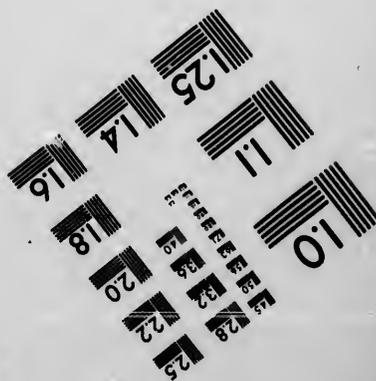
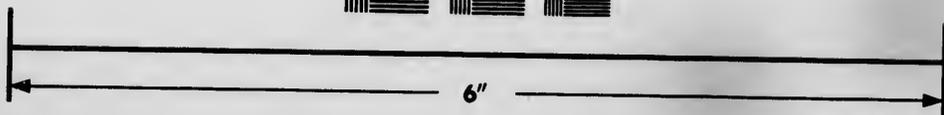


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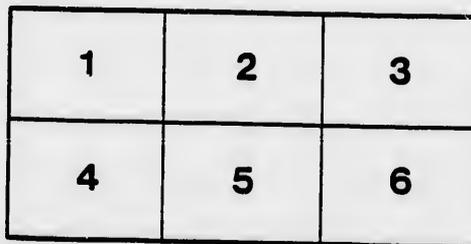
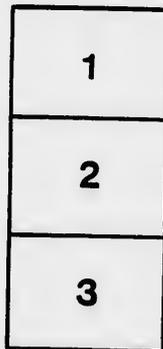
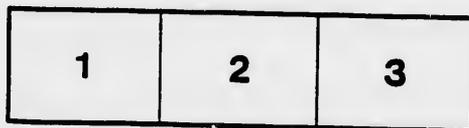
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CENTRAL EXPERIMENTAL FARM.

DEPARTMENT OF AGRICULTURE,  
OTTAWA, . . . CANADA.

BULLETIN No. 16.

EXPERIMENTS IN THE FEEDING OF STEERS.

NOVEMBER, 1892.

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To the Honourable

The Minister of Agriculture.

SIR,—I have the honour to submit for your approval, the sixteenth bulletin of the Central Experimental Farm, which has been prepared under my direction by Jas. W. Robertson, Agriculturist.

The information contained in this bulletin, has been derived from experiments which have been conducted at the Central Experimental Farm, during the two winters which have passed since cattle were added to its equipment. The economical and profitable feeding of store-cattle and the fattening of steers for market, form a most important branch of the live stock industry of Canada ; and I trust that the conclusions which have been drawn from these experiments, will be accepted by the farmers and be acted upon by them in their practice with great benefit to themselves.

I beg to direct special attention to the results which are reported in the bulletin, from the fattening of steers upon corn ensilage and frozen wheat, and from the feeding of young steers of the Quebec dairy breed of cattle.

I have the honour to be  
Your obedient servant,

WM. SAUNDERS,  
*Director, Experimental Farms.*

OTTAWA, November 14th, 1892.

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CENTRAL EXPERIMENTAL FARM.

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DEPARTMENT OF AGRICULTURE.

OTTAWA, - - - - CANADA

BULLETIN No. 16.

**EXPERIMENTS IN THE FEEDING OF STEERS.**

BY JAS. W. ROBERTSON, *Agriculturist.*

Experiments in the fattening of steers were begun at the Central Experimental Farm in December, 1890. The main object of the first experiments, was to obtain information upon the relative cost of fattening steers, (1) upon a ration of which the bulky-fodder portion was mainly corn ensilage, hay and roots, (2) upon a ration of which the bulky-fodder portion was mainly hay and roots, and (3) upon a ration of which the bulky-fodder portion was mainly corn ensilage.

Six 2-year old steers were purchased and were sorted into three lots as nearly even in quality and size as possible. They were apparently all Shorthorn grades. On Dec. 1, the average weight per head was 1,135 lbs. During the test, (which lasted from Dec. 1 to May 18), they were weighed once every week, and the feed which they consumed was weighed every day. They had free access to water in a trough in front of the stalls, and a supply of salt was provided at the side of each manger. The preparatory period of feeding lasted from Dec. 1 to Dec. 29, and during it all the animals were fed upon the same ration.

