Volume 3 | Number 27 Article 2

July 2017

Soiling crops 1894.

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SOILING CROPS, 1894.

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Our station pursued its line of inquiry in feeding soiling crops, through July and August of 1894. No rain fell from the 23d of June until the 10th of August. The pastures were dried up and stock that was not fed by hand suffered more severely than at any time since the prairies of the State were enclosed and animals were confined within fences. The drouth affected pastures unusually early, continuing all summer, strengthening our conviction that successful animal husbandry in the State requires additions to our cropping system that will furnish plants in their best condition for feeding during all the months of summer. We have been depending in the past on pasture grasses until the corn was fit to cut. It has been fed, in addition to pasture, until fall rains revived the grasses. This has given us indifferent and varying results, but it never has kept the dairy cow up to her maximum of milk-giving, nor has it kept the young animal growing as it should grow, nor the meat-making animal putting on flesh satisfactorily. As values of land advance, it becomes more evident that we must have better returns from domestic animals, and to this end it will be necessary to add to our crops the leguminous plants that trial has proved can be developed from those native to the soil, or that can be imported from climates similar to ours, where they have served mankind for long periods of time.

We have in recent BULLETINS reported indications had of the value of numerous plants for butter-making, noting their effects on flow of milk, and its quality, with the observations of our dairy experts on the quality of the butter, and accompanying these with the analyses of the several plants by the station chemists. We have fed under experimental conditions for these purposes, beets, potatoes, peas and oats, clover, blue grass, rape, cabbage, white fall turnips, mangold wurtzel, sweet corn, field corn, corn fodder and silage. During

the summer of 1894 we grew Soja beans, or Japan beans, under experimental conditions, for feeding to dairy cows, so as to get indications of their value as an addition to our field crops and their effect on the quantity and quality of milk, and on the flavor of butter. This bean comes to blossoming —which is the best feeding stage for milk-making—in August, when few plants now known to our cropping system are in succulent condition. It seems to be entirely at home in a dry climate. It is rich in protein, palatable when cows become used to it, gives a fine flavor to butter, increases the flow of milk when substituted for green sweet corn, and increases the fat per cent over corn, as our tables will show.

The seed was sent to the college by Prof. Georgeson, of Manhattan, Kansas, who brought several varieties of it from Japan.

The station also grew the Whipperwill, or Southern Cow Pea, the seed of which came from Arkansas. Coming from a latitude so far to the south, it did not bear seed, being in blossom when frost came, but it is valuable to the Iowa farmer for that reason, as it fits admirably into our system, furnishing succulent nitrogenous feed at a time when other feeds of that character are scarce. It is very palatable, rich in protein, makes superior butter when heavily fed, induces a full flow of milk that has a comparatively high per cent of fat, and is a very promising plant to our dairymen.

In order that the dairy herd may do its best work it is of prime necessity that a succession of succulent plants, of approved value for butter and cheese making, be grown on the farm that will succeed each other throughout the spring, summer and fall, to be used in supplementing the pasture, should it fail at any season, and that can be cut and cured for winter use, when the pasture, the cheapest source of milk, is abundant.

Very many plants will be tried and rejected before an approved list suitable in all regards to our soil and climatic conditions can be adopted. The grasses, the clovers, oats and garden peas, all answer these ends, but July and August find pastures bare, often, the clovers cut, with little second growth, the oats in the stack and the garden pea ripe. The corn crop is then the only resort, and while it is very valu-

able and makes the finest butter, its composition clearly indicates that it is lacking in the protein element, without which the cow can not give milk up to her maximum limit, and on which her flow will certainly shrink, so that it can not be regained, even with the most liberal feeding, during that period of lactation. Bran can be bought by dairymen, and it is by many, but if the leguminous plants that furnish the protein element can be grown on the farm, to feed with green corn, or corn meal, or by themselves, the outlay of money will be avoided. For these reasons our station continues inquiry in these directions.

