be noticed again.

LOT IV.

This lot, consisting of three bull calves, received daily during the first fortnight, 16½ pounds meal, 29½ pounds hay, and 42 pounds roots. During the second, third, and fourth fortnights, the average daily ration of the lot was 17 pounds meal, 14¼ pounds hay, and 80¾ pounds ensilage. For the fifth and sixth fortnights, the calves consumed daily, on the average, 17½ pounds meal, 15¾ pounds hay, and 89½ pounds ensilage. The gains of the lot for the different periods are here given:

	Pounds.
First fortnight, gain in weight	122
Second, third, and fourth fortnights, average gain in weight per fortnight	107
Fifth and sixth fortnights, average gain in weight per fortnight	118.5

The comparison seems to be unfavorable to ensilage; but before drawing any conclusions let us review the facts. At the end of the first fortnight, ensilage was made to take the place of the roots pound for pound, and also of 15 pounds of the hay, three pounds for one. The ninety pounds of ensilage had in the 15 pounds hay and 45 pounds roots, a strong competitor, to say the least. The calves could not take this allowance of ensilage, as the table clearly shows. Yet, during the last two fortnights, on *nearly* the full feed of ensilage, the gains approach very closely to that of the first period.

2. *By Individuals:*

As Lots II and III were divided at the end of the third fortnight, the following

comparisons are of single animals, and cover the whole time of the experiment. Each animal is referred to by the number given in the table, and the daily rations and returns are brought together.

No. 3.

Time fed.	Daily Ration.	Returns per fortnight.
2 weeks..	Meal, 5 lbs.; hay, 5¾ lbs.; cornstalks, 9 lbs.	loses 30 lbs.
4 weeks..	Meal, 4¾ lbs.; hay, 7 lbs.; ensilage, 23¾ lbs.	gains 34 lbs.
6 weeks..	Ensilage, 39 lbs.	loses 10½ lbs.

The superiority of ensilage over cornstalks as an ingredient in a mixed ration is marked. The loss on the 39 pounds of ensilage—all the steer would eat—is also significant.

No. 4.

Time fed.	Daily Ration.	Gains per fortnight.
2 weeks..	Meal, 5 lbs.; hay, 5¾ lbs.; cornstalks, 9 lbs.	20 lbs
4 weeks..	Meal, 4¾ lbs.; hay, 6¾ lbs.; ensilage, 21 lbs	28 lbs
6 weeks..	Meal, 3 lbs.; ensilage, 42 1-5 lbs.	8 lbs

Here the fluctuations are similar to those of No. 3, though not nearly as marked. During the last 4 weeks of the experiment, this steer would have eaten more ensilage had the allowance been increased. It is worth while to note that, *with three pounds of meal added*, No. 4, though not so hearty a feeder as No. 3, could eat 42 pounds of ensilage, while No. 3, on ensilage *alone*, ate only 39 pounds.

No. 5.

Time fed.	Daily Rations.	Gains per fortnight.
2 weeks..	Meal, 3¼ lbs.; hay, 7½ lbs.; cornstalks, 11¼ lbs.; oat straw, 9¾ lbs.; roots, 15 lbs.	14 lbs.
4 weeks..	Meal, 3½ lbs.; hay, 7 lbs.; cornstalks, 9 1-5 lbs.; oat straw, 8¾ lbs.; ensilage, 15 lbs	20 lbs.
6 weeks..	Meal, 3¼ lbs.; ensilage, 78¾ lbs.	22 lbs.

The above is a strong showing for ensilage, especially as compared with roots.

No. 6.

Time fed.	Daily Rations.	Gains per fortnight.
2 weeks..	Meal, 3¾ lbs.; hay, 7¼ lbs.; cornstalks, 10⅛ lbs.; oat straw, 11⅛ lbs.; roots, 15 lbs.	38 lbs.
4 weeks..	Meal, 3½ lbs.; hay 7 lbs.; cornstalks, 9 lbs.; oat straw, 8¾ lbs.; ensilage, 14¾ lbs..	32 lbs.
6 weeks..	Meal, 3½ lbs.; hay 25¼ lbs.	17½ lbs.

