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**A Comparison of
Alfalfa, Sweet Clover, and
Sudan Grass as Pasture
Crops for Dairy Cows**



**Dairy Department
Agricultural Experiment Station
SOUTH DAKOTA STATE COLLEGE OF
Agriculture and Mechanic Arts
Brookings, S. D.**

A Comparison of Alfalfa, Sweet Clover, and Sudan Grass as Pasture Crops for Dairy Cows

THOMAS M. OLSON and BEN L. ROBINSON

Introduction

Dairying is recognized as one of the major farm enterprises in the Northwest. Over much of this area conditions for producing winter feeds are very favorable but moisture conditions are such that it is difficult to maintain satisfactory pastures for dairy cows during the summer months. Native pastures, where available, will carry the herd in a satisfactory manner for a short time in the spring but these pastures soon dry up and are unsatisfactory during a large part of the pasture season.

These conditions make it necessary for dairymen in this region to rely on cultivated crops for summer pasture. Information concerning the relative productivity, dependability, length of grazing season and other factors having to do with pasture crops is needed. With a view of supplying information on these points the experiment was started in 1927.

Review of Literature

Experiments conducted at the Dodge City Branch Experiment station at Dodge City, Kansas (1) on the value of sudan grass pasture covered the grazing season of 1914. In this experiment sudan grass produced 125 cow days of pasture per acre. More cows were turned in than the pasture would carry continuously, making it necessary to run the cows on good buffalo sod a part of the time. The records show that the milk increased on the average of 3.2 pounds per head daily each time the cows were turned on the sudan grass pasture. A similar experiment conducted at the Kansas Agricultural college at Manhattan during the summer of 1919 gave a yield for sudan grass pasture of 103 cow days and 1.35 tons of field cured hay per acre. Holstein cows used in this experiment were fed grain at the rate of one pound to each four pounds of milk produced. The pasture produced 2,271 pounds of milk and 72.1 pounds of butterfat per acre.

Experiments carried on at the Branch Agricultural Experiment station at Ardmore, South Dakota (2) during the summer of 1929 gave a yield of 24.83 cow days, 729 pounds of milk, and 24.47 pounds of butterfat per acre for sudan grass pasture. This pasture was estimated to be a 50 per cent stand.

At the Yuma Experiment farm at Bard, California (3) eight acres of irrigated sudan grass carried an average of three head of horses and cattle per acre for six months.

A sweet clover pasture experiment was conducted at the North Dakota Experiment station (4) during the summer of 1921 in which twelve head of two and three-year-old steers and heifers were pastured on 4.34 acres. As the supply of pasture diminished cattle were taken off until at the end of the experiment only three head of steers remained. A production of 204 cattle grazing days and 330 pounds of live weight per acre was obtained. Some difficulty was encountered in getting the cattle to eat the sweet clover in the earlier part of the pasture season and they showed a distinct craving for variety.

The following information was collected from members of cow testing associations of South Dakota (5).

Questionnaire Sent to Eighty Dairy Farmers

1. Have you used sweet clover for pasturing dairy cattle?
Eighty replied yes.
2. How many seasons?
Seventy-nine replied. Varied from one to eleven seasons with the average between three and four. More than half of the seventy-nine had pastured sweet clover three seasons or more.
3. How many acres?
Seventy-nine replied. Varied from four to one hundred ten. Average per farm was 20.5 acres.
4. How many cows each season?
Seventy-five replied. Varied from six to one hundred twenty-eight head of livestock averaging about twenty-three per farm.
5. Does an average stand of sweet clover supply more pasture per acre than native prairie pasture?
Eighty replied. Yes.
6. Does an average stand of sweet clover supply more pasture per acre than blue grass pasture?
Sixty-four replied. Sixty—yes. Four—doubtful.
7. Does sweet clover supply more pasture per acre than alfalfa?
Forty-nine replied. Thirty-two—yes. Eight—doubtful. Eight—no. One—same.
8. Does sweet clover supply more pasture per acre than red clover or timothy?
Sixty-three replied. Fifty-seven—yes. Four—same. One—no. One—doubtful.
9. Does sweet clover supply more pasture per acre than brome grass?
Forty-eight replied. Forty-six—yes. Two—doubtful.