The three experimental rations were composed as shown in the following Table :—

TABLE I.

RATION No. 1.	Lbs.	RATION No. 2.	Lbs.	RATION No. 3.	Lbs.
Corn Ensilage.....	20			Corn Ensilage.....	50
Hay (cut).....	10	Hay (cut).....	20		
Roots.....	20	Roots.....	40		
Straw (cut).....	5	Straw (cut).....	5	Straw (cut).....	5
Oil-cake.....	1	Oil-cake.....	1	Oil-cake.....	1
Cotton-seed Meal....	1	Cotton-seed Meal....	1	Cotton-seed Meal....	1
Pease (ground).....	2	Pease (ground).....	2	Pease (ground).....	2
Barley (ground).....	2	Barley (ground).....	2	Barley (ground).....	2
	61		71		61

For a period of five weeks from March 17 to April 20, an additional 1 lb. each of oil-cake and cotton-seed meal were put into each ration.

For the purpose of obtaining some data which would be understood easily and remembered readily by the farmers, and which would afford means for making a comparison between the cost of feeding the steers on the three different rations, a cash value was estimated for the component fodders in each. The hay was valued at \$8 per ton ; roots (turnips and mangels) at \$4 per ton ; straw at \$4 per ton ; oil-cake and cotton-seed meal at \$30 per ton ; pease and barley at \$20 per ton ; and corn ensilage at \$1.40 per ton. The corn ensilage was placed at the actual cost, as per statement in Bulletin No. 12, and the other fodders at an estimated valuation, which may be high or low, according to ever fluctuating circumstances of seasons and markets.

Table II shows, (1) the increase in weight of each steer after 20 weeks, (2) the average quantity of feed consumed per day per head, and (3) the average cost per head per day, for feed consumed.

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TABLE II.

RATIONS.		Increase in Weight.	Feed consumed.	Cost per head per day.
Lbs.		Lbs.	Lbs.	Cents.
	No. 1. { Hay, Roots, Corn Ensilage and Meal.	123	} 52.8	15.58
	do. ....	182		
50	No. 2. { Hay, Roots and Meal.....	188	} 55.5	19.23
	do. ....	179		
	No. 3. { Corn Ensilage and Meal.....	221	} 60.	11.90
	do. ....	212		

*Conclusions.* From these tests it appears that :—

(1.) During the feeding period of 20 weeks, the steers which were fed upon Ration No. 3, (corn ensilage and meal), GAINED in weight, on the average, 33 lbs. per head MORE, and COST 7.33 cents per head LESS, per day for feed consumed, than the steers which were fed upon Ration No. 2, (hay, roots and meal) ;

(2.) During the feeding period of 20 weeks, the steers which were fed upon Ration No. 3, (corn ensilage and meal), GAINED in weight, on the average, 61½ lbs. per head MORE, and COST 3.68 cents per head LESS, per day for feed consumed, than the steers which were fed upon Ration No. 1, (hay, roots, corn ensilage and meal) ;

(3.) When the experiment was ended, the steers which were fed upon Ration No. 2, (corn ensilage and meal) were in the most attractive condition of the three lots for handling and selling ;

(4.) A ration of which the bulky-fodder portion was mainly corn ensilage, was more profitable for the fattening of steers, than a ration of which the bulky-fodder portion was mainly or wholly hay and roots.

#### EXPERIMENTS IN 1891-2.

The experiments in the feeding of steers during the winter of 1891-2, were planned,—

(1.) To obtain further information upon the relative cost of fattening steers upon a ration of which the bulky-fodder portion was mainly, (a) in the one case, corn ensilage, hay and roots, (b) in another case, hay and roots, and (c) in the third case, corn ensilage,—

(2.) To discover the comparative values of feed consumed, per 100 lbs. of increase in live weight, by 3-year-old steers, 2-year-old steers, 1-year-old steers and calf-steers respectively.

THE FATTENING OF TWO-YEAR-OLD STEERS.

Eight 2-year-old steers were purchased and were sorted into four lots as nearly even in quality and size as possible. They were apparently all Shorthorn grades.