This cow would not eat the full allowance of ensilage for several days, still her gain is a large one, though not equal to that of the first fortnight. During the next period, though getting all the good hay she would eat and the regular allowance of meal, the gain is less.

Condition of the Animals at the Close of the Experiment.

The cattle continued to eat with relish throughout the experiment. All the animals were sleek, lively, and apparently in excellent health when the experiment closed. Even the Devon steer, No. 3 that had been losing weight on an exclusive ensilage diet, began to gain at once, on a ration of ensilage and meal, showing that his constitution had not been injured.

Comparative Feeding and Cost Value of Ensilage.

The meal fed to the cows is worth $22.40 per ton. That fed to the bull calves, $25. Hay is worth $10, and corn stalks and oat straw each $5 per ton, and rutabagas 40 cents per bushel.

Compared with the other feeds at the above rates, the ensilage has a feeding value four times the cost of growing the crop and putting it into the silo.

I was not at all sanguine, when we began the experiment, as to the decided merits of ensilage as claimed by many writers, but I have been greatly pleased with the results of the feeding. The convenience in handling the prepared fodder; the large amount that can be stored in a small space; the avidity with which cattle eat it and thrive and grow when a meal ration is fed with it; the fact that it can be stored in a wet time, during lowery weather, when fodder could not be cured; the furnishing of succulent food for stock during our long winters at very small cost,—these are some of the reasons that lead me to think that the ensilaging of corn especially will prove to be a practical and profitable method of preparing food for stock. I think it may take the place of roots and be a cheap substitute for them. I am disposed to believe that the best results will be secured by feeding one daily ration of dry fodder in connection with the ensilage. The experiment shows that it is not a complete food ration. A meal ration adapted to the animal and the desired result must be fed with it. The winter has been exceptionally favorable for the feeding of fodder of this character, on account of its extreme mildness, the mean temperature having been about 28° during the time embraced in the feeding. With severe weather the results might be less favorable. On account of changes in his laboratory, and domestic afflictions, our chemist, Dr. R. C. Kedzie, was unable to make such chemical investigations during the feeding experiment as we had desired. A sample of ensilage from the college silo was therefore sent to Prof. George H. Cook, director of the New Jersey experimental station, with the request that it be analyzed. Prof. Cook had the analysis made very promptly and refused all proffered compensation. I am under special obligations to him for this favor and his permission to publish in this connection his report of an experiment in feeding ensilage, giving results of interest, especially from a chemical standpoint.

To Mr. W. P. Latta, my assistant, I am greatly indebted for most faithful and intelligent work during the entire time of carrying out this experiment.

It will be borne in mind by any who may think we have been needlessly lengthy in making our report in detail, that it is published mainly for the purpose of giving plain facts to the farmers of our State, who have not given much attention to this subject.

The experiments will be continued another season. We shall plant several varieties of corn, sugar cane, millet, and other forage crops, to ascertain as far as we can their comparative values for ensilage.

Hoping that the expense incurred may result in giving practical information

of real value, and so aid in advancing the agricultural interests of our State, I respectfully submit this report.

SAM'L. JOHNSON,
Professor of Practical Agriculture and Supt. of the Farm.
AGRICULTURAL COLLEGE, June 1, 1882.

The report of Prof. Geo. H. Cook, Director of the New Jersey Experimental Station, referred to above, is as follows:

On November 16th four cows of native breed were taken from the herd at the college farm, placed side by side in the same barn, and for a term of ninety-one days were fed, exercised, and milked at the same time.

During the first period of twenty-eight days a ration was divided among them, made up of twenty-two and one-half pounds of clover hay, forty-nine pounds of wheat straw, seventy-five pounds of brewers' grains, seventy-five pounds of turnips, and seven and one-half pounds of cotton seed meal. It was calculated to furnish daily to each 1,000 pounds of live weight,

2.5 lbs. digestible protein.
0.5 lbs. digestible fat.
12.5 lbs. digestible carbhydrates.

This being, according to German investigators, the necessary amount of food.

For the second period of twenty-eight days no change was made in the ration fed cows Nos. I andII, while in that fed III and IV, 100 pounds of ensilage were substituted for 40 pounds of turnips; in other respects it remained the same as that fed during during the first period; it furnished daily to each 1,000 pounds of live weight,

2.50 pounds digestible protein.
.90 pounds digestible fat.
14.90 pounds digestible carbhydrates.