10. Does sweet clover grow better in dry weather than other pasture?
Seventy-eight replied. Seventy-seven—yes. One—doubtful.
11. Did you have trouble getting cows to eat sweet clover pasture?
Eighty replied. Seventy-two—no. Eight—yes.
12. Did the cows in milk produce well on sweet clover?
Seventy-seven replied. Seventy-six—yes. One—no.
13. Is it satisfactory for growing dairy heifers?
Seventy-five replied. Seventy-three—yes. Two—no.
14. Do you prefer white or yellow blossom sweet clover for pasture?
Seventy-seven replied. Sixty-seven—white. Four—yellow. Two—no preference.
One—Grundy County Dwarf. One—a mixture of yellow and white.
A large number stating their preference for white sweet clover also stated that they had never grown any other variety.
15. Which pasture crop do you consider most satisfactory in your locality?
Seventy-five replied. Sixty-four preferred straight sweet clover. Six—grass mixtures including sweet clover. Five—preferred other crops or mixtures not including sweet clover.
16. Were your cows troubled with bloat when pastured on sweet clover?
Seventy-nine replied. Fifty—no. Twenty-nine—yes. Thirteen—reported only slight trouble.
17. Was milk from cows which were pastured on sweet clover tainted in taste or odor?
Seventy-seven replied. Fifty-seven—no. Twenty—yes but only one stated the taint was serious.
18. Have you fed sweet clover hay to dairy cattle?
Fifty-three replied, yes.
19. How many years?
Forty-eight replied. Varied from one to ten. Average, three years.
20. Do you consider it a desirable hay for milk cows?
Sixty-three replied. Fifty-three—yes. Ten—no.
21. For Dairy Heifers?
Forty-seven replied. Forty-two—yes. Five—no.
22. Do you prefer sweet clover hay to alfalfa hay?
Sixty-one replied. Forty-two—no. Five—equal. Two—mixed. Two—yes.
23. To prairie hay?
Forty-nine replied. Forty-one—yes. Eight—no.
24. To wild hay?
Forty-seven replied. Forty-one—yes. Six—preferred wild hay.
25. To red clover hay?
Thirty-one replied. Twenty-two—preferred red clover and nine preferred sweet clover.

A similar questionnaire although less extensive, was sent to Montana stockmen in 1921 (6). One hundred and thirty-one farmers reported. Of

this number only five experienced losses from bloat. The attitude of the growers toward sweet clover hay is indicated by the following tabulation:

Answers	Per cent of Replies
Better than alfalfa hay	10.6
Same as alfalfa hay	25.7
Not as good as alfalfa hay	15.1
Better than other hay	15.1
Same as other hay	31.8
Not as good as other hay	1.5

Some farmers fear to plant sweet clover because they believe it difficult to eradicate. The question, "Is sweet clover difficult to eradicate?" was answered by ninety-eight farmers.

Answers	No. of Answers	Per cent of Answers
No.	67	68.4
Yes	14	14.3
Don't want to get rid of it	5	5.1
Haven't tried to get rid of it	12	12.2

The carrying capacity of sweet clover pasture reported by this group of farmers ranged from one to two head per acre and a few said their pasture would have carried more than two head per acre.

Coe (7) of the U. S. D. A. states that good stands of sweet clover will run two to three mature steers per acre from early spring until the middle of June and that under proper management it should carry one milk cow per acre during the entire summer. He has observed that cattle running on sweet clover always crave dry feed and states that hay or straw should be kept available at all times.

A few farms have been found by Coe (7) where sweet clover produced trouble by tainting the milk. This, however, is a rare source of trouble most likely to occur in the spring and can be prevented by taking the cows off pasture two hours before the evening milking and not putting them back until after the morning milking.

In practically all sections where sweet clover has been used for pasture loss from bloat has been sustained. The losses which have been reported are quite spasmodic and there seems to be no uniform set of conditions which can be depended upon either to prevent or produce bloat on sweet clover pasture.

In 1924 an unusual amount of loss from bloat on sweet clover pasture occurred in Montana. In response to this situation a questionnaire (8) was sent to western and middlewestern states where sweet clover was pastured quite extensively. Answers from twelve states were tabulated.

South Dakota reported frequent losses from bloat on sweet clover pasture before 1924 but all other states reported none or only a few and scattering cases. Eight states reported unusually heavy losses in 1924. Of these eight states five considered their losses to be due to wet cool weather, rank growth or late frosts which were prevalent that year. One state reported practically all of its loss during the night. Two states offered no possible explanation, and no states reporting felt sure they knew what conditions were causing their trouble.

Ralph E. Johnston, extension agronomist of South Dakota State college, prepared a report summing up information obtained from twenty-nine farmers regarding the unusual amount of loss from bloat on sweet clover pasture in South Dakota during the spring and summer of 1924.

Nineteen gave information regarding losses from bloat in years before 1924. Eleven reported no loss. Eight reported that they had had trouble before 1924 but only six reported losses. Of the ten who did not answer this question nine had pastured sweet clover only one year, and one had pastured it for two years. In 1924 twenty-two farmers reported trouble from bloat. Seventeen of this number lost a total of forty-four animals. The other five had lost no animals.

The conditions under which trouble was experienced are not uniform. The majority reported trouble after rain and frost when the clover and soil were wet and early in the season when the plants were tender and juicy. A few reported trouble when the clover plants were dry and a few reported trouble later in the season when the plants were quite old and had lost much of their succulence.

Of the twenty-two reporting trouble in 1924, nine allowed their stock only sweet clover pasture, five fed either hay or straw, three provided grass pasture with sweet clover, and two provided both hay and grass pasture. Three did not give information bearing on this question.

Most of the trouble was reported in May and June with some in the first part of July. Three reported all their trouble in July and August.