The preparatory feeding period lasted from October 29 to December 1, and during it the animals were all fed upon the following ration:—

Corn Ensilage.....	25 lbs.
Roots.....	50 "
Straw (cut).....	15 "
Pease (ground).....	3 "
Barley (ground).....	3 "
	96 lbs.

They were each allowed as much of the mixture as they would eat.

On October 29, the average weight per head was 1,079 lbs.; and on December 1, it was 1155 lbs.,—showing a gain of 76 lbs. per head.

Three rations were composed as in Table III.

TABLE III.

RATION No. 1.	Lbs.	RATION No. 2.	Lbs.	RATION No. 3.	Lbs.
Corn Ensilage.....	20			Corn Ensilage.....	50
Hay (cut).....	10	Hay (cut).....	20		
Roots.....	20	Roots.....	40		
Straw (cut).....	5	Straw (cut).....	5	Straw (cut).....	5
Oil cake.....	2	Oil-cake.....	2	Oil-cake.....	2
Pease (ground).....	2	Pease (ground).....	2	Pease (ground).....	2
Barley (ground).....	2	Barley (ground).....	2	Barley (ground).....	2
	61		71		61

For the purpose of making a comparison of the relative cost of fattening steers upon the three different rations, a cash value was estimated for the component fodders in each. The hay was valued at \$8 per ton; roots at \$4 per ton; straw at \$4 per ton; oil-cake at \$30 per ton; pease and barley at \$20 per ton; and corn ensilage at \$2 per ton. The corn ensilage was valued at a higher figure than in the former experiment (in 1890-1) for the reason that the corn was wilted to a greater extent before it was put into the silos, and because it cost more in 1891 than in 1890 owing to the crop being damaged by a hail storm in August. The prices at which the several fodders are valued for the purposes of this comparison are higher than the cost of production to the ordinary farmer, and may be higher or lower than the prices which could be realised from their sale as fodders.

The following Table shows, (1) the increase in weight of each steer in 18 weeks, (2) the total quantity of feed consumed on the average per head per day, (3) the average quantity of the meal mixture (included in the former) consumed per head per day, and (4) the average cost per head per day, for feed consumed.

TABLE IV.

RATIONS.		Increase in Weight.	Feed consumed per head.	Meal in feed per day.	Cost per head per day.
		Lbs.	Lbs.	Lbs.	Cents.
No. 1.	{ Hay, Roots, Corn Ensilage and Meal	152	61.96	6.09	18.28
	{ do. do.	265			
No. 2.	{ Hay, Roots and Meal.....	165	53.92	4.55	18.22
	{ do. ....	213			
No. 3.	{ Corn Ensilage and Meal.....	290	67.92	6.68	14.47
	{ do. ....	229			

THE FATTENING OF STEERS ON CORN ENSILAGE AND FROZEN WHEAT.

From December 1 until January 5, the other two steers were fed upon a ration composed of,—

Corn Ensilage..... 50 lbs.  
 Straw (cut)..... 5 "

55 lbs.

During that period, they gained in weight an average of 11 lbs. per head, and consumed on the average 61.9 lbs. of feed per head per day, at a cost of 6.75 cents per head per day.

From January 5 until April 5, these two steers were fed upon a ration composed of,—

Corn Ensilage.....	50 lbs.
Straw (cut).....	5 "
Frozen Wheat (ground).....	6 "
	61 lbs.

During that period of 13 weeks, they gained in weight an average of 159 lbs. per head, and consumed on the average 59.88 lbs. of feed per head per day, at a cost of 9.32 cents per head per day. The frozen wheat was valued at 35 cents per bushel.

Table V shows, (1) the average increase in weight per head per day, (2) the average cost per head per day for feed consumed, and (3) the average cost of feed consumed per 100 lbs. of increase in live weight.

TABLE V.