This was fed in order to determine whether an increased amount of the heat-producing compounds, fat and starch, was rendered necessary by the severity of the weather. The additional food caused no increase in the yield of milk; cows I and II on the poorer ration gave during this period more milk than during the preceding.

Our intention thus far was to ascertain the quantity of food required to keep these cows up to their full yield of milk.

For the third period, of five weeks ending February 17, Nos. I and II were fed the same as during the first and second periods; to III and IV an equal amount of digestible food was given daily, in 120 pounds of ensilage and five pounds of cotton seed meal per cow; it was eaten without waste and with apparent relish.

We tabulate below the yield of milk for 13 weeks. It must be remembered that during the first period all four cows received the same ration; that during the second and third periods cows I and II received the same as during the first; that cows III and IV were fed during the second period with an unusually rich ration, and during the third period with one made up of ensilage and cotton seed meal alone, containing, however, an amount of food equal to that fed during the first period.

TABLE SHOWING THE YIELD OF MILK.

	I. 7 yrs. old. Calved July 15.	II. 9 yrs. old. Calved Oct. 8.	III. 6 yrs. old. Calved Oct. 23.	IV. 6 yrs. old. Calved Oct. 10.
	lbs.	lbs.	lbs.	lbs.
Average daily yield for 1st period	23.5	25.1	25.6	24.1
" " " " 2d "	25.2	26.1	24.9	24.
" " " " 3d "	25.2	23.2	23.8	24.
Average daily yield for 91 days	24.6	24.8	24.8	24.

An opportunity is here offered to call attention to the fact that up to a certain point the yield of milk may be influenced by the quantity of digestible food; but beyond this point which is determined by breed, time of calving, and individual peculiarity, an increased amount of food fails to increase the yield of milk. Ensilage can produce no more milk than any other fodder which contains an equal amount of food, a point well illustrated by the above table.

While the yield of milk and its percentage of butter cannot be increased at will, it is well-known that its quality may be very materially influenced by the feeding. It is claimed for ensilage that it makes "winter butter equal to June butter," a claim willingly admitted, butter made from the fodder being to our knowledge of unusually fine color and flavor.

The composition of ensilage is by no means constant, as the following table of analyses shows; soil, variety of corn, method of planting and cultivating, and above all, the time of harvesting exert a decided influence on its quality.

The samples furnished by Mr. Platt and Messrs Whitman & Burrill had the characteristic vinous smell which indicated that they had been exposed to the air before reaching the laboratory—and probably an analysis of a perfect sample would have indicated a larger amount of nutritive matter. From personal observation at the silo, we know that Mr. Platt's ensilage was as well preserved as any we have seen.

In this table the samples have been arranged with reference to their percentage of water and carbhydrates:

	Loss at 212° F. Pr. Ct.	Protein. Pr. Ct.	Fat. Pr. Ct.	Fiber. Pr. Ct.	Ash. Pr. Ct.	Carbhydrates. Pr. Ct.
Mr. Mills, Pompton, N. J	77.4	1.02	0.68	6.85	1.00	13.04
Mr. Morris, Oakland Manor, Md	78.51	.88	0.62	6.43	1.53	12.03
Buckley Bros., Port Jervis, N. Y	80.86	1.27	0.67	5.47	1.00	10.73
Coe Bros., West Meridian, Conn	82.10	1.21	0.71	5.34	1.02	9.62
Mich. State Agricultural Col., Lansing	82.27	1.63	0.76	4.72	1.94	8.68
College Farm, New Brunswick, N. J	83.52	.94	0.65	5.18	1.43	8.28
Mr. Platt, Suffield, Conn	83.56	1.06	0.73	5.76	.81	8.08
Whitman & Burrill, Little Falls, N. Y	83.54	1.06	0.50	5.85	1.40	7.65
James Lippincott, Mt. Holly, N. J	84.28	1.37	0.50	4.98	1.26	7.91
Dr. J. M. Bailey, Billerica, Mass	84.87	1.06	0.45	5.61	.98	7.03

The amount of ensilage to be used depends entirely upon its quality and upon the plans of the farmer.