On the 28th of June, 1894, we tied up six cows of three different breeds; two Holsteins, Nos. 106 and 115; two Short Horns, Nos. 211 and 213; and two Red Polls, Nos. 401 and 402. They were under experimental conditions until August 28th. They were fed five pounds each of hay, and nine pounds each of corn and cob meal daily during the two months while the several green feeds being tested were fed. They were turned into a yard every day several hours for exercise, and had free access to salt and water. They were milked regularly at the same hour, morning and evening, when the milk of each cow was weighed and sampled, and the sample put in a separate Mason jar, with corrosive sublimate preservative. The milk was tested at the end of each preliminary and test period, and report made of it, by F. L. Kent, a graduate of the four-year agricultural course. At the end of each test period two days' milk of the six cows was taken to the creamery, separated by itself; the cream ripened and churned; the butter worked and packed, the conditions of temperature, of separating, ripening, churning and working being the same for all the butters. The acidity of the cream at churning of all the lots being also the same. The butters were then taken to the chemist for analyses, whose report will be found accompanying the results of the feeding of each plant.

The following table shows composite tests of the milk of the six cows during the several periods, with daily yields of milk and average daily pounds of butter fat. While the cows had peas and oats their average of butter fat daily was 4.42 lbs.; it was 4.59 on clover, 3.52 on sweet corn, and 3.97

on soja beans. We had not enough of cow peas to feed six cows long enough to get the cows under the full effects of them; the Holstein cow, No. 115, and the Short Horn, No. 213, were fed on them for seven days. The average daily fat from these two cows was 1.69 pounds. While the same two cows had sweet corn their average daily butter fat was 1.49 pounds.

TABLE No. 1.

DAILY HERD COMPOSITE TESTS.

DATE.	PER CENT FAT.	KIND OF FEED.	WEIGHT OF MILK.	LBS. FAT.	AV. LBS. FAT.
June 26	2.70	Prelim.			
27	2.80				
July 2	3.00	Prelim. to feed of Green Peas and Oats.	175		
3	3.05		176¼		
4	3.05		179		
5	3.00		168½		
6	2.85		164¾		
7	2.95		167½		
8	3.00		170½		
9	2.65		170		
10	2.90	Green Peas and Oats.	165¾	4.79	
11	2.85		163¼	4.65	
12	2.75		164¼	4.41	
13	2.80		154½	4.31	
14	2.70		158¼	4.27	
15	2.75		162¼	4.45	
16	2.70		150½	4.05	Av. 4.42
17	2.75	Green Clover.	162	4.45+	
18	2.80		159	4.45+	
19	2.90		156¾	4.54+	
20	3.00		150¼	4.50+	
21	3.10		158¼	4.90+	
22	3.10		148½	4.60+	
23	2.90		152½	4.42+	
24	3.10		156¾	4.85+	Av. 4.59+
27	2.60	Sweet Corn prelim.	145		
28	2.70		143½		
29	2.80		143¼		
30	2.70		139½		
31	2.85		146¾		
Aug. 1	2.80		142		
2	2.80		135¼		
			132¼		
4	2.75	Sweet Corn.	134	3.68+	
5	2.80		134½	3.76+	
6	2.80		135¼	3.78+	
7	2.00		133¼	2.66+	
8	2.85		131¾	3.75+	Av. 3.52+
13	3.20	Soja Beans.	119	3.80+	
14	3.05		125	3.81+	
15	3.20		121¼	3.88	
16	2.90		138½	4.01+	
17	3.10		136¼	4.22+	
18	3.00		137¼	4.11+	
19	3.10		133½	4.13+	Av. 3.99
22	3.15	Whippoorwill Peas.	53¾	1.69+	
23	3.20		53¾	1.72	
24	3.15		50½	1.59+	
25	3.10		56	1.73+	
26	3.20		53½	1.71+	
27	3.25		55¾	1.81+	
28	3.10		52	1.61+	Av. 1.69+

PEAS AND OATS.

