SILAGE

SUNFLOWER, CORN, SWEET CLOVER AND OTHER SILAGES: THEIR NATURE AND COMPOSITION

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This bulletin contains the analysis of a large number of silages produced and fed at one or other of the Farms or Stations of the system during the past two years. The several series include silages from sunflower, corn, oat, pea, vetch, sweet clover and Sudan grass and various mixtures of these crops. The data and information presented are of peculiar interest from the fact that the samples examined are representative of silage from crops grown at a number of widely distant points in the Dominion and cut at various stages of growth. Silage is undoubtedly the most important of all succulent fodders; without it, profitable winter dairying would be all but impossible in most parts of the Dominion. The present studies make a distinct contribution to our knowledge respecting the composition and nutritive value of several of the more important classes of Canadian-grown silage.

SUNFLOWER SILAGE

During the past four years the acreage sown to sunflowers as a silage crop has steadily increased, this increase being more particularly in the north-western provinces—Manitoba, Saskatchewan and Alberta. Certain phases of the subject, e. g., palatability and nutritive value, may as yet be said to be in the experimental stage, in spite of the accumulation of a considerable amount of experience and data on these matters. Feeding experiments with this silage have been carried on at a number of the Farms and Stations of the Experimental system and, further, it is being extensively used on many farms. A survey of the reports received shows a wide variation both as to results and in the opinions expressed. Nevertheless, there is a sufficiency of satisfactory evidence to show that sunflower silage is a valuable succulent fodder and that it may serve as a substitute for corn silage in stock feeding—both for beef and milk. There seems now but little doubt that sunflowers are a fairly satisfactory and acceptable silo crop for districts in which seasonal conditions do not meet the requirements for the best results with corn, i.e., districts in which the summer season is comparatively short, the nights cool and the precipitation scanty.

The report of this Division for 1921 contains the analysis and field data of nine samples of sunflower silage produced on certain of the western Farms and Stations of the system. Great variation in composition was observed, due probably in a large measure to differences in the stage of growth of the crop when cut for the silo at the several Stations, and to some degree, no doubt, to the extent of fermentation, the action of frost and other and unknown factors. It was however fairly evident that the young and immature plants—as for instance, when in bud—would yield a silage more watery, and apparently of lower feeding value than silage from a crop cut after the seeds had formed.

The work detailed in the 1922 report, in connection with the sunflower crop, comprises the analysis of a series of ten samples of the plant from the Experimental Station, Summerland, B.C. These were grown on the same plot and cut at weekly intervals from June 20 to August 29, representing the crop from "before flowering" to "full bloom." The results showed that as growth proceeded there was a steady and marked increase in the dry matter

content. The data for the composition of the dry matter were extremely interesting, showing the falling off in the crude protein content as growth advanced and that as the plant matured the proportion of true albuminoids to non-albuminoids increased and therefore the crude protein in the mature plant has a higher nutritive value than that of the young immature plant. Another salient feature was the increase of fibre in the dry matter at each successive collection, but since even the last member of this series was still succulent and immature (all the plants in bloom, no material development of seed) this increase did not denote any serious impairment in digestibility.

A second series of five members furnished by the Division of Field Husbandry, Central Experimental Farm, Ottawa, was also submitted to analysis. The analytical data in this series would show the composition of the crop cut at approximately *the same stage of growth* as indicated by inflorescence but with *varying periods of growth* as determined by dates of sowing. The crop on all five plots at the time of cutting, August 23, was approximately 40 to 60 per cent in bloom and considered to be about the right stage or condition for ensiling. The results are discussed in some detail in our 1922 report and it may suffice, therefore, here, to say that they prove that age as measured by periods of growth, i.e., length of time, does not necessarily determine stage of growth. It was noted that there is a relationship between percentage of dry matter and yield—the crop with the lowest percentage of dry matter giving the lowest yield per acre and vice versa. The crops with the higher dry matter content and yield were, contrary to expectation, from the later sowings, again proving that the length of the growing period is not always indicative of physiological activity. The data further showed that there is a period in the history of the crop during which the dry matter content increases without any *marked* change in its composition.

The third series, comprising sunflower plants cut at six distinct stages of growth, was furnished by the Division of Forage Plants. The analytical data indicated that between the stages "bud formed but unopened" and "seed developed but not ripe" there was little change in the percentage of dry matter present or in the composition of the dry matter.

The 1922 report also includes the analyses of four samples of sunflower silage, three from Experimental Stations in the western provinces and one from the Central Experimental Farm, Ottawa. Those from the west were more or less of average quality while that from the more mature crop grown at Ottawa contained somewhat less protein and more fibre than is usually found.