The U. S. D. A. Yearbook of Agriculture of 1930 states that at the Ardmore South Dakota Experiment station it has been difficult and in some cases impossible to force cows to graze sweet clover pasture. This extreme condition has not been encountered at other stations of the Bureau of Agriculture. Attempts to put up palatable sweet clover hay at this station have also been unsuccessful. In 1928 a quantity of sweet clover was ensiled at this station. It kept well but proved to be unpalatable to cattle. Cows to which it was fed lost weight and decreased in milk production.

In discussing sweet clover further the Yearbook just referred to states that there is an increasing tendency to sow some kind of grass with sweet clover for pasture. Orchard grass, timothy, and red top have been used. The advantages claimed for this mixture are as follows: 1. The grass fills vacant spaces where the sweet clover fails to catch, 2. gives variety to the diet, 3. lessens the danger from bloat, and 4. extends the pasture season at both ends of the year. On soils which heave badly during the winter the grass roots tend to bind the surface soil together and lessen serious slippage of sweet clover roots. When it is not practical to follow this practice it may be advantageous to sow a field of sudan grass near by. This will serve as a reserve pasture to protect the new sweet clover seeding from too heavy grazing and also provides late pasturage after the old sweet clover pasture is mature.

Although it is believed that there is more bloat risk in pasturing alfalfa than sweet clover, farmers in some localities pasture considerable acreages of alfalfa. Oakley and Westover (9) state that few pasture plants excel alfalfa in palatability and carrying capacity. It should not

be pastured the first year and only lightly the second year, but by the third year it should be firmly established and may be pastured to its full carrying capacity.

Close grazing they believe to be harmful to alfalfa at any time, but it is especially harmful in the late fall, since close grazing at this time is conducive to winter killing. They also believe that a system of rotation grazing, where each field is allowed to get ready to cut for hay and then enough stock turned in to pasture it down in a few days, should be followed for best results.

Experiment

The experiment reported in this bulletin has been in progress over a period of five pasture seasons beginning in 1927 and continuing through 1931. It was planned to give a comparison of alfalfa, sweet clover and sudan grass pastures for dairy cows on the basis of carrying capacity, milk and butterfat production, length of pasture season, loss or gain of body weight, and other points which aid in determining the value of pasture crops. Studies on bloat and effect on quality of milk were also contemplated in these trials.

Procedure

Measured plots were selected for each of the pasture crops under trial. During 1927 and 1928 the alfalfa plot contained 6.39 acres, the sweet clover plot 4.91 acres, and the sudan grass plot 3.2 acres. Since this time the plots have all contained 3.2 acres.

Groups of eight to ten cows of the four major dairy breeds were selected, as similar in period of lactation, age, persistency of milk production, size, etc. as possible. They were turned in the experimental plots as soon as the growth of the different pastures was fit and kept there until it was evident that the pasture was no longer furnishing sufficient feed.

The cows were weighed for three consecutive days before going on the pasture and the average of these three weights was taken as the initial weight. All cows were weighed at regular ten-day intervals during the pasture season. Ten-day composite samples of the milk were taken and tested by the Babcock method. The milk was weighed daily. Accurate records were kept of the amount of grain fed during the experiment. Grain was fed at the rate of one pound to seven or eight pounds of milk for Holsteins and Ayrshires and one pound to six or seven pounds of milk for Guernseys and Jerseys. In 1929 grain was fed only to cows producing one pound or more of butterfat per day. In 1931 grain was limited to Holsteins and Ayrshires producing twenty pounds of milk or more and to Jerseys and Guernseys producing fifteen pounds of milk or more.

1927 there was a sufficient number of cows available for only alfalfa and sweet clover plots. In 1931 a good stand of sudan grass was obtained, but the plot became so weedy that it was thought inadvisable to include it in the experiment. Sweet clover was seeded in 1930 but failed to make a stand.

In 1931 two plots of sweet clover were available for experimental purposes. One of these plots was pastured the same as usual but the other was not pastured until after a crop of hay had been cut. Cows were then turned in and the plot was pastured as long as the feed lasted. The plot which was cut for hay is designated as plot 2. In order to put both plots on a comparable plane the following adjustments were made:

The average milk production per head daily, the average test of the milk, and the average weight of the cows were all determined for the time they were pastured on plot No. 2. From these figures the amount of protein and total digestible nutrients required daily for maintenance and milk production per cow and per acre was determined according to Haecker's Feeding Standards. The amount of grain fed per acre daily and the nutrients it contained was determined. From these figures it was calculated that the nutrients contained in the hay cut would have lasted the cows twelve days had it been pastured. The production which would have been obtained in twelve days was added to that which actually was obtained. The total calculated production on plot No. 2 was averaged with that obtained on plot No 1. It is this average figure which appears in the sweet clover column for 1931 except where notes accompanying the table indicate otherwise.

The values obtained as described above are listed in column 3 Table VIII.

Discussion of Results.

Length of Pasture Season.— The length of time the various crops furnish pasture and the dates between which they are of most value are often very important factors in making a choice of pasture crops especially when a rotation of two or more crops is to be used during the season. Table I. shows the number of days the cows are pastured on each crop and the dates of pasturing during the five years of this experiment.