Mr. Mills, for instance, could make up a full ration for a cow of 1,000 pounds live weight, by feeding daily eighty pounds of his ensilage and five and

one-half pounds of cotton seed meal; while at the college farm, with five pounds of cotton seed meal, one hundred and twenty pounds were necessary. In these rations nearly all the carbhydrates needed, and a portion of the protein and fat is furnished at a very low price by the ensilage; the balance of the protein and fat is drawn from the cotton seed meal. If desirable, a much smaller quantity of the ensilage could be used, and the carbhydrates given in form of corn meal or any feed rich in these compounds; in ensilage they can be had however, much cheaper than in any feed known to us at present. One thing must be considered: If the quality of the ensilage obliges the farmer to feed his cows more than eighty or ninety pounds daily per head, there is reason to fear they will scour. The amounts fed by the above named gentlemen have varied from sixty-five to eighty pounds, and with these amounts no trouble whatever has been experienced. We therefore conclude that if the ensilage is of first-class quality, eighty pounds per day will furnish an animal with the full amount of carbhydrates; if it is of medium quality, it will be safer to limit the amount to about ninety pounds, furnishing the rest of the carbhydrates in form of feed or straw.

From the above experiment we feel justified in concluding that milch cows can be safely fed large quantities of this fodder, and that it is a perfect substitute for hay. The question of expense we reserve for a future bulletin.

ENSILAGE EXPERIMENTS OF 1882-3.

Is an acre of corn grown for fodder, ensilaged, worth more to feed cattle; will it go farther than if cut up and dried in the ordinary way? is a question often asked, but still not answered conclusively. While the answer possibly may be in the negative (I am not of that opinion), it by no means follows that ensilage would not even then have a very important place among our cattle foods. If the reply should be in the affirmative, then, on the score of economy, convenience in handling, and value, it would be almost indispensable on a stock farm. This would be especially true where cows were kept for dairy purposes, as ensilage being a succulent food, is calculated to produce a liberal yield of milk.

To still further test the value of ensilage as a practical, economical method of storing and preserving fodder fresh and juicy for winter feeding—as a chief substitute for roots—as a part ration with straw and coarse fodders, and especially in comparison with corn grown on adjacent plats and under the same conditions as the ensilage; but cut up and cured with great care in the ordinary way—were the thoughts in mind in planning our feeding experiments for 1882 and '83.

ANIMALS CHOSEN FOR THE EXPERIMENT.

Three lots of cattle were selected from the college herd December 18, 1882.

Lot I.

consisted of three bulls, two Shorthorns and one Ayreshire. No. 1, a Shorthorn bull calf, aged 9 months; No. 2, an Ayreshire bull, aged 15 months; No. 3, a Shorthorn bull, aged 14 months.

Lot II.

was composed of two large dry cows, Shorthorns, nearly alike as to weight, condition and feeding qualities. No. 4, aged 6 years; No. 5, aged 8 years.

Lot III.

was made up of four milk cows; three Ayrshires and one Shorthorn. No. 6, Ayreshire, aged 3 years, calved October 2, 1882; No. 7, Ayreshire, aged 4 years, calved September 29, 1882; No. 8, Ayreshire, aged 4 years, calved October 4, 1882; No. 9, Shorthorn, aged 4 years, calved November 24, 1882.

PREVIOUS TREATMENT.

Owing to the mildness of the fall weather the cows were turned out during the day until about the first of December, when they were given dry cornstalks and meal twice daily. The three bulls had been let out during the summer previous, only for exercise.

During the month of November all the cows selected for the experiment had lost weight except No. 4 (Stewart Queen 9th), she having gained nothing. The bulls had each gained in weight.

They were all in good or fair condition except No. 9 (Hermia 2d); she, having dropped a calf a short time previous, was rather thin in flesh.

TREATMENT DURING THE EXPERIMENT.

The cattle were attended throughout the experiment by one person, and pains was taken to secure regularity in everything pertaining to the feed and care of the animals.

The animals were fed regularly three times daily at 6:15 A. M., 11:30 A. M., and 4:30 P. M. They were watered in the stall at 9 A. M., and had access to water when turned out to exercise, from 2 P. M., till 4 P. M.