The object of the experiment was to get indications of the value of the soja bean and cow pea for butter-making, compared with peas and oats, clover and corn. The foregoing table shows that the average pounds of fat from peas and oats was 4.42 pounds daily from the six cows; by adding a sixth we get 5.15 pounds of butter. This is not a great return, but it will be remembered that the cows are being fed chiefly what grew on the college farm, and while heavier yields would have been had by adding bran, gluten meal, or oil meal, these by products give milk their own peculiar flavors, and it was desirable to learn what effect on milk the two new plants would have, and that could not be done if the by products of the mills were fed. We here insert the complete analyses of peas and oats, by Prof. Patrick, of three samples, cut during the test period. For feeding in June and early July these plants are valuable to the dairyman, being palatable, succulent, rich in protein, and having no deleterious volatile acid to injure milk or its products.

TABLE NO. 2.

SOILING EXPERIMENT, 1894.

PEAS AND OATS—*Samples brought to Laboratory July 3d, July 9th, July 12th and July 17th—the first three for complete analyses, and the last one for dry matter only.*

	SAMPLE CUT JULY.		SAMPLE CUT JULY.		SAMPLE CUT JULY.		*SAMPLE CUT JULY 16TH, ANALYZED JULY 17TH.
	Original sample.	Dry matter.	Original sample.	Dry matter.	Original sample.	Dry matter.	Original sample.
Water	79.81	.....	76.03	.....	78.94	.....	70.95
Dry matter	20.19	.....	23.97	.....	21.06	.....	29.05
100 PARTS CONTAIN—							
Water	79.8	.....	76.03	.....	78.94	.....	.....
Crude ash	2 04	10.10	2.17	9.04	2.33	11.06	.....
Ether extract (crude fat)	.89	4 42	.83	3.48	.93	4.43	.....
Nitrogen free extract (soluble carbhydrates)	8.08	40.00	9.76	40.73	7.73	36.69	.....
Crude fibre	4.94	24.49	6.79	28.30	5.29	25 13	.....
Crude protein (total Nx6.25)	4.24	20.99	4.42	18.45	4.78	22.69	.....
True albuminoids (albuminoid Nx6.25)	[2.88]	[14.29]	[2.82]	[11.76]	[3.04]	[14.45]	.....
Total	100.00	100.00	100.00	100 00	100 00	100.00	.....

*This was a sample of the feed that had been hauled to the barn the day previous (July 16th), and it was desirable to learn how fast it dried out.

RED CLOVER.

There was 4.58 pounds of butter fat daily from the six cows during the test period on medium red clover, from 155 pounds of milk daily. The milk had decreased four pounds daily, but its butter fat had slightly increased. There is no plant of greater value to the dairyman than red clover. It is ready to cut earlier than peas or oats, being a biennial, but, because it is a biennial and must be sown the year previous to cutting, we have experimented with peas and oats, so that farmers who may not have clover growing can resort to them; besides, red clover is not so rich in protein as peas and oats, and if substitutes for the pasture and mill products are to be grown on the farm, it is well to inquire into as extensive a list as possible. We insert here the analyses of red clover, cut and taken to the laboratory during the test feeding period. It was second growth, rather a short crop, owing to the excessive drouth. The high per cent of dry matter is owing to the weather.

TABLE NO. 3.

SOILING EXPERIMENT, 1894.