The twenty samples of sunflower silage examined during the year 1922-3, and now reported on, may be grouped into the following six series. 1. Four samples from the Experimental Station at Scott, Sask., two of which represented the crop at "heads forming" stage and two of the crop when "seeds nearly mature." 2. Twelve samples from the Experimental Farm, Brandon, Man., representative of silage from the top and bottom respectively of six experimental silos, each silo being filled with the crop cut at one of six stages of growth—from "heads forming" to "seeds fifty per cent ripe." 3. A sample representative of silage from a pit silo at the Experimental Station, Scott, Sask. 4. A sample from the Experimental Station, Kapuskasing, Ont., from a crop cut when about 20 per cent in bloom. 5. A sample from the Experimental Station, Cap Rouge, Que., from crop cut when "seeds in dough stage." 6. A sample taken 1 foot from bottom of stave silo at the Central Experimental Farm, Ottawa, April 3.

The table further includes the analysis of two samples (series 7 and 8) examined in the year 1923-4 and consequently from the crop of 1923. The first was silage from an irrigated crop of sunflowers grown at Lethbridge, Alta., the other, also from the crop of 1923, grown at Lacombe, Alta. Both samples of silage were collected in April, 1924.

Lab'y No.	Locality	Date of Cutting	Stage of Growth	Number of Silo and Position in Silo	As Received							Water-free					
					Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash	Acidity	Protein		Fat	Carbo-hydrates	Fibre	Ash
												Albumin-oids	Non-albumin-oids				
					p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
61169A	Experimental Station, Scott, Sask.	.....	Heads forming.....	.....	81·18	2·47	0·45	8·87	3·81	3·22	1·56	9·54	3·56	2·43	47·10	20·25	17·12
61169B	" " ..	.....	" "	.....	80·93	2·37	0·38	9·56	3·78	2·98	1·84	9·59	2·82	2·02	50·12	19·84	15·61
61170A	" " ..	.....	Seeds nea.ly mature.....	.....	81·25	2·10	0·43	9·67	4·37	2·18	1·70	7·27	3·91	2·31	51·57	23·32	11·62
61170B	" " ..	.....	" "	.....	82·39	1·98	0·44	8·99	4·03	2·17	1·80	9·31	1·91	2·51	51·06	22·87	12·33
62482	Experimental Farm, Brandon, Man.	15–8–22	A. Heads not formed and forming.	No. 1)1½ ft. from top	81·58	1·86	0·81	7·56	4·53	3·66	1·88	8·06	2·02	4·38	41·08	24·60	19·86
62483	" " ..	15–8–22	B. Heads not formed and forming.	No. 1 (1½ ft. from bottom)	82·41	1·99	0·78	8·42	3·81	2·59	1·70	9·92	1·37	4·43	47·86	21·70	14·72
62484	" " ..	25–8–22	A. 10 to 12 per cent in bloom	No. 2 (1½ ft. from top)	78·23	2·07	0·93	10·57	5·44	2·76	2·15	8·48	1·02	4·27	48·54	25·00	12·69
62485	" " ..	25–8–22	B. 10 to 12 per cent in bloom	No. 2 (1½ ft. from bottom)	78·23	1·84	0·98	9·83	6·31	2·81	2·02	7·66	0·78	4·49	45·17	29·00	12·90
62486	" " ..	31–8–22	A. 35 to 37 per cent in bloom	No. 3 (1½ ft. from top)	76·05	2·00	1·03	10·98	6·80	3·14	1·74	7·49	0·87	4·31	45·86	28·37	13·10
62487	" " ..	31–8–22	B. 35 to 37 per cent in bloom	No. 3 (1½ ft. from bottom	76·42	2·24	1·12	11·24	5·78	3·20	1·87	7·35	2·16	4·75	47·62	24·54	13·58
62488	" " ..	7–9–22	A. 60 to 65 per cent in bloom	No. 4 (1½ ft. from top)	70·12	2·11	1·16	10·42	6·91	3·28	1·82	6·73	2·10	4·87	43·65	28·94	13·71
62489	" " ..	7–9–22	B. 60 to 65 per cent in bloom	No. 4 (1½ ft. from bottom)	75·76	2·27	1·22	10·47	6·56	3·72	2·13	7·33	2·03	5·02	43·21	27·05	15·36
62490	" " ..	17–9–22	A. 100 per cent in bloom..	No. 5 (1½ ft. from top)	76·21	2·48	1·11	10·55	6·76	2·89	1·97	9·36	1·08	4·63	44·35	28·42	12·16
62491	" " ..	17–9–22	B. " " ..	No. 5 (1½ ft. from bottom)	72·63	2·61	1·26	12·99	7·50	3·01	1·59	7·48	2·05	4·61	47·47	27·41	10·98
62492	" " ..	2–10–22	A. 50 per cent seed ripe. remainder in soft dough	No. 6 (1½ ft. from top)	64·65	1·84	1·33	15·40	13·15	3·63	1·33	4·39	0·83	3·76	43·57	37·19	10·26
62493	" " ..	2–10–22	B. 50 per cent seed ripe, remainder in soft dough	No. 6 (1½ ft. from bottom)	71·42	2·67	1·20	13·49	7·98	3·24	1·71	7·69	1·66	4·19	47·18	27·93	11·35
63100	Experimental Station, Scott, Sask.	.....	20 per cent in bloom, remainder just coming into head	From near top of pit silo	79·37	2·53	0·75	9·88	4·72	2·75	3·24	8·99	3·25	3·66	47·86	22·91	13·33
63169	Experimental Station, Kapuskasing, Ont.	.....	20 per cent in bloom.....	.....	79·47	1·59	0·67	8·67	7·72	1·88	1·52	7·25	0·52	3·26	42·23	37·58	9·16
63266	Experimental Station, Cap Rouge, Que.	11–7–22	Dough Stage.....	.....	74·12	2·42	0·79	11·81	9·28	1·58	2·74	7·51	1·87	3·04	45·64	35·84	6·10
63438	Division of Animal Husbandry, C.E.F., Ottawa	.....	.....	.....	79·26	1·77	0·45	6·57	9·59	2·36	1·47	6·89	1·67	2·17	31·64	46·24	11·39
71664	Experimental Farm, Lethbridge, Alta.	.....	.....	.....	74·21	1·79	1·12	10·08	9·84	2·96	1·75	4·64	2·29	4·32	39·14	38·16	11·45
71665	Experimental Farm, Lacombe, Alta.				76·96	2·34	1·04	8·65	7·59	3·42	2·30	7·75	2·42	4·51	37·57	32·96	14·79