The milking was done just before the regular morning and evening feedings.

The animals were daily groomed with card and brush; the stables were cleaned and littered both morning and afternoon. Salt was given regularly three times each week. They were weighed on putting up, and regularly each week thereafter at 3:30 P. M. The time of feeding consisted of periods of three weeks each.

FEED AND FEEDING NOTES.

The rough feed was cut into one-fourth and one-half inch lengths by a power cutter. The cornstalks, dried corn fodder, and hay were all of good quality. The meal had 14 parts corn meal, 4 parts oat meal, and 9 parts wheat bran by weight.

During the second and third periods the bulls had daily one pound of oil meal each, besides their regular feed of corn and oat meal and wheat bran. One pound per day of oil meal was given No. 8 during the third week of the first period. Exact notes were kept of feed given to each animal, and if any was left in mangers it was weighed and deducted from amount given.

COMPARISONS BY LOTS.

Lot I.

During the first period this lot had a daily ration of 15.95 pounds of meal 38.90 pounds hay, and 44.75 pounds roots. During second period 20 pounds of meal, 28.89 pounds of hay, and 42.89 pounds of ensilage. During the third period 20 pounds of meal 29.73 pounds of hay, and 69.77 pounds of ensilage.

GAINS IN WEIGHT.

	Gain.
First period	187 lbs.
Second period	83 "
Third period	118 "

They were each given all the hay they would eat during the three periods, and during the first period nearly all the roots they would eat. During the second and third periods ensilage was substituted for roots, and they had what they would eat up clean once a day.

Lot II.

During the first period this lot had a daily ration of 6 pounds of meal, 12 pounds of hay, and 29.42 pounds of cut cornstalks; during the second period 6.38 pounds of meal, 12 pounds of hay, and 89.94 pounds of ensilage; during the third period 6 pounds of meal, 12 pounds of hay, and 105 pounds of ensilage.

GAINS IN WEIGHT.

	Gain.
First period	126 lbs.
Second period	22 "
Third period	32 "

During the first period they had all the cornstalks they would eat, but when ensilage was substituted for the corn stalks they were limited to 50 and 55 pounds respectively.

Lot III.

During the first period this lot received 28.33 lbs. of meal and 78.34 lbs of dried corn fodder.

During the second period 28 pounds of meal and 236.62 lbs. of ensilage.

During third period the lot was divided; Nos. 6 and 7 receiving as a daily ration 14 pounds of meal and 133.06 lbs. of ensilage, about the same amount they had received during the second period. While Nos. 8 and 9 received 14 lbs. of meal and 37.09 lbs. of dried corn fodder, about the same amount they had received during the first period.

Number 8 during the second period received, in addition to the regular feed, a feed of 3.42 lbs. of hay per day.

GAIN OR LOSS IN WEIGHT.

	Gain.	Loss.
First period		133
Second period	116	
Third period (Nos. 6 and 7)	24	
Third period (Nos. 8 and 9)		50

	Milk Yield.	Daily Average.
First period, Lot III (Nos. 6 and 7)	614⅜	29.26
Second period, " " " " "	636⅜	30.30
Third period, " " " " "	584⅜	27.83
First period, Lot IV (Nos. 8 and 9)	681¼	32.45
Second period, " " " " "	655	31.19
Third period, " " " " "	569¼	27.11

From the table it is seen that during the first period, when the ration was simply meal and dried corn fodder, that there was a loss of 133 pounds of flesh, but that when ensilage was substituted for dried corn fodder, there was a marked increase of 116 lbs., and a daily increase of milk.

During the last period the cows fed on ensilage still gained, while those fed dried corn fodder lost in weight. Although during the first and second periods lot IV gave considerable more milk than lot III yet when, during the third period, lot IV had dried corn fodder substituted for ensilage, their yield of milk fell below that of lot III.

BY INDIVIDUALS.

No. 1.

Time Fed.	Daily Ration.	Gain.
First period	Meal, 4.95 lbs.; hay, 9.46 lbs.; roots, 14.28 lbs.	26
Second period	" 6 " " 7.11 " ensilage, 10.52 lbs.	24
Third period	" 6 " " 7.37 " " 21.11 "	38

The decrease in the amount of gain the second period was due to the fact that it took this animal some time to become accustomed to eating ensilage.