RED CLOVER—*Samples brought to the Laboratory on July 18th, 21st and 25th, for complete analysis; also one on July 19th, of the feed cut on the 18th, that had lain in the barn for 21 hours—this for dry matter only.*

	SAMPLE CUT JULY.		SAMPLE CUT JULY.		SAMPLE CUT JULY.		SAMPLE CUT JULY 18TH, ANALYZED JULY 19TH.
	Original sample.	Dry matter.	Original sample.	Dry matter.	Original sample.	Dry mat er	Original sample.
Water	66.08	.....	71.22	.....	63.98	.....	60.97
Dry matter	33.92	.....	28.78	.....	36.02	.....	39.03
100 PARTS CONTAIN—							
Water	66.08	.....	71.22	.....	63.98	.....	.....
Crude ash	2.85	8.40	2.75	9.56	3.23	8.98	.....
Ether extract (crude fat)	.88	2.60	.70	2.44	1.02	2.84	.....
Nitrogen free extract (soluble carbhydrates)	16.54	48.76	13.75	47.77	17.23	47.86	.....
Crude fibre	8.36	24.63	6.86	23.85	8.92	24.76	.....
Crude protein (total Nx6.25)	5.29	15.61	4.72	16.38	5.62	15.56	.....
True albuminoids (albuminoid Nx6.25)	[4 34]	[12.80]	[3.79]	[13.16]	[4.72]	[13.10]	.....
Total	100.00	100.00	100.00	100.00	100.00	100.00	.....

SWEET CORN.

There was 3.52 pounds of butter fat daily average from sweet corn, from 133 pounds daily average of milk—a very pronounced shrinkage of both milk and fat per cent, but corroborating former experiments. Iowa has, perhaps, no cultivated plant as valuable as corn. It is fed to all of our domestic animals; it is the basis of our high class beef, pork, mutton and poultry. It is fed to our horses of all ages and under all conditions. It is fed almost exclusively to our dairy cows, and makes the finest flavored butter; but when fed alone, either as a soiling crop in summer or when fed by itself in winter, the cow will not yield up to her full limit. We feed it in our soiling experiments to measure the flavor of new, untried plants by, and at the same time get comparisons between it and more nitrogeneous plants. We insert here its analyses, so that farmers can compare it with the legumes fed before and after it.

TABLE No. 4.

SOILING EXPERIMENT, 1894.

SWEET CORN FODDER.—*Three Samples brought to the Laboratory July 28th, August 3d and August 7th, 1894.*

	SAMPLE CUT JULY.		SAMPLE CUT AUGUST.		SAMPLE CUT AUGUST.	
	Original sample.	Dry matter.	Original sample.	Dry matter.	Original sample.	Dry matter.
Water	77.95	.....	77.56	.....	77.80	.....
Dry matter	22.05	.....	22.44	.....	22.20	.....
100 PARTS CONTAIN—						
Water	77.95	.....	77.56	.....	77.80	.....
Crude ash	1.28	5.83	1.59	7.07	1.53	6.90
Ether extract (crude fat)	.54	2.44	.41	1.88	.56	2.53
Nitrogen free extract (soluble carbhydrates)	13.62	61.78	13.41	59.74	12.98	58.48
Crude fibre	4.07	18.45	4.51	20.11	4.42	19.90
Crude protein (total nitrogen x 6.25)	2.54	11.50	2.52	11 20	2.71	12 19
True albuminoids..... } Albuminoid N x 6.25... }	[1.93]	[8.73]	[1.94]	[8.64]	[1.84]	[8.28]
	100.00	100.00	100.00	100.00	100.00	100.00

SOJA BEAN.

The Soja bean, or soy bean, or Japan bean, has been grown at different times on the college farm for twenty years. It has been long enough in the United States to have had the digestive coefficients of some of its varieties determined. The seed used came from Prof. Georgeson, of Manhattan, Kansas, who, during his residence in Japan, selected varieties suitable to our climate. We grew two varieties of it, the yellow soja, the earlier, and the Keyuska succeeding, in order of ripening. Our attention was attracted to it by the fact of its late maturing characteristics, and further from its growing green and vigorous in the severest drouths. It was fed just at and after blossoming from the 9th to the 19th of August, when little on the farm was green except itself and the Southron cow pea. We grew it in hills, planted and cultivated as corn is. It does not stand frost as the garden pea does; our earliest planted was injured by the late May frost after it was four inches high. It grows similar to the bush bean, and should be planted much closer than corn in hills; perhaps sowing broadcast for soiling, so as to secure a finer stalk, will be suggested in the future. It is widely advertised as a coffee] plant, and sold at high figures for that purpose. The cows did not eat it readily at first, but after getting it sprinkled with bran and salt for a few days they ate it readily. While getting accustomed to it the milk flow shrunk considerably, as the table shows; but at the end of the test period, August 19th, they had reached a larger flow than at any time during the feeding of sweet corn; and, notwithstanding the shrinkage while getting used to it, the average daily yield of butter fat reached 3.97 pounds, and the last four days of the test went over four pounds. This shows the value of plants richer in protein than corn is.