SERIES I.—SILAGE FROM EXPERIMENTAL STATION, SCOTT, SASK.

Laboratory Nos. 61169-70. This series of four samples comprises two from the crop when the "heads were forming" (buds forming) and two when the "seeds were nearly mature." The averages of the more important data are as follows:

SUNFLOWER SILAGE FROM SCOTT, SASK.

—	Heads forming		Seeds nearly mature	
	Fresh material	Dry matter	Fresh material	Dry matter
	p.c.	p.c.	p.c.	p.c.
Total dry matter	18·95	.....	18·18	
Crude protein*	2·42	12·75	2·04	11·20
Fibre	3·79	20·05	4·20	23·09
Ash	3·10	16·37	2·17	11·97
*Albuminoids	1·81	9·57	1·50	8·29
Non-albuminoids	0·61	3·19	0·54	2·91

These results show that the silage from the earlier-cut crop is slightly the richer in dry matter, from which perhaps it may be safely deduced that while there is undoubtedly a large increase in yield—and hence in the total amount of dry matter—per acre between the times of the two collections here considered, the percentage of dry matter in the plant suffers but little change.

The percentage of crude protein in the silage from the earlier-cut crop is slightly the higher but the proportion or ratio of true albuminoids to the non-albuminoids in the two silages remains almost constant.

The fibre in the silage of the later cut crop shows a decided increase as calculated both on the fresh material and dry matter, but the percentage in this silage from the more mature crop is not such as to materially impair the digestibility of the material.

There is a very considerable difference in the ash content between the silages from the earlier- and later-cut crops—the data showing a reduction of 4.4 per cent, as calculated on the dry matter, with increased maturity. This merely points to the fact so often noted in the study of the chemical life history of crops, that it is more particularly during the earlier stages of growth that the mineral elements of plant food are absorbed. Later in the life of the plant the carbohydrates are more particularly developed and the percentage of the ash constituents lowered by their distribution throughout the greater bulk of the tissues of the plant.

Summing up, the data furnish some evidence towards the conclusion that, weight for weight, the silage from the earlier-cut crop is slightly the more nutritious.

SERIES II.—SILAGE FROM EXPERIMENTAL FARM, BRANDON, MAN.

Laboratory Nos. 62482-93. This series comprises twelve samples from six collections beginning August 15 with plants the heads of which were beginning to form and ending October 2 when "fifty per cent of the seeds were ripe and the remainder in a dough stage." These were from six experimental silos of galvanized iron holding about half a ton each; the two samples of each collection consisted of one taken 1½ feet from the top and one taken 1½ feet from the bottom of the silo. The samples were collected and forwarded for analysis during the first week in December.

The water content of the silage decreases as the crop advances in growth, the dry matter ranging during the experimental period from, approximately, 18 per cent to 28 per cent.