During the third period the amount of ensilage was increased, and there was quite an increase in weight.

We have rarely found an animal that does not eat the ensilage with avidity from the start.

No. 2.

Time Fed.	Daily Ration.	Gain.
First period	Meal, 5 lbs.; hay, 13.24 lbs.; roots, 15.23 lbs.	71
Second period	" 6 " " 9.26 " ensilage, 15.30 lbs.	11
Third period	" 6 " " 10.06 " " 23.33 "	24

During the second period there was a greater falling off in this case than in the other, but nearly as large a gain during the third period.

No. 3.

Time Fed.	Daily Ration.	Gain.
First period	Meal, 6 lbs.; hay, 16.16 lbs.; roots, 15.23 lbs.	90
Second period	" 8 " " 12.21 " ensilage, 17.06 lbs.	48
Third period	" 8 " " 12.16 " " 25.33 "	56

Notes on No. 1 apply here.

Table Showing by Periods of three Weeks, the Results of the Feeding Experiment.

Number of Lot.	Number of Animal.	Name of Animal.	Number of Period.	Average Daily Ration.								Weights:—Gains and Losses.					Milk Yield.			
				Meal.	Cut Hay.	Cut Cornstalks.	Cut dried Corn-fodder.	Ensilage.	Sliced Rutabagas	Full Ration.	Total Feed Consumed.	Weight at beginning of period	Weight at end of period.	Gain in weight.	Loss in weight.	Gain per cent. of Live weight.	Total No. pounds	No. pounds gain.	No. of pounds shrinkage.	Daily Average.
Lot I.	1	College Baron.	1	9.45	9.46	.....	.....	.....	14.28	28.69	601	770	796	26	..	3.3	.....	.....	.....	.....
			2	6.	7.11	.....	.....	10.52	.....	23.63	496	796	820	24	..	3.	.....	.....	.....	.....
			3	6.	7.37	.....	.....	21.11	.....	34.48	724	850	888	38	..	4.7	.....	.....	.....	.....
	2	Horace of Lansing.	1	5.	13.24	.....	.....	.....	15.23	33.47	702	683	754	71	..	10.4	.....	.....	.....	.....
			2	6.	9.26	.....	.....	15.30	.....	30.56	641	754	765	11	..	1.4	.....	.....	.....	.....
			3	6.	10.23	.....	.....	23.33	.....	39.56	830	780	804	24	..	3.	.....	.....	.....	.....
	3	Hebe's Baron.	1	6.	16.16	.....	.....	.....	15.23	31.39	659	890	980	90	..	11.	.....	.....	.....	.....
			2	8.	12.21	.....	.....	17.06	.....	37.27	782	980	1028	48	..	4.9	.....	.....	.....	.....
			3	8.	12.16	.....	.....	25.33	.....	45.49	955	1050	1106	56	..	5.3	.....	.....	.....	.....
Lot II.	4	Crystal Queen 9th.	1	3.	6.	13.44	.....	.....	.....	22.44	741	1400	1430	30	..	2.1	.....	.....	.....	.....
			2	3.19	5.80	.....	.....	43.52	.....	52.51	1102	1430	1460	30	..	2.	.....	.....	.....	.....
			3	3.	6.	.....	.....	50.	.....	59.	1239	1440	1454	14	..	.9	.....	.....	.....	.....
	5	Bonny Red Rose.	1	3.	6.	15.97	.....	.....	.....	24.97	524	1512	1608	96	..	6.3	.....	.....	.....	.....
			2	3.19	6.	.....	.....	53.09	.....	62.28	1307	1608	1600	..	8	....	.....	.....	.....	.....
			3	3.	6.	.....	.....	55.	.....	64.	1344	1580	1598	18	..	1.1	.....	.....	.....	.....
Lot III.	6	Phylletta.	1	7.	.....	.....	.....	21.42	.....	28.42	596	887	864	..	23	....	325½	.....	.....	15.50
			2	7.	.....	.....	.....	64.94	.....	71.49	1501	864	902	38	..	4.3	339	13½	.....	16.14
			3	7.	.....	.....	.....	67.24	.....	74.24	1559	890	918	28	..	3.1	309	..	30	14.71
	7	Stewart Queen.	1	7.	.....	.....	.....	21.99	.....	28.99	608	960	954	..	6	....	289	.....	.....	13.76
			2	7.	.....	.....	.....	63.78	.....	70.78	1486	954	966	12	..	1.2	297⅜	8½	.....	14.16
			3	7.	.....	.....	.....	66.11	.....	73.11	1535	960	956	..	4	....	275½	....	22	13.11
	8	Lulu of Lansing.	1	7.	3.42	.....	.....	12.18	.....	22.60	474	926	892	..	34	....	187½	.....	.....	8.92
			2	7.	.....	.....	.....	.....	43.47	50.47	1059	892	912	20	..	2.2	191½	4	.....	9.11
			3	7.	.....	.....	.....	17.73	.....	24.73	519	910	910	..	..	....	170	....	21½	8.09
	9	Hermia 2d.	1	7.	.....	.....	.....	22.73	.....	29.73	624	1250	1180	..	70	....	474	.....	.....	22.57
			2	7.	.....	.....	.....	.....	65.47	72.47	1517	1180	1226	46	..	3.9	463⅜	....	10½	22.07
			3	7.	.....	.....	.....	19.35	.....	26.35	553	1170	1120	..	50	....	399½	....	64	19.02