TABLE I.—Total Days on Pasture per Season and Date of Pasturing

Year	Length of Pasture Season—Days			Dates of Pasturing		
	Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Sweet Clover	Sudan G.
1927	98	98	*	June 3-Sept. 8	June 3-Sept. 8	*
1928	63	63	63	July 14-Sept. 14	July 14-Sept. 14	July 11-Sept. 11
1929	89	88	63	June 12-Sept. 8	June 13-Sept. 8	July 7-Sept. 8
1930	62	*	25	May 24-June 24	*	July 1-July 25
1931	42	52	*	June 16-July 28	June 16-Aug. 7	*
Average	71	75	50			

*—No pasture available.

It will be noted that alfalfa and sweet clover correspond very closely both in the length of pasture season and in the dates between which they furnish pasture. In two out of three years when sudan was available it shows a considerably shorter pasture season than alfalfa and sweet clover. Sudan grass can not be pastured until later in the summer. In 1928, however, it was pastured three days earlier than alfalfa and sweet clover. Reference to Table XI. will reveal the fact that there was an abnormally small amount of rain fall in 1928 prior to the month of June. This would

retard both alfalfa and sweet clover in their early growth but would not seriously affect sudan grass. This probably explains the late pasturing dates for alfalfa and sweet clover in this one year. The summer of 1930 and 1931 were very hot and dry. This fact explains the short pasture seasons these years. The pasturing dates show that sudan grass can usually be depended upon to furnish pasture during the driest part of the summer.

Carrying Capacity.—There are two ways in which the carrying capacity of pastures may be compared. One is the number of cows per acre which is carried through the season and the other is the number of cow days of pasture produced per acre. (Cow days is obtained by multiplying the number of cows per acre by the number of days of pasture).

TABLE II.—Cow Days and Cows per Acre per Season

Year	Alfalfa		Sweet Clover		Sudan Grass	
	Cow Days per Acre	Cows per Acre	Cow Days per Acre	Cows per Acre	Cow Days per Acre	Cows per Acre
1927	122.7	1.25	159.67	1.63	*	*
1928	84.5	1.34	102.80	1.63	144.7	2.33
1929	194.7	2.18	192.20	2.18	137.8	2.18
1930	178.7	2.88	*	*	62.5	2.50
1931	69.4	1.65	110.	2.80	*	*
Average	130.	1.86	141.20	2.06	115.	2.34

*—No pasture available.

Sudan grass has averaged carrying more cows per acre than either alfalfa or sweet clover but due to its shorter pasture season it has produced fewer cow days of pasture per acre than either of the other crops. Sweet clover ranks slightly above alfalfa both in the number of cows carried per acre and in the number of cow days of pasture produced per acre. The fact that sudan grass produced more cow days of pasture per acre than either alfalfa or sweet clover in 1928 is explained by the moisture conditions that year.

Milk and Butterfat Production.—Table III. presents a summary of the total milk and butterfat produced per acre by the three pasture crops during the five years through which this experiment has run.

TABLE III.—Milk and Butterfat Produced per Acre per Season

Year	Alfalfa		Sweet Clover		Sudan Grass	
	Milk-lbs.	B. F. lbs.	Milk lbs.	B. F. lbs.	Milk lbs.	B. F. lbs.
1927	3941.9	145.33	4939.7	179.02	*	*
1928	1426.8	60.83	1786.9	74.86	2911.4	126.37
1929	3177.1	146.62	3847.8	160.83	2508.1	114.69
1930	3422.	142.49	*	*	1408.2	56.66
1931	1775.	62.40	2229.	86.40	*	*
Average	2748.6	111.53	3200.9	125.20	2275.9	99.24

*—No pasture available.

A study of table III shows that sweet clover has produced an average of 452.3 pounds more milk and 13.7 pounds more butterfat per acre than alfalfa, and 925.0 pounds more milk and 26.0 pounds more butterfat per acre than sudan grass.

Sweet clover has produced more milk and butterfat per acre than alfalfa every year it has been pastured, but sudan grass surpassed it in 1928.

Mention has already been made of moisture conditions which probably account for this result.

Table IV. shows the amount of milk and butterfat produced per acre per day per season by each of the pasture crops.

TABLE IV.—Milk and Butterfat Produced per Acre per Day per Season

Year	Alfalfa		Sweet Clover		Sudan Grass	
	Milk lbs.	B. F. lbs.	Milk lbs.	B. F. lbs.	Milk lbs.	B. F. lbs.
1927	40.2	1.48	50.4	1.83	*	*
1928	22.6	.97	28.3	1.19	46.2	2.00
1929	35.7	1.64	43.7	1.83	39.8	1.82
1930	55.2	2.29	*	*	56.3	2.26
1931	40.9	1.65	58.1	2.22	*	*
Average	38.9	1.61	45.1	1.76	47.4	2.03

*—No pasture available.