A study of the data for the dry matter of these silages has not revealed any consistent or regular changes in composition due to advance in growth of the crop, but it does furnish some evidence in confirmation of the view that as growth proceeds there is a slight falling off in crude protein and ash constituents associated with a certain increase in fibre. The evidence, however, is not sufficient to contradict the deduction made when discussing a previous series that during a certain fairly long period in the life of the sunflower crop—approximately between appearance of bloom and development of seed—there is no marked change in the composition of its dry matter

Attention may be directed to one member of this series, No. 62492, which appears to be of an exceptional character. Respecting this sample, the Superintendent writes, " This crop was cut on October 2 after there had been a severe frost; the leaves had fallen to quite an extent and the stems had ripened and dried up." As received it was comparatively dry, of a light brown colour and consisted almost entirely of harsh, almost brittle fragments of stem. It differs entirely in its composition from normal silage in a very high dry matter and fibre content and a low percentage of protein. From its dry and harsh condition one would judge that it would require moistening and softening before being acceptable to stock.

Series III.—Silage from Experimental Station, Scott, Sask.

Laboratory No. 63100. This sample is of particular interest in being the product of a pit silo. " The crop when cut was about twenty per cent in bloom; the remaining part of the crop was just coming into head." The crop was not allowed to wilt before ensiling. The sample forwarded for analysis was taken from near the top of the silo.

Description of sample: greenish-brown colour: essentially leaf and stem with a very small proportion of flower and head; stems rather soft; odour not very pungent: general condition, sound and good.

Considering the data, it will be observed that the water content is very high, indicating the comparative immaturity of the crop when cut. The high non-albuminoid nitrogen and low fibre further indicate immaturity. It seems probable that it is this feature which also accounts for the exceptionally high degree of acidity. It is of interest in this connection to note that on emptying the silo the Superintendent found approximately one foot of liquid which had drained out of the superincumbent silage.

With respect to nutritive value this sample might be ranked as fairly good; it is not equal, however, to the best examples of sunflower silage analysed in these laboratories. The Superintendent reported that although the silage was in excellent condition the cattle " did not at first take readily to it." They however in a few days ate it as eagerly as silage from a stave silo—steers receiving 40 pounds, milch cows, 30 pounds, per day.

Series IV.—Silage from Experimental Station, Kapuskasing, Ont.

Laboratory No. 63169. The crop as cut for the silo was "about twenty per cent in bloom and drawn in immediately."

Description of sample: Finely cut; dark greenish-brown colour; essentially stem and leaf; pleasant and mildly pungent odour.

Although, apparently from a crop yet quite immature, this silage agrees more or less closely, in respect to the composition of its dry matter, with samples from crops much further advanced in growth. This lends some support to the view that the composition of the dry matter is not always closely indicative of the stage of growth as measured by inflorescence and vice versa: the conditions of growth—precipitation, temperature, cultivation, etc.,—may have exerted a greater influence on composition (and more particularly on the protein and fibre content) than might be deduced from the stage of inflorescence.

The Superintendent reported that the cattle ate this silage with great relish.

Series V.—Silage from Experimental Station, Cap Rouge, Que.

Laboratory No. 63266. The sunflower (Giant Russian) crop from which this silage was made, was sown May 11 and cut September 11, when the seeds were in the "dough" stage. The crop was not allowed to wilt before being put in the silo.

The silage was finely cut, with leaf preponderating. Very dark greenish-brown; pleasant and slightly aromatic odour; condition, sound and wholesome.

The dry matter content is that of silage from a fairly well-advanced crop —and this deduction is supported by the percentage of fibre, which is above the average. This sample may be considered as representative of fairly well-made sunflower silage. The particulars of sowing, etc., are as follows: distance between rows 3½ feet; distance between plants 5 to 8 inches; the time of cutting would appear to have been judicious, considering yield per acre, composition and palatability.

Series VI.—Silage from Experimental Farm, Ottawa, Ont.

Laboratory No. 63438. Sample from 1922 crop ensiled in stave silo and taken for analysis from the centre of silo April 3, 1923. It was finely cut, of very dark green-brown colour; sound with a somewhat mouldy odour.

The dry matter content of the silage is comparatively low and yet the percentage of fibre—especially on the dry matter basis—is very high. Though probably wholesome and palatable this sample must be regarded as of low feeding value.

Series VII.—Silage from Experimental Station, Lethbridge, Alta.

Laboratory No. 71664. Sample from 1923 crop; taken from silo April, 1924. It consisted essentially of stalks with no trace of flower or head and very little leaf; brownish-yellow; somewhat pungent odour of sound sunflower silage. Cut moderately fine; decidedly fibrous. Crop grown on irrigated land, fairly well matured when cut and wilted 12 to 30 hours before being ensiled.

The Superintendent reported this silage as comparing very poorly with corn silage as to palatability; both in steer feeding and lamb feeding the corn silage gave much better results. Better samples of sunflower silage, as judged from the chemical data, have been reported from this Station in previous reports of this Division.

Series VIII.—Silage from Experimental Station, Lacombe, Alta.