We insert here the analysis of the soy bean:

TABLE No. 5.

SOILING EXPERIMENT, 1894.

SOJA BEAN.—*Two samples brought to the Laboratory August 10th and August 15th.*

	SAMPLE CUT AUGUST.		SAMPLE CUT AUGUST.	
	Original sample.	Dry matter.	Original sample.	Dry matter.
Water	68.50	.....	74.42	.....
Dry matter	31.50	.....	25.58	.....
100 PARTS CONTAIN—				
Water	68.50	.....	74.42	.....
Crude ash	3.41	10.83	2.34	9.13
Ether extract (crude fat)	.99	3.14	.84	3.28
Nitrogen-free extract (soluble carbhydrates)	13.13	41.67	10.70	41.85
Crude fibre	8.59	27.26	6.78	26.45
Crude protein (total Nitrogen x 6.25)	5.38	17.10	4.92	19.29
True albuminoids.... } Albuminoid N x 6.25.. }	[3.78]	[12.00]	[3.60]	[14.07]
	100.00	100.00	100.00	100.00

SOUTHERN COW PEA.

The Southern cow pea, or Whipperwill pea seed, planted in the spring of 1894, came from Arkansas. It came to feeding condition in the latter part of August, when there was nothing but scorched field corn to use for dairy cows, either in the field or in the barn. We had not enough of the pea growing to continue feeding the six cows, so we tested it with two cows, the Holstein No. 115 and the Short-Horn No. 213. The Holstein's milk tested 2.40 on sweet corn, 2.60 on Japan beans and 2 90 on cow peas. The Short-Horn's milk tested 3.15 on sweet corn, and 3 40 on Japan beans and 3.40 on cow peas. The amount of milk given by the two cows on sweet corn and cow peas was the same average number of pounds daily for the test periods. We insert here the analyses of the cow pea.

TABLE NO. 6.

SOILING EXPERIMENT, 1894.

SOUTHERN COW PEA—WHIPPERWILL PEA—*Two samples, brought to the Laboratory August 22d and 27th. Both samples were moist with dew.*

	SAMPLE CUT AUGUST 22D.		SAMPLE CUT AUGUST 27TH.	
	Original sample.	Dry matter.	Original sample.	Dry matter.
Water	85.61	.....	83.42	.....
Dry matter	14.39	.....	16.58	.....
100 PARTS CONTAIN—				
Water	85.61	.....	83.42	.....
Crude ash	2.54	17.64	2.27	13.68
Ether extract (crude fat)	.59	4.09	.74	4.45
Nitrogen free extract (soluble carbhydrates)	5.63	39.15	6.50	39.22
Crude fibre	2.36	16.38	2.83	17.04
Crude protein (total Nitrogen x 6.25)	3.27	22.74	4.24	25.61
True albuminoids (albuminoid Nx6.25)	[2.17]	[15 09]	[2.72]	[16.45]
Total	100.00	100.00	100.00	100 00

The following table shows the average daily yield of milk from the six cows, except when feeding cow peas, when two cows were used; the fat per cent, the pounds of fat, the pounds of butter, and flavor on a basis of 45.

TABLE NO. 7.