According to the above table sudan grass produced an average for all the pasture seasons of 8.5 pounds more milk and .42 pounds more butterfat per acre daily than alfalfa and 2.3 pounds more milk and .3 pounds more butterfat per acre than sweet clover. The heavier carrying capacity of sudan grass gives it a distinct advantage over both alfalfa and sweet clover in this comparison. In 1928 sudan grass exceeded both alfalfa and sweet clover in this respect. In 1929 it exceeded alfalfa in both milk and butterfat production per acre per day and was practically the same as sweet clover in butterfat production, but slightly under it in milk production. In 1930 alfalfa and sudan grass ranked practically the same in the production of milk and butterfat per acre per day. Sweet clover has excelled alfalfa in all years.

Grain and Silage Fed.—Grain was fed at the rate of one pound of grain to each seven to eight pounds of milk produced for Holsteins and Ayrshires, and one pound of grain to each six or seven pounds of milk produced for Jersey and Guernseys during the five years of this experiment. In 1929 grain was limited to cows producing one pound of butterfat or more per day and in 1931 grain was limited to Holsteins and Ayrshires producing twenty pounds of milk or more daily and to Jerseys and Guernseys producing fifteen pounds of milk or more daily.

Table V. shows the amount and kind of grain consumed by the cows on each pasture lot during the five years of the experiment.

TABLE V.—Amount and Kind of Grain Fed per Acre

Grain Fed	1927		1928			1929			1930		1931		Average		
	Alf. lbs	S. Clov. lbs	Alf. lbs	S. Clov. lbs	Sudan G. lbs	Alf. lbs	S. Clov. lbs	Sudan G. lbs	Alf. lbs	Sudan G. lbs	Alf. lbs	S. Clov. lbs	Alf. lbs	S. Clov. lbs	Sudan G. lbs
Corn	275.4	345.6	47	54.5	152.0	247.5	284.5	167.0	324	129	130.5	157.5	204.9	210.5	149.3
Oats	275.4	345.6	47	54.5	152.0	247.5	284.5	167.0	324	129	130.5	157.5	204.9	210.5	149.3
Oil Meal	45.8	58.8	—	—	—	—	—	—	—	—	—	—	9.2	14.7	—
Total	596.6	750.0	94.0	109.0	304.0	495.0	596.0	334.0	648.0	258.0	261.0	315.0	419.0	435.7	298.6

TABLE VII.—Weights of Cows by Ten Day Periods.—Actual Averages

10-Day Period	1927		1928			1929			1930		1931			Average		
	Alfalfa	Sweet Clover	Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Sudan Grass	Alfalfa	Sw. Cl. No. 1	Sw. Cl. No. 2	Alfalfa	Sweet Clover	Sudan Grass
Initial	1231	1300	1139	1226	1217	1104	1185	1174	1251	1275	1077	1182				
1	1206	1256	1122	1194	1196	1104	1182	1149	1217	1259	1083	1187				
2	1207	1256	1146	1204	1188	1098	1172	1181	1218	1227	1057	1159				
3	1192	1238	1145	1144	1161	1090	1171	1147	1239	1222	1093	1165	1198			
4	1219	1264	1080	1135	1126	1046	1148	1132	1216		1076	1149	1182			
5	1199	1246	1123	1152	1164	1058	1182	1134	1168			1148				
6	1197	1217	1133	1155	1167	1052	1113	1113	1179							
7	1191	1222				1038	1099									
8	1201	1239				1047	1113									
9	1214	1220				1036	1099									
Loss	17	80	6	71	50	68	86	61	72	53	1	34	16	33	68	55

Since grain was fed in proportion to the milk production of each cow it will be found that the most grain has been fed on the plots where the most milk was produced.

In 1927 sixteen to eighteen pounds of silage per head daily was fed from August 15 until September 8, the date on which the cows were taken off pasture. In 1928 cows went on pasture July 14 and silage feeding was discontinued August 1. On August 24 silage feeding was started again, at the rate of twenty pounds per head daily, and continued until the cows were taken off pasture September 14. The following amounts of silage were fed per acre.

1927		1928		
Alfalfa	S. Clover	Alfalfa	S. Clover	Sudan G.
532 lbs.	693 lbs.	1052 lbs.	1348 lbs.	1656 lbs.
Silage was not fed during 1929, 1930, or 1931.				

Perhaps a clearer conception of the amount of grain and silage fed can be obtained by comparing the amounts fed for each 100 pounds of milk and per pound of butterfat on the various pastures.

TABLE VI.—Amount of Grain and Silage Fed per 100 lbs. Milk and per lb of Butterfat

Yr.	Alfalfa				Sweet Clover				Sudan Grass			
	Grain lbs.		Silage lbs.		Grain lbs.		Silage lbs.		Grain lbs.		Silage lbs.	
	Per 100 lbs. Milk	Per lb. B. F.	Per 100 lbs. Milk	Per lb. B. F.	Per 100 lbs. Milk	Per lb. B. F.	Per 100 lbs. Milk	Per lb. B. F.	Per 100 lbs. Milk	Per lb. B. F.	Per 100 lbs. Milk	Per lb. B. F.
1927	15.1	4.10	13.5	3.6	15.1	4.10	14.0	3.8	—	—	—	—
1928	6.5	1.54	73.7	17.2	6.1	1.45	75.4	17.8	10.4	2.40	53.4	13.1
1929	15.5	3.60	—	—	14.7	3.53	—	—	13.3	2.90	—	—
1930	18.9	4.56	—	—	—	—	—	—	18.3	4.52	—	—
1931	14.7	4.17	—	—	12.9	3.04	—	—	—	—	—	—
Ave.	14.14	3.55	11.5	2.84	12.14	3.17	16.1	4.1	14.0	3.27	24.25	5.6