RATIONS.	Increase in weight per day.	Cost per head per day.	Cost per 100 lbs. increase in weight.
	Lbs.	Cents.	\$
No. 1. Hay, Roots, Corn Ensilage and Meal.	1.65	18.28	11.05
No. 2. Hay, Roots and Meal.....	1.50	18.22	12.14
No. 3. Corn Ensilage and Meal.....	1.94	14.47	7.45
No. 4. Corn Ensilage and Frozen Wheat ...	1.74	9.32	5.33

*Conclusions.* From these tests it appears that:—

(1.) During the feeding period of 18 weeks, the steers which were fed upon Ration No. 3 (corn ensilage and meal), GAINED in weight on the average  $55\frac{1}{2}$  lbs. per head MORE, and COST 3.75 cents per head LESS, per day for feed consumed, than the steers which were fed upon Ration No. 2 (hay, roots and meal) ;

(2.) During the feeding period of 18 weeks, the steers which were fed upon Ration No. 3 (corn ensilage and meal), GAINED in

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weight on the average 36 lbs. per head MORE, and cost 3.81 cents per head LESS, per day for feed consumed, than the steers which were fed upon Ration No. 1 (hay, roots, corn ensilage and meal);

(3.) The cost for feed consumed per 100 lbs. of increase in live weight, was 62.95 per cent. greater on Ration No. 2 (hay, roots and meal), and 48.32 per cent. greater on Ration No. 1 (hay, roots, corn ensilage and meal) than it was on Ration No. 3 (corn ensilage and meal);

(4.) On Ration No. 2 (hay, roots and meal) the quantity of meal consumed per head per day, was 4.55 lbs. as against 6.68 lbs. per head per day on Ration No. 3 (corn ensilage and meal);

(5.) The quality of the beef, from the steers fed upon corn ensilage and frozen wheat, was pronounced to be particularly excellent by the butchers, and by the members of 8 different households who examined it critically when served as roast beef.

#### THE FEEDING OF THREE-YEAR-OLD STEERS.

Four 3-year-old steers were purchased and were sorted into two lots of apparently even quality. On December 3, the operation of dehorning was performed on them. The wounds on the heads of three of the animals appeared to be acutely painful for about a week, and during that time they all lost from 40 to 100 lbs. each. The other animal did not seem to suffer much, after the operation of sawing off the horns was ended. After the wounds were healed the animals were fed loose in a cold shed with only one thickness of lumber between them and the outside air.

The preparatory feeding period lasted from October 29 to December 1, and during it the animals were all fed upon the following ration:—

Corn Ensilage.....	25 lbs.
Roots.....	50 "
Straw (cut).....	15 "
Pease (ground).....	3 "
Barley (ground).....	3 "

---

96 lbs.

NOTE.—To furnish further data for a comparison between the bulky-fodder portions of Ration Nos. 1, 2 and 3, an equal quantity of meal per head per day, will be fed to the several animals in our next series of experiments, instead of equal quantities of meal being added to the different rations.

They were each allowed as much of the mixture as they would eat. On October 29, the average weight per head was 1,182 lbs.; and on December 1, it was 1,251 lbs.,—showing a gain of 69 lbs. per head.

Two rations were composed as in Table VI.

TABLE VI.

RATION No. 3.	Lbs.	RATION No. 5.	Lbs.
Corn Ensilage.....	50	Corn Ensilage.....	50
Straw (cut).....	5	Straw (cut).....	5
Oil-cake.....	2		
Pease (ground).....	2		
Barley (ground).....	2		
	61		55

For the purpose of making a comparison, a cash value was estimated for each of the component fodders in each ration as mentioned after Table III.

The following Table shows, (1) the increase in weight of each steer in 18 weeks, (2) the quantity of feed consumed on the average per head per day, (3) the quantity of the meal mixture (included in the former) consumed per head per day, and (4) the average cost per head per day, for feed consumed.

TABLE VII.

RATIONS.		Increase in Weight.	Feed Consumed.	Meal in feed per day.	Cost per head per day.
		Lbs.	Lbs.	Lbs.	Cents.
No. 3.	{ Corn Ensilage and Meal.....	102	65.96	6.48	14.05
	{ do. do. ....	155			
No. 5.	{ Corn Ensilage.....	50	54.65	0	5.96
	{ do. ....	7			

## THE FEEDING OF ONE-YEAR-OLD STEERS.

Four 1-year-old steers were purchased and were sorted into two lots of apparently even quality.

The preparatory feeding period lasted from October 29, to December 1, and during it, the animals were all fed upon the following ration:—

Corn Ensilage.....	25 lbs.
Roots.....	50 "
Straw (cut).....	15 "
Pease (ground).....	3 "
Barley (ground).....	" "
	96 lbs.