Laboratory No. 71665. From 1923 crop. Sample collected April, 1924; composed of stalk with fair proportion of leaf; flower-parts distinguishable; brownish-yellow; pungent odour; finely cut.

It is superior to the immediately preceding sample. Although the Lethbridge silage is slightly higher in dry matter content, this Lacombe sample is richer in protein and, further, is lower in fibre. It also contains a larger proportion of its crude protein in the form of true albuminoids. These points of superiority become more apparent by comparing the silages on the dry matter basis (see table) and support the results of feeding trials.

Lab'y No.	Particulars	As Received							Water-free					
									Protein					
		Moisture	Protein	Fat	Carbohydrates	Fibre	Ash	Acidity	Albuminoid	Non-Albuminoid	Fat	Carbohydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
58835	Experimental Station, Lennoxville, Que....	77·36	2·79	0·61	10·49	7·16	1·59	3·32	8·36	3·94	2·73	46·30	31·63	7·04
60160	Experimental Station, Lacombe, Alberta...	78·65	2·63	0·29	9·82	6·81	1·80	2·68	6·53	5·05	1·33	46·03	31·86	8·48
63016	Agricultural School, Kemptville, Ont.....	79·90	1·88	0·41	11·84	4·88	1·09	3·27	5·76	3·59	2·06	58·89	24·26	5·44
63163	Field Husbandry Division, C.E.F., Ottawa	77·96	1·84	0·49	11·77	6·62	1·32	3·16	4·70	3·66	2·25	53·38	30·03	5·98
63267	Experimental Station, Cap Rouge, Que.....	73·83	1·42	0·57	15·60	6·60	1·98	2·57	4·40	1·02	2·18	59·61	25·22	7·57
63436	Animal Husbandry Division, C.E.F., Ottawa.....	74·90	1·66	0·52	14·62	7·24	1·06	2·25	5·43	1·19	2·07	58·24	28·85	4·22
63437	Animal Husbandry Division, C.E.F., Ottawa.....	76·50	2·37	0·54	11·27	7·19	2·13	3·51	6·65	3·44	2·32	47·92	30·60	9·07
69166	Experimental Farm, Brandon, Man.....	67·45	3·24	1·12	16·49	8·72	2·98	1·23	7·05	2·91	3·43	50·63	26·80	9·18

CORN SILAGE

This series consists, for the most part, of samples from corn silage used in feeding trials at one or other of the Farms and Stations of the Experimental Farm system. They are to be regarded as more or less representative of good quality silage as made in their respective localities.

Silage from Experimental Station, Lennoxville, Que.

Laboratory No. 58835. Received April 26, 1922. This silage consisted largely of leaves and stem, with a small proportion of cob. Colour, odour and condition apparently normal, and the silage from inspection would be regarded as sound and good.

The percentage of dry matter, 22·64, is fairly satisfactory and would indicate a silage of good average quality. With respect to protein, the data are excellent; in fibre the figures are somewhat high, which may possibly lower to a slight degree the nutritive value of an otherwise highly satisfactory silage.

Silage from Experimental Station, Lacombe, Alberta

Laboratory No. 60160. Received August 29, 1922, from silage of 1921 crop. This sample was rather light in colour, was finely cut and consisted almost entirely of stalk and leaf. Odour normal. Condition sound and good.

This silage appears to be slightly lower in dry matter (21·35 per cent) than that from corn which has reached the glazing stage before cutting. It has an average protein content, but the comparatively high proportion of non-albuminoid nitrogen indicates again the somewhat immature stage at which the crop was ensiled. The percentage of fibre is in fair accord with that of good corn silage. It may be regarded as of good quality, in respect to both composition and state of preservation.

Silage from Agricultural School. Kemptville, Ont.

Laboratory No. 63016. Received February 2, 1923. "This silage was largely of the Golden Glow variety, no Flint varieties being present. It was in the firm dough stage when cut and ensiled directly." The silage is entirely free of mould and of excellent quality.

The sample was largely leaf and stem, but cob in pieces of from $\frac{1}{2}$ to $\frac{1}{4}$ inch in thickness was apparent. It was rather light in colour, with a somewhat pungent, sour odour.

This silage is decidedly below the average in dry matter (20·10 per cent) and the data for the composition of this dry matter further indicate a certain degree of immaturity of the crop when cut. It is, however, a silage of fair feeding value.

Silage from Field Husbandry Division, C.E.F., Ottawa

Laboratory No. 63163. Received for analysis February 27, 1923. Light greenish-yellow in colour; finely cut; odour, somewhat pungent and acrid; bright and fresh looking; would be judged wholesome and in excellent condition.

This sample is a little low in dry matter (22.04 per cent) and protein (1.84 per cent). The data generally point to a condition somewhat less mature than that usually recommended (dough stage or glazing) for the silo.