TEMPERATURE.

The temperature was much colder during the entire period of feeding than during the experiments a year ago. At 8 o'clock each morning a note was taken of the temperature as indicated by the thermometer, the direction of the prevailing wind, the aspect, and the humidity.

The prevailing wind on a majority of days was from the southwest.

Temperature.	1st Period.	2d Period.	3d Period.
The maximum temperature	40°	31°	48°
The minimum temperature	6°	–18°	–10°
The average temperature	25.66°	11.85°	19.18°

I am under obligations to the Chemical Department over which Dr. Kedzie presides, for the following analyses of samples of the ensilage and fodder corn used in the experiments.

The corn fodder contained 22.85 per cent of water, while the ensilage contained 79.60 per cent of water.

The results of analysis are calculated water free.

	Corn Fodder.	Ensilage.
Cellulose or fiber	32.15	27.75
Carbo-hydrates (not fat)	52.02	46.42
Albuminoids (protein)	7.00	7.15
Ether extract, fat, wax, etc	1.95	1.19
Ash	6.88	5.49
Acid	....	12.00
	100.00	100.00

The per cent of carbo-hydrates and albuminoids in the ensilage show it to have been of good quality. The per cent of acid seems large; but not larger than some other samples here shown.

CORN FODDER GROWN FOR ENSILAGE AND FOR DRIED FODDER.

The land upon which it was grown was a sandy loam. Bailey's ensilage corn and Chester county corn were grown on the same plat in rows four feet apart, dropped in drills and covered with hoes. It was cultivated four times with a one-horse double-shovel cultivator. It attained a large growth, had a few ears and had become a little brown at the butts of the stalks when cutting was commenced September 12. The filling of the silo being finished September 15, it was covered September 16 and weighted with 100 pounds of stone to the square foot.

The area of corn put in the silo was 211 rods, yielding 46,763 pounds. The dried corn fodder was grown on an area of 64 rods, yielding, when dried, 4,350 pounds. This would make the weight of ensilage grown on one square rod 221 pounds, or 35,360 pounds per acre. The yield of dried corn fodder per rod was 68 pounds and 10,880 pounds to the acre. In other words, 3¼ pounds of ensilage makes 1 pound of dried fodder.

The weight of corn in silo—weighed as it was put in September 12, 13, 14, 15—51,433 pounds. The silo was opened December 15 and each load taken out was carefully weighed and a record kept. Finished the feeding April 1, but a few cubic feet of the ensilage left in the silo at this writing, June 8, seems after the surface is removed in a good state of preservation. The number of pounds weighed out was 44,315. This indicates a loss of 7,118 pounds or about

15 per cent. I estimate the loss in weight of the fodder corn by drying out in the barn about the same as ordinary hay, from 15 to 25 per cent.