It will be noted from Table VI. that it required somewhat less grain to produce 100 pounds of milk and a pound of butterfat on sweet clover than alfalfa every year except 1927 when this requirement was the same for both. Sudan grass required considerably more grain to produce 100 pounds of milk in 1928 than either alfalfa or sweet clover but required less than either alfalfa or sweet clover in 1929. When the average for all years is taken sudan grass ranks between alfalfa and sweet clover.

The average silage requirement is low for all three crops due to the fact that it was fed only during the first two years and then in comparatively small quantities. The most silage per 100 pounds of milk was fed on sweet clover and the least on alfalfa.

Weight of Cows.—Table VII. shows the average initial weight and the average weight of the cows on the different pasture lots by ten day periods. The weights included in this table are the actual weights of the cows that were on the experiment plots at the time of weighing. In 1927 and in 1931 the same cows remained on the pasture plots through the entire season but in the other three years it was necessary to make some changes for unavoidable reasons. It is obvious that the necessity of making such changes would either raise or lower the average live weight of the cows

on a particular pasture plot according to whether the cow put on pasture was heavier or lighter than the cow which she replaced. When a cow was added to the number already on the pasture and did not replace another animal the same error would be obtained. Without making a correction for such changes it is obvious that the true effect of the pasture on the body weights of the cows could not be determined. The following example will illustrate the method used in making such a correction.

In 1928 eight cows were turned on the alfalfa plot at the beginning of the season. August 15 marked the end of a ten day period when all cows were weighed. At this time it was decided to add two more cows to the alfalfa lot. The eight cows originally on the pasture had an average weight August 15 of 1145 pounds. The ten cows which were going on pasture at this time had an average weight of 1118.5 pounds. Thus we see that the addition of these two extra cows lowered the average weight of the alfalfa lot of cows 26.5 pounds. This would show an apparent loss when compared to the initial weight at the beginning of the experiment of 1139 pounds while the cows that had been on the pasture all the time, had actually gained six pounds per head. At the next weighing the ten cows averaged 1080 pounds per head. Twenty-six and five-tenths pounds were added to this weight giving 1106.5 pounds. This figure does not represent the actual average weight of the cows on pasture but it does show how much weight has been lost which can be correctly charged to the pasture.

Table VII. shows the actual average weight of cows on pasture at the end of each ten-day period and Table VIII. shows weights corrected for changes as described above. Where no changes were made the two tables are the same but where changes were made they differ slightly.

The losses shown in Table VIII. are the differences between the last weight recorded and the initial weight. If we take the average of all the years this experiment has been run we find that the cows on sweet clover have lost an average of 54.7 pounds per head, the cows on sudan grass 59 pounds per head, and the cows on alfalfa 35.4 pounds per head. Expressed on an acreage basis we find the following losses to have taken place. Alfalfa has an average loss for the five years of 81.8 pounds per acre, sweet clover 107.4 pounds per acre and sudan grass 137.7 pounds per acre.

Hay Produced.—In 1927 the alfalfa plot (6.38A) produced 4021.6 pounds of field cured hay in addition to the pasture. The sweet clover plot (4.91A) produced 4282.6 pounds of field cured hay. This is equivalent to 872.2 pounds of hay per acre for the sweet clover and 629.3 pounds of hay per acre for the alfalfa.

In 1928, 6075 pounds of hay was hauled off the sudan grass plot which is equivalent to 1900 pounds per acre. The notes for this year do not indicate whether this was green or field cured hay. In 1931 a total of 3810 pounds of field cured hay was cut on sweet clover plot No. 2. This is equivalent to 1191 pounds per acre.

No hay was cut other years. Instead cows were added to keep the growth down.

TABLE VIII.—Weight of Cows by Ten Dy Periods Corrected to Eliminate Loss or Gain in the Average Weight

10-Day Period	1927		1928			1929			1930		1931			Average		
	Alfalfa	Sweet Clover	Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Grass Sudan	Alfalfa	Sw. Cl. No. 1	Sw. Cl. No. 2	Alfalfa	Sweet Clover	Sudan Grass
Initial	1231	1300	1139	1227	1217	1104	1185	1174	1251	1275	1077	1182				
1	1206	1256	1122	1194	1220	1104	1182	1147	1218	1259	1083	1187				
2	1207	1256	1146	1204	1212	1098	1172	1181	1233	1228	1057	1159				
3	1192	1238	1145	1183	1149	1090	1171	1147	1255	1222	1098	1165	1198			
4	1219	1264	1107	1173	1112	1046	1148	1132	1216		1081	1149	1182			
5	1199	1246	1121	1191	1152	1058	1142	1134	1168			1148				
6	1197	1217	1131	1194	1154	1052	1118	1113	1179							
7	1191	1222				1038	1104									
8	1201	1239				1047	1118									
9	1214	1220				1036	1105									
Loss per head	17	80	8	33	63	68	80	61	72	53	4	34	16	35.4	55	59
Gain per head																