	Peas and oats.	Red clover.	Sweet corn.	Soja beans.	Cow peas, cows No. 115. No. 213.	Yi'ld of Nos. 115 and 213 on sweet corn.
Milk, pounds.....	160	155	134	130	54	54
Fat, per cent.....	2.78	2.96	2.64	3.08	3.16	2.17
Fat, pounds.....	4.42	4.59	3.52	3.99	1.69	1.49
Butter, pounds.....	5.16	5.35	4.10	4.65	1.97	1.73
Flavor, 45 per cent.....	43	43	45	45	43	.....

The yields from peas and oats, and clover, were substantially alike. There is a sharp decrease in milk from feeding green corn, in per cent of fat, and consequently, in pounds of fat and butter. The college creamery averages 16 per cent over-run during the year, and the yield of butter is found by adding a sixth to the butter fat. The two new plants fed to two cows have a good influence. We add a column showing the yield of cows 115 and 213, when eating corn, so as to compare these two plants with the green corn. The peas and oats were coming into blossom when first fed, and were nearly fit for harvesting at the end of the test period. The clover was partly in blossom and the corn was in the stage when ears can be taken for table use; the aim being to feed each plant in its most valuable condition. The soja bean makes butter of a superior flavor; the creamery experts pronounced it equal to butter from corn, which stands at the head of all feeding stuffs for producing a fine flavor. The per cents of fat are low, and lowest on corn; the table shows that low per cents of fat are raised with better feeding. We fed for flavor, and could not add mill feeds without mixing flavors, it being desirable in testing new plants to feed them alone, so as to learn the effects of their volatile acids, independently of others. The

corn-meal and hay, fed with all the green feeds, are known to give approved flavors. The corn growing section of the country is famed for its fine flavored butter; and the almost exclusive use of corn for cow feed results in low average yields, perhaps in low per cents of butter fat. The college has cows of four breeds being milked; the range is from a little over two, to over seven per cent of fat in the milk. The low per cent cows are mostly heavy milkers, and the high per cent cows are moderate milkers. When we use low per cent cows in testing plants we work parallel with many Iowa dairymen. Feeding cows for yield solely, up to their limit, is another line of experimentation.

The following table shows the amount fed of each of the five soiling crops to each cow daily; the average per cent of dry matter in each; the dry matter each cow had daily; the average per cent of crude protein in each plant; the crude protein each cow had daily during each test period from the plant tested; and the per cent of it that is digestible, the nutritive ratio of the tested green plants, and the nutritive ratio of the total ration during each test period.

TABLE NO. 8.

	Peas and oats.	Red clover.	Sweet corn.	Soja bean.	Cow Peas. cows Nos. 115, 213.
Amount fed daily to each cow, lbs.	90	65	85	65	75
Dry matter, per cent, of tested plants	20.07	32.90	22.23	28.54	15.48
Dry matter fed each cow daily, lbs.	19.86	21.38	18.89	18.55	11.61
Crude protein, per cent in each plant	20.71	15.85	11.63	18.19	24.17
Crude protein fed each cow from tested plant, daily, lbs.	4.09	3.38	2.19	3.40	2.90
Digestible protein in daily feed from tested plants, lbs.	2.90	2.23	1.30	2.41	2.05
Protein from hay, corn and green feed	4.10	3.43	2.50	3.61	3.25
Nutritive ratio of tested plants	1:3.9	1:5.4	1:13	1:3.9	1:2.9
Nutritive ratio of total ration	1:6.4	1:6.8	1:11.3	1:6.1	1:6.2

The nutritive ratio of total ration in the last line of the foregoing table includes the hay and corn and cob meal, added to each green feed tested. The nutritive ratio is found by dividing the dry matter of the digestible carbhydrates by the dry matter of the digestible protein. The carbhydrates are the nitrogen free extract, the crude fibre and two and a

half times the fat. In this case we considered 71 per cent of the protein digestible (following Dr. Jenkins, of Connecticut), and the sum of the digestible extract and fibre equal to the total nitrogen free extract.