The analysis of the fodder corn shows a large per cent of water, although the fall had been quite favorable for curing thoroughly. I have always found difficulty in drying corn fodder so that it could be stored without injury in large quantities. Here is one advantage in storing in a silo: If the work has been properly attended to, cover and weights on, you may be quite certain that the ensilage will come out in good shape. You will be saved the vexation of watching and turning your fodder, unbinding and binding, and seeking out new devices to prevent the fodder corn from moulding, which it is so likely to do. I am inclined to believe that the green corn can be cut and placed in the silo at as little cost as the fodder can be cut, dried and passed through the cutting box before feeding; and this, too, at a season of the year when the work can be more economically performed than in the winter.

SILOS.

I need only to add to my former report on this point that experience confirms the statement then made that any material may be used in the construction of silos that will exclude the air; that it is better to have several silos, or divisions, rather than a very large one; that weighting with stone, barrels of earth, or sacks of grain is likely to be more satisfactory than a screw, which may not receive attention at the right time; and that the silo is one of the most economical methods of providing shelter for fodder. In no way, perhaps, can the same equivalent in dried fodder be secured with so little expense. Several silos were built in the State last year of wood, and I have yet to learn that any one of them has proven a failure.

The results of the experiment, so far as comparing ensilage with dried fodder corn, show that when ensilage was substituted for the fodder corn in the second period, there was an increase in the weight of the cows and in the milk yield from Nos. 6, 7 and 8, while No. 9 shows an increase in weight, but a shrinkage in milk yield. I should here say that the corn fodder was of good quality, and the cows were fed what they would eat clean. It will be noticed that the daily ration of corn fodder equals in weight nearly one-third of the daily ensilage ration. I am confirmed in the belief that three tons of the ensilage is equal in feeding value to one ton of hay. The yield of ensilage corn was eighteen tons per acre, equivalent in feeding value in a combined ration to six tons of hay. Ensilage means the growing of an equivalent to six or ten tons of hay per acre. Admit, only, that three pounds of ensilage will take the place of one pound of hay in a mixed cattle ration, even then, if animals fed with it thrive, are healthy, and present a general appearance much like that resulting from grass feeding, coming out, after four or five months' confinement, with sleek coats, with not much, if any, loss of weight, and with no more shrinkage of milk yield than we ought reasonably to expect as the time from calving increases, we must conclude that there is some virtue in fodder prepared in this manner Claim only this, and is it not a profitable and a practical method of securing large yields of corn, sorghum, and other forage crops, and preparing them for convenient and economical feeding?

It is to be regretted that so many extravagant statements have been made in relation to the value of ensilage—the number of cattle that could be kept from the product of a single acre, etc. Practical, thinking men have been deterred from investigating this subject and giving it such attention as it really deserves, because of the wild statements of impractical enthusiasts.

ENSILAGE A CHEAP SUBSTITUTE FOR ROOTS.

I am more than ever convinced that the idea I suggested two years ago that ensilage will prove a cheap substitute for roots, will be approved by any farmer who will make the trial. Farmers who have had experience in feeding stock know how desirable it is to have some succulent food as a part ration at least, during our long cold winters. Roots are a desirable cattle food, but an expensive crop for the average farmer to raise and handle. But few farmers have the facilities for storing them in any quantity. They must be buried in the field; and in the winter with the thermometer below zero, digging out the roots and getting them to the stock is not a desirable task. If ensilage will give us the succulent food at less cost, in shape to be easily handled and occupying but a small space in storage, it must prove of value. What are the farmers in Michigan to do with the coarse fodders raised on our farms, but to feed them. They are too bulky to transport to market—they must help make beef and mutton, but the farmer needs something to feed in connection with them to make them of more value, and the ensilage will help out in this direction.

The large number of silos erected during the last year in all parts of our country, indicates that ensilage has the sanction of a number of our leading farmers, and that actual tests confirm reasonable claims as to its value as a cattle food. The farmers of Great Britain, too, are greatly interested in this subject, and it has received the favorable attention of some of the leading English agriculturists.

To Mr. Will E. Hale, class of '82, I am under obligations for most careful and efficient aid in the carrying out of these experiments.

Respectfully submitted,

SAM'L JOHNSON,

Prof. of Practical Agriculture and Supt. of the Farm.

AGRICULTURAL COLLEGE, June 8, 1883.