They were each allowed as much of the mixture as they would eat.

On October 29, the average weight per head was 751 lbs.; and on December 1, it was 805 lbs.;—showing a gain of 54 lbs. per head.

From Dec. 1 until April 5, both lots were fed upon Ration No. 3:—

Corn ensilage.....	50 lbs.
Straw (cut).....	5 "
Oil-cake.....	2 "
Pease (ground).....	2 "
Barley (ground).....	2 "
	61 "

The two steers of one lot, were fed loose in a cold shed with only one thickness of lumber between them and the outside air; and the two steers of the other lot, were fed tied in stalls in the cattle stable. The average temperature of the stable would be about 50° Fahr.

The following Table shows, (1) the increase in weight of each steer in 18-weeks, (2) the quantity of feed consumed on the average, per head per day, (3) the quantity of the meal mixture (included in the former), consumed per head per day, and (4) the average cost per head per day, for feed consumed.

TABLE VIII.

RATIONS.	How fed.	Increase	Feed	Meal	Cost
		in weight.	consumed per head.	in feed per day.	per head per day.
		Lbs.	Lbs.	Lbs.	Cents.
{ Corn Ensilage and Meal.....	In stable..	173	45.25	4.45	9.64
{ do. ....	do. ...	163			
{ do. ....	In shed...	172	43.94	4.32	9.36
{ do. ....	do. ...	129			

*Conclusion.* From this single test, it is not evident that there was an appreciable difference in the increase in the weight of the steers, or in the quantity of feed consumed, which was due to the place or manner of feeding,—stable *v.* shed and tied *v.* loose.

#### THE FEEDING OF CALF-STEERS.

Four calf-steers were put under test on Rations Nos. 2 and 3. Each lot contained one steer, out of a grade Shorthorn cow by a Shorthorn bull, and one steer out of a "Quebec Jersey" or "French Canadian" cow. The breeding of the sire of the Quebec steers was not known to us.

The preparatory feeding period lasted from Oct. 29 to Dec. 1, and during it the animals were all fed upon the following ration:—

Corn Ensilage.....	25 lbs.
Roots.....	50 "
Straw (cut).....	15 "
Pease (ground).....	3 "
Barley (ground).....	3 "
	96 "

They were each allowed as much of the mixture as they would eat.

On Oct. 29, the average weight per head was 465 lbs. ; and on Dec. 1, it was 526 lbs.,—showing a gain of 61 lbs. per head.

The two rations were composed as in Table IX.

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TABLE IX.

RATION No. 2.		Lbs.	RATION No. 3.		Lbs.
Hay (cut) .....	26		Corn Ensilage.....	50	
Roots.....	40		Straw (cut).....	5	
Straw (cut) .....	5		Oil-cake.....	2	
Oil-cake.....	2		Pease (ground).....	2	
Pease (ground).....	2		Barley (ground).....	2	
Barley (ground).....	2				
	71				61

For the purpose of making a comparison, a cash value was estimated for each of the component fodders in each ration, as mentioned after Table III.

The following Table shows, (1) the increase in weight of each steer in 18 weeks, (2) the quantity of feed consumed on the average per head per day, (3) the quantity of the meal mixture (included in the former) consumed per head per day, and (4) the average cost per head per day, for feed consumed.

TABLE X.

RATIONS.		BREED.	Increase in weight.	Feed consumed per head.	Meal in feed per day.	Cost per head per day.
			Lbs.	Lbs.	Lbs.	Cents.
No. 2.	{ Hay, Roots and Meal.	Shorthorn.	255	30 71	2 59	10 38
	do.	Quebec....	164			
No. 3.	{ Corn Ensilage & Meal.	Shorthorn.	212	35 25	3 46	7 51
	do.	Quebec....	175			

The following Tables have been arranged to show, (1) the relative rates of increase in weight, (2) the relative cost per head per day, and (3) the relative cost of feed consumed per 100 lbs. of increase in live weight, of the steers of Shorthorn and Quebec blood respectively.

TABLE XI.