The foregoing table shows first the amount of green feed each cow ate during each test period. It is less than reported in BULLETIN 23, but more corn meal was fed in this case. The cows did not take the soja bean readily; it had to be cut fine and mixed with bran for several days; but they got used to it after a week's coaxing, after which they each ate sixty-five pounds daily. The dry matter per cent shows that each cow got about as many pounds of dry matter from the soja bean as from the three preceding green feeds. The cow pea was readily eaten, but its dry matter per cent is less than any of the plants used, being only 15.48. Its crude protein per cent is higher than any of the others, being 24.17. These protein per cents are the average of the analyses made by the chemists. We bring the protein feature into this table to show the relation that exists between the yield of milk and its fat and the amount of crude and digestible protein found in the cow's feed. Table No. 7 shows a sharp decrease in the amount of milk and its fat per cent and butter when sweet corn was fed. Table No. 8 shows a sharp decrease in the pounds of crude and digestible protein from sweet corn. There was 2.90 pounds of digestible protein in 90 pounds of peas and oats, 2.23 pounds of digestible protein from 65 pounds of clover, and but 1.30 pounds of digestible protein from 85 pounds of sweet corn. It increased to 2.41 pounds from 65 pounds of soja beans, and was 2.05 pounds from 75 pounds of the cow pea.

The most reliable authority we have regarding the amount of digestible protein the dairy cow weighing 1,000 pounds requires, says it should be 2.5 pounds daily. The corn and cob meal and hay would add 1.2 pounds of digestible protein to each green plant fed, which would make the 2.5 pounds of protein for the sweet corn period; but where this nutrient is furnished from green plants, it is cheap, and in this case the best results come where protein is plentiest. The cow gets protein cheapest from the abundant pasture, and soiling crops most closely imitate the pasture in all respects.

When 2.5 pounds of protein are given as the standard amount of digestible protein for a milking cow for one day, 24 pounds of chemically dry matter is the standard quantity of fodders and grains in which it should be found. In the sweet corn period each cow had 30.69 pounds of dry matter, including the hay and meal. The nutritive ratios show the quality of the total rations in each case.

We have called attention to the contrasts between the sweet corn results and those of the leguminous plants, because, Iowa farmers feed corn more than any people we know of, while our soil is capable of producing plants richer in protein.

We insert here a table from the chemist showing the volatile acids of butter made from milk from each tested plant. It will be seen that the volatile acids are highest in sweet corn butter, and that the melting point is lowest. Butter from the soja bean is lower in volatile acids than from any plant tested, except the cow pea, but the melting point is highest in butter from the soja bean, while butter from the cow pea is lowest in volatile acids, and similar in melting point to the other butters, except that from sweet corn. Butter with a high melting point is desirable for shipment to warm climates, or for shipping in our own latitude in hot weather.

Soiling Experiment, 1894.

BUTTERS.

Properties of the Butter Fats.

	Peas and oats.	Clover.	Sweet corn fodder.	Soja bean.	Cow pea.
Volatile acids, Wollny figure	29.95	29.9	32.2	28.95	28.7
Melting point	32.2°	3.26°	31.5°	33.0°	32.5°

It will be noticed that we feed corn meal with green soiling crops. It is usual in Iowa feeding to seek mill feeds of a highly nitrogenous character, to balance up corn or corn fodder, or ensilage, because these are deficient in protein; but

when leguminous plants are fed, rich in protein, it is profitable to add corn meal. We fed in 1891 (BULLETIN 15) 12 pounds of corn meal daily, and found that the cows gained in weight; we fed in 1893 (BULLETIN 23) 4 pounds of corn meal daily, and found that the cows lost in weight. During this experiment we fed 9 pounds of corn and cob meal to each cow daily, and found that the weight of the cows remained nearly stationary.

With green corn the cows should have bran, oil-meal or other nitrogenous by-product; that is expensive feeding. With the leguminous plants we should feed corn meal (that is found on every farm), that is cheap feeding.