Silage from Experimental Station, Cap Rouge, Que.

Laboratory No. 63267. Very light in colour; rather coarsely cut; very small proportion of cob; odour, slightly pungent; condition, apparently normal and good.

Variety Longfellow (flint); planted May 18, cut and ensiled in the dough stage, September 11; sample received for analysis March 12, 1923.

This is an excellent silage in respect to dry matter content, the percentage, 26.17, being somewhat above the average for well-matured corn. The proportion of albuminoids to non-albuminoids (together constituting the crude protein) further, is very satisfactory, confirming the above statement in respect to the maturity of the crop when cut.

Silage from Division of Animal Husbandry, C.E.F., Ottawa

Laboratory No. 63436. Received April 4, 1923; from crop of 1922; very light in colour; rather dry; slight odour; some cob present. The variety was Wisconsin No. 7 (Dent) and the crop was cut in the early dough stage.

This silage ranks well in respect to dry matter (25·10 per cent) and fairly well in regard to fibre. The data, as a whole, indicate a silage of good average quality.

Silage from Division of Animal Husbandry, C.E.F., Ottawa

Laboratory No. 63437. Received April 4, 1923; from crop of 1921; dark greenish-yellow colour; finely cut; almost odourless. The variety was Wisconsin No. 7 (Dent).

The percentage of dry matter is 23·50, a figure closely approximating the average of silage from fairly well-matured corn. The data for protein and fibre are satisfactory and may be considered as representative of well-made silage.

Silage from Experimental Farm, Brandon, Manitoba

Laboratory No. 69166. Received December 18, 1923; from crop of 1923; yellowish-green colour; very dry; very little cob, leaf predominating; odour, acrid. From appearance of silage, the crop was well advanced when harvested. Crop ensiled September 5, wilted 48 hours; corn, firm dough stage.

This sample possesses a dry matter content (32·55 per cent) above the average. This appears to have been brought about partly by wilting but in some measure is no doubt due to the crop having reached a desirable stage of growth when harvested. This would appear to be a very satisfactory silage not only in percentage of dry matter but in protein and fibre content.

CORN AND OAT, WITH SUNFLOWER

Silage From Experimental Station, Beaverlodge, Alberta

Laboratory No. 58810. Received April 21, 1922. This silage is composed essentially of corn and oats, the latter being ripe and shocked for ten days when ensiled. There is also present a small proportion of sunflower, cut in bloom, but which had been killed by an unusually hard frost a few days previous to filling the silo.

As received this silage was found to be finely cut, sweet smelling and apparently sound and wholesome.

For a silage, this sample contains a very high percentage of dry matter (37.61), which is characterized by two excellent features—a high percentage of protein and a very low fibre content.

OAT

Silage From Experimental Farm, Brandon, Manitoba

Laboratory No. 69161. Received December 18, 1923. From crop of 1923. Greenish-brown colour; finely cut; large proportion of leafy material for an oat silage; odour decidedly sour but not offensive; sound and wholesome. Ensiled August 3, grain medium dough stage; wilted 24 hours.

The analysis is in very fair agreement with recorded data for oat silage. In point of dry matter content it would appear to be superior to the silage of corn and of sunflower—the difference in favour of the oat silage being from 3 to 5 per cent. Further, this silage is slightly richer than average corn silage in crude protein, though this crude protein does not contain as large a proportion of true albuminoids. The indications are that this is an excellent feed—probably of higher feeding value, weight for weight, than average corn silage.

OAT AND PEA

Silage from Division of Animal Husbandry, C. E. Farm, Ottawa

Laboratory No. 63439. Received April 4, 1923; from centre of silo, 10 feet from bottom. As received, bright and fresh looking; finely cut and almost odourless. Apparently sound, wholesome and palatable.

The percentage of dry matter (23.71) is decidedly low for oat and pea silage according to our previous analyses for this mixture. As compared with corn silage its dry matter is distinctly richer in protein but much higher in fibre. The former is accounted for by the presence of the legume and the latter probably by the somewhat ripened oat stem.

Silage From Experimental Farm, Brandon, Manitoba

Laboratory No. 69162. Received December 18, 1923; from crop of 1923; greenish-brown, finely cut, large proportion of leaf, odour sour but not suggestive of decay; sound and wholesome. Ensiled August 3, oats medium dough; peas, pods well formed; wilted 24 hours.

The percentage of dry matter (31.58) is decidedly higher than that of the preceding sample and approximates the average for this class of silage, as previously analysed in these laboratories. It is, further, superior to No. 63439, in that its dry matter is richer in protein and lower in fibre. It is an excellent example of the more nutritious types of silage.