	BREED.	Weight	Weight	Increase.
		Dec. 1.	April 5.	
		Lbs.	Lbs.	Lbs.
Steer No. 174.....	Shorthorn.....	595	850	255
do. 173.....	Quebec.....	480	644	164
do. 172.....	Shorthorn.....	600	812	212
do. 171.....	Quebec.....	430	605	175

TABLE XII.

RATIONS.	BREED.	Increase	Feed	Cost	Cost per
		in weight per day.	consumed per day.	per head per day.	100 lbs. of increase in weight.
		Lbs.	Lbs.	Cents.	\$
No. 2. { Hay, Roots and Meal.	Shorthorn.	2.02	35.85	12.11	5.96
	do. Quebec....	1.30	25.65	8.67	6.66
No. 3. { Corn Ensilage & Meal.	Shorthorn.	1.68	31.00	8.31	4.94
	do. Quebec....	1.38	31.50	6.71	4.83

*Conclusions.* From these tests with calf steers, it appears that:—

(1.) During the feeding period of 18 weeks, the steers which were fed upon Ration No. 3 (corn ensilage and meal), GAINED in weight on the average 16 lbs. per head LESS, and COST 2.87 cents per head LESS, per day for feed consumed, than the steers which were fed upon Ration No. 2 (hay, roots and meal);

(2.) The cost for feed consumed per 100 lbs. of increase in live weight, was 27.6 per cent. greater, on Ration No. 2 (hay, roots and meal), than it was on Ration No. 3 (corn ensilage and meal);

(3.) The cost of feed consumed per 100 lbs. of increase in weight was lowest in the case of a calf steer of "French Canadian" or "Quebec Jersey" breed, fed upon Ration No. 3 (corn ensilage and meal).

## COMPARISONS IN THE FEEDING OF STEERS OF DIFFERENT AGES.

In the foregoing Tables some information has been given showing the comparative quantities of feed consumed and the cost per 100 lbs. of increase in live weight, by 3-year-old steers, 2-year-old steers, 1-year-old steers and calf steers respectively, when fed upon the same ration.

The following additional Tables have been arranged to present a comparison of the results in convenient form. The lots which are compared were fed from Dec. 1 to April 5, upon Ration No. 3, viz. :—

Corn Ensilage.....	50 lbs.
Straw (cut).....	5 "
Oil-cake.....	2 "
Pease (ground).....	2 "
Barley (ground).....	2 "
	61 lbs.

TABLE XIII.

STEERS.	Increase in Weight.	Increase in weight per day per head.	Feed consumed per day per head.	Meal in feed per day per head.	Cost per head per day.	Cost per 100 lbs. of increase in weight.
	Lbs.	Lbs.	Lbs.	Lbs.	Cents.	Dollars.
3-year-old, No. 189.	102	1'02	65'96	6'48	14'05	13'77
do. No. 188.	155					
2-year-old, No. 183.	260	1'94	67'92	6'68	14'47	7'45
do. No. 182.	229					
1-year-old, No. 178.	173	1'33	45'25	4'45	9'64	7'23
do. No. 177.	163					
Calf steer, No. 172.	212	1'53	35'25	3'46	7'51	4'89
do. No. 171.	170					

*Conclusions.* From this one series of experiments, it appears that:—

(1.) The *cost* for feed consumed per 100 lbs. of increase in live weight was *lowest* in the case of calf-steers, viz.: \$4.89 per 100 lbs.;

(2.) The *cost* for feed consumed per 100 lbs. of increase in live weight was *84.83 per cent. greater*, by the 3-year-old steers than by the 2-year-old steers;

(3.) The original weight of the 2-year-old steers, was enhanced *in value per lb.*, quite as much by the feeding for 18 weeks, as was the original weight of the 3-year-old steers;

(4.) The original weight of the 1-year-old steers and calf-steers, was not enhanced *in value per lb.*, to any appreciable extent by the feeding for 18 weeks.

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NOTES.—The 1-year-old steers and calf steers have been carried over to be fed during the winter of 1892-93.

The corn ensilage, which was used in these experiments, was made from several varieties of Indian Corn, most of which had not reached the early milk stage of growth. By the planting of varieties of corn which ripen early (mainly Longfellow and Pearce's Prolific) a quality of ensilage which appears to be much superior, has been provided for the feeding experiments of 1892-93.