TABLE XII.—Mean High, Mean Low, and Mean Temperature

Year	April			May			June			July			August			September		
	Mean High	Mean Low	Mean	Mean High	Mean Low	Mean	Mean High	Mean Low	Mean	Mean High	Mean Low	Mean	Mean High	Mean Low	Mean	Mean High	Mean Low	Mean
1927	35.5	56.0	45.8	63.6	43.2	53.4	76.7	52.2	64.4	80.2	56.1	68.2	78.5	52.3	65.4	75.0	51.7	63.4
1928	52.8	26.0	39.4	74.9	44.7	59.8	73.7	49.9	61.8	83.5	59.9	71.7	82.8	58.3	70.5	71.8	45.1	58.4
1929	57.2	34.4	45.8	67.7	40.9	54.3	78.2	53.2	65.8	85.5	60.5	73.0	84.4	58.2	71.3	67.3	47.0	57.1
1930	62.0	36.5	49.3	68.5	44.9	56.7	79.1	53.4	66.3	91.8	61.5	76.7	87.0	60.9	74.0	73.6	48.1	60.8
1931	62.2	34.6	48.4	66.5	41.3	53.8	86.8	61.1	73.9	90.4	61.7	76.1	83.6	59.2	71.4	85.3	55.3	70.3

Nutrients Produced.—Table IX. shows the number of pounds of digestible crude protein and total digestible nutrients produced by each pasture crop for the five years of the experiment. In arriving at these figures the average test of the milk produced on each pasture plot and the average weight of cows on each plot were determined for each year. By the use of Haecker's Feeding Standards as tabulated in South Dakota Bulletin 231 it was thus possible to determine the amount of protein and total digestible nutrients required by the cows carried on an acre for maintenance and for milk production. The protein and total digestible nutrients equivalent to the body weight lost per acre, and the protein and total digestible nutrients contained in the grain and silage fed per acre were determined and their sum deducted from the total maintenance and production requirements as found above. The differences thus found are the pounds of digestible crude protein and total digestible nutrients which were theoretically produced by an acre of pasture. The nutrients equivalent to the loss of body weight was found by multiplying the pounds lost per acre by 3.245 which is the number of therms Armsby (11) gives as being equivalent to one pound of increase in live weight in cattle. From the table given by Armsby (11) pp. 718 the pounds of corn required to produce the number of therms of energy equivalent to the body weight lost per acre, was determined. The digestible crude protein and total digestible nutrients contained in this amount of corn was taken as the amounts equivalent to the loss of body weight per acre. In years when hay was cut the nutrients contained in this hay was added to the nutrients produced by pasture to obtain the total nutrients produced per acre.

TABLE IX.—Digestible Crude Protein and Total Digestible Nutrients Produced per Acre.

	1927			
	Alfalfa Prot.	T.D.N.	Sweet Clover Prot.	T.D.N.
Nutrients Required of Milk Produced	200.2	1255.8	247.5	1553.0
Nutrients Required for Maintenance	103.6	1171.5	138.3	1565.2
Total Nutrients Required per Acre	303.8	2427.3	385.8	3118.2
Nutrients Furnished by Grain Fed	60.1	454.8	75.8	571.6
Nutrients Furnished by Silage Fed	6.4	89.8	8.3	116.4
Nutrients Equivalent to Body Weight Lost	5.7	65.8	35.1	403.3
Total Nutrients Coming from Sources Other Than Pasture	72.2	610.4	119.2	1091.3
Nutrients Furnished by Pasture	231.6	1816.9	266.6	2026.9
Nutrients Contained in Hay Cut	66.5	320.8	95.0	442.1
Total Nutrients Produced per Acre	298.1	2137.7	361.6	2469.0

TABLE IX.—(Continued)

	1928					
	Alfalfa Prot.	T.D.N.	Sweet Clover Prot.	T.D.N.	Sudan Grass Prot.	T.D.N.
Nutrients Required of Milk Produced	78.9	508.2	98.1	627.0	162.1	1049.1
Nutrients Required for Maintenance	66.5	752.8	84.5	956.1	119.0	1345.8
Total Nutrients Required per Acre	145.4	1261.0	182.6	1583.1	281.1	2394.9
Nutrients Furnished by Grain Fed	7.9	71.5	9.1	82.9	25.5	231.2
Nutrients Furnished by Silage Fed	12.6	176.7	16.2	226.5	19.9	278.2
Nutrients Equivalent to Body Weight Lost	2.88	33.2	14.49	166.8	39.52	454.8
Total Nutrients Coming from Sources Other Than Pasture	23.4	281.4	39.8	476.2	84.9	964.2
Nutrients Furnished by Pasture	122.0	979.6	142.8	1106.9	196.2	1430.7
Nutrients Contained in Hay Cut					70.3	976.6
Total Nutrients Produced per Acre	122.0	979.6	142.8	1106.9	266.5	2407.3