Lab'y No.	Particulars	As Received							Water-free					
									Protein					
		Moisture	Protein	Fat	Carbohydrates	Fibre	Ash	Acidity	Albuminoid	Non-albuminoid	Fat	Carbohydrates	Fibre	Ash
	Corn, Oat and Sunflower—	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
58810	Experimental Sub-station, Beaverlodge, Alberta	62·39	3·52	1·60	22·52	7·16	2·81	2·05	7·88	1·48	4·26	59·88	19·04	7·46
	Oat—													
69161	Experimental Farm, Brandon, Man	71·23	2·69	0·80	12·57	9·62	3·09	1·69	5·10	4·25	2·73	43·66	33·44	10·32
	Oat and Pea—													
63439	Division of Animal Husbandry, C.E.F	76·29	2·52	0·93	8·89	9·85	1·52	1·45	7·47	3·16	3·91	37·52	41·52	6·42
69162	Experimental Farm, Brandon, Man	68·42	4·00	0·97	12·98	10·21	3·42	1·11	5·95	6·73	3·03	41·12	32·34	10·83
	Oat, Pea, and Vetch—													
63164	Field Husbandry Division C.E.F., Ottawa	77·42	2·08	0·78	8·66	9·17	1·89	1·30	5·77	3·46	3·45	38·35	40·59	8·38
63170	Experimental Station, Kapuskasing, Ont.	67·90	2·79	0·96	15·96	10·38	2·01	2·15	5·45	3·25	2·99	49·73	32·32	6·26
	Sweet Clover—													
63015	Agricultural School, Kemptville, Ont	76·54	3·44	0·99	8·81	8·39	1·83	1·17	7·73	6·94	4·22	37·57	35·76	7·78
69163	Experimental Farm, Brandon, Man	82·93	3·11	0·39	6·17	5·43	1·97	0·52	12·19	6·04	2·21	36·19	31·84	11·53
70272	Cranbrooke, B.C. No. 1	79·66	4·65	0·92	3·55	7·64	3·58	nil	18·69	4·21	4·49	17·45	37·58	17·58
70273	" No. 2	62·13	4·23	1·10	12·40	16·20	3·94	nil	7·92	3·24	2·82	32·78	42·78	10·45
70274	" No. 3	76·00	4·09	1·18	5·82	10·13	2·78	2·93	13·26	3·80	4·94	24·21	42·21	11·58
	Sweet Clover and Oat—													
69164	Experimental Farm, Brandon, Man	75·50	3·27	0·78	10·73	7·44	2·28	1·53	7·52	5·85	3·17	43·83	30·35	9·28
	Sudan Grass—													
63200	Experimental Farm, Brandon, Man	78·87	2·31	1·02	8·62	6·84	2·34	2·33	7·13	3·79	4·81	40·81	32·36	11·10
69165	Experimental Farm, Brandon, Man	72·69	2·46	0·83	11·61	9·36	3·05	0·64	7·28	1·72	3·03	42·50	34·30	11·17

OAT, PEA AND VETCH

Silage From Division of Field Husbandry, C. E. Farm, Ottawa

Laboratory No. 63164. Received February 26, 1923. As received, colour, dark brown; finely cut; very soft; offensive odour, suggestion of putrefaction.

In ensiling this mixture, through an oversight water was allowed to run into the silo too long, with the result that the silage subsequently spoiled—practically rotted. As already remarked it had a very offensive odour and was refused by stock.

Silage From Experimental Station, Kapuskasing, Ontario

Laboratory No. 63170. The crop was cut when "the oats were in the dough stage and peas well formed in the pod." As received, greenish-brown in colour; finely cut; very little odour; apparently sound and wholesome.

Analyses made during the past three or four years have shown that the silage from the mixed crop of oats, peas and vetch, speaking generally, contains a higher percentage of dry matter than that from corn, sunflower or clover. In the present instance the percentage is 32.10, an amount slightly below the average for this class of silage but still considerably above the average dry matter content of corn silage and sunflower silage.

The composition of the dry matter, in respect to protein and fibre, indicates a silage not quite so nutritious as that usually obtained from this mixture. It is, however, an excellent silage of high nutritive value and the Superintendent reports that it was much relished and readily eaten by stock.

SWEET CLOVER

Silage From Agricultural School, Kemptville, Ontario

Laboratory No. 63015. Received February 9, 1923. The following notes respecting the crop were supplied by the Department of Field Husbandry of the School. "The crop was cut June 20, it being quite succulent and about 50 per cent in flower somewhat more mature than has been the custom to cut for the silo; good keeping qualities and excellent results in feeding obtained."

As received, pale greenish-brown colour, with leaf apparently predominating; finely cut; sound with no mould or mustiness; strong odour of sweet clover.

A comparison of the present data with those of a sample of silage made from the 1921 crop and submitted from the same source (Report, Division of Chemistry 1922, p. 86) indicates the higher nutritive value of the silage from the less mature crop (1921); the percentage of protein is lower and that of fibre higher in the silage from the more mature crop of 1922.

Silage From Experimental Farm, Brandon, Manitoba

Laboratory No. 69163. Received December 12, 1923; from crop of 1923; dark brown in colour; very moist and slightly mouldy; consists of stems and leaves, the latter predominating with the former rather woody and hard; odour suggestive of mould and decay. Stage of growth, 5 per cent in bloom. Ensiled August 6, and wilted for 6 hours.

The percentage of dry matter is 17.07, a decidedly low figure for silage. The data for the composition of the dry matter would indicate that the crop was cut and ensiled when quite young. This is shown by the high moisture content of the silage and its comparatively high protein and low fibre content. Further wilting would probably have resulted in a better silage, both as to composition and condition.

Silage From Cranbrook, B.C.,

Laboratory No. 70272-3-4. A series of three samples of sweet clover silage from a silo constructed by planking a root cellar underneath a barn. No. 1 taken at a depth of 1 foot from top of silage; No. 2, a depth of 3 feet; and No. 3, at a depth of 6 feet. The District Representative submitting these samples stated that the crop had been ensiled rather than cured on account of continued wet weather. He further said that after some weeks during which there was active fermentation (heating), the silage was found to have spoiled to a considerable depth.

No. 1 (No. 70272). Silage soft, dark brown, almost black, pasty mass, with no appearance of plant structure; earthy odour; slightly moulded.

No. 2. (No. 70273). Dark brown; comparatively finely cut; essentially stem and stalk, no leaf noticeable; rather dry and easily broken down; very offensive smell (like rotting manure); badly moulded.

No. 3. (No. 70274). Greenish-brown in colour; finely cut; fair proportion of leaf; flower stalks showed the presence of seeds; odour of butyric acid and that characteristic of sweet clover silage; no mould.

Nos. 1 and 2 were very bad, practically rotten, and quite unusable—except as manure. No. 3 was in a fairly sound condition and suitable for feeding; it might be considered, from both appearance and data, as representative of average quality sweet clover silage—except perhaps for its fibre content, which is somewhat high.

It is evident that the crop when ensiled was too mature and hence more fibrous than is desirable. This condition would prevent close packing of the material and lead to complete degradation and moulding. Most probably the improvised silo was too shallow and this in conjunction with the fibrous character of the clover, did not permit close packing and, hence, the proper exclusion of air.

SWEET CLOVER AND OAT

Silage from Experimental Farm, Brandon, Manitoba

Laboratory No. 69164. Received December 18, 1923; from crop of 1923. Dark greenish-brown; odour characteristic of sweet clover; sound and wholesome. Ensiled August 6, after wilting for 6 hours, clover being 5 per cent in bloom and oats at the " firm dough " stage.

The dry matter content (24.50 per cent) is approximately equal to that of average corn silage, but this dry matter is somewhat richer than that of corn by reason of its higher percentage of protein. This, however, is somewhat offset by its more fibrous character.

SUDAN GRASS

Sudan grass (*Andropogon sorghum*) is a tall, annual grass, closely related to the sorghums. Though rank in growth, it furnishes a fairly nutritious hay; it is, however, better preserved as silage. As a crop possessing marked drought resistant properties and one that furnishes a fair tonnage of palatable and nutritious silage it seems worthy of trial in the drier districts of the Prairie Provinces.

Silage from Experimental Farm, Brandon, Manitoba

Laboratory No. 63200. Particulars of crop: sown, June 22; cut for silo September 12, 1922; about 5 feet in height, heads well formed and seeds developing; yield 8 tons of green fodder per acre. The Superintendent reports an exceptionally favourable season for this crop, there being plenty of moisture and hot weather to start it.

As received: this silage was of a bright green colour; finely cut; leaf and stems in about equal proportions; slight odour of fermentation; apparently sound and wholesome. The Superintendant writes: "This is a very satisfactory silage from the standpoint of palatability."

Its percentage of dry matter (21·13) is distinctly low as compared with either that of corn or sunflower silage. Its dry matter is slightly higher in fibre content than that of the dry matter of these two classes of silage but would appear to be somewhat similar in this respect and also in regard to protein content to that of green oat silage.

Laboratory No. 69165. Received December 18, 1923, crop of 1923. Cut August 25, seed being in "late dough" stage; wilted 48 hours and ensiled. As received: greenish-brown; finely cut; rather dry; slightly mouldy but odour distinctly aromatic.

This sample contains, practically, 6 per cent more dry matter than No. 63200—the silage from this crop of the preceding year—indicating a more advanced stage of development when harvested. This conclusion is supported by the composition of the dry matter, which shows a higher percentage of fibre, a lower percentage of protein and a larger proportion of this protein in the form of true albuminoids .

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