TABLE IX.—(Continued)

	1929					
	Alfalfa		Sweet Clover		Sudan	Grass
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required of Milk Produced	184.3	1211.0	211.2	1350.2	144.7	947.8
Nutrients Required for Maintenance	145.4	1644.8	154.2	1743.4	110.6	1251.0
Total Nutrients Required per Acre	329.7	2855.8	365.4	3093.6	255.3	2198.8
Nutrients Furnished by Grain Fed	41.6	376.4	47.8	432.7	28.0	254.0
Nutrients Furnished by Silage Fed						
Nutrients Equivalent to Body Weight Lost	40.8	500.0	47.0	540.8	35.8	412.1
Total Nutrients Coming from Sources Other Than Pasture	82.4	876.4	94.8	973.5	63.8	666.1
Nutrients Furnished by Pasture	247.3	1979.4	270.6	2120.1	191.5	1532.7
Nutrients Contained in Hay Cut						
Total Nutrients Produced per Acre	247.3	1979.4	270.6	2120.1	191.5	1532.7

TABLE IX.—(Continued)

	1930			
	Alfalfa		Sudan	Grass
	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required of Milk Produced	186.5	1191.5	76.1	481.7
Nutrients Required for Maintenance	151.6	1714.6	52.4	616.5
Total Nutrients Required per Acre	338.1	2906.1	128.5	1098.2
Nutrients Furnished by Grain Fed	54.4	492.8	21.7	196.2
Nutrients Furnished by Silage Fed				
Nutrients Equivalent to Body Weight Lost	48.84	642.7	35.7	410.8
Total Nutrients Coming from Sources Other Than Pasture	103.2	1135.5	57.4	607.0
Nutrients Furnished by Pasture	234.9	1770.6	71.1	491.2
Nutrients Contained in Hay Cut				
Total Nutrients Produced per Acre	234.9	1770.6	71.1	491.2

TABLE IX.—(Continued)

	1931							
	Alfalfa		Sw. Cl. No. 1		Sw. Cl. No. 2		Sw. Cl. Av.	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required of Milk Produced	87.9	553.4	114.8	729.4	73.2	459.8	94.0	592.3
Nutrients Required for Maintenance	52.2	592.3	92.8	1049.3	25.5	615.2	72.6	832.2
Total Nutrients Required per Acre	140.1	1145.7	207.6	1778.7	125.7	1075.0	166.6	1424.5
Nutrients Furnished by Grain Fed	21.9	198.4	24.04	217.7	17.7	160.1	20.9	188.9
Nutrients Furnished by Silage Fed								
Nutrients Equivalent to Body Weight Lost	5.9	68.2	20.29	233.5	13.5	155.0	16.9	194.2
Total Nutrients Coming from Sources Other Than Pasture	27.8	266.6	44.33	451.2	31.2	315.1	37.8	383.1
Nutrients Furnished by Pasture	112.3	879.1	163.2	1327.5	94.5	759.9	128.8	1041.4
Nutrients Contained in Hay Cut					129.8	603.6		
Total Nutrients Produced per Acre	112.3	879.1	163.2	1327.5	224.3	1363.5	193.7	1345.5

TABLE IX.—(Continued)

	AVERAGE					
	Alfalfa 5 yrs.		Sw. Cl. 4 yrs.		Sudan Gr. 3 yrs.	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required of Milk Produced	147.7	944.3	162.7	1030.6	127.6	827.6
Nutrients Required for Maintenance	103.3	1175.2	112.4	1274.2	94.0	1071.1
Total Nutrients Required per Acre	251.5	2119.5	275.1	2304.8	221.6	1898.7
Nutrients Furnished by Grain Fed	37.2	311.8	38.4	190.0	25.1	229.0
Nutrients Furnished by Silage Fed	3.8	53.3	6.1	85.7	6.6	92.7
Nutrients Equivalent to Body Weight Lost	20.8	262.0	28.4	326.2	37.0	425.9
Total Nutrients Coming from Sources Other Than Pasture	61.8	627.1	72.9	730.9	68.7	747.6
Nutrients Furnished by Pasture	189.7	1492.4	202.2	1573.9	153.0	1151.1
Nutrients Contained in Hay Cut						
Total Nutrients Produced per Acre	202.9	1549.3	242.2	1760.4	176.4	1477.0

TABLE X.—Digestible Crude Protein and Total Digestible Nutrients Required to Produce 100 Pounds of Milk and 1 Pound of Butterfat.

	1927			
	Alfalfa		Sweet Clover	
	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required per 100 lbs. Milk	7.70	61.6	7.8	63.1
Nutrients Required per lb. Butterfat	2.09	16.7	2.2	17.4

TABLE X.—(Continued)

	1928					
	Alfalfa		Sweet Clover		Sudan Grass	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required per 100 lbs. Milk	10.2	88.4	10.2	88.6	9.7	82.2
Nutrients Required per lb. Butterfat	2.38	20.7	2.43	21.1	2.23	19.0

TABLE X.—(Continued)

	1929					
	Alfalfa		Sweet Clover		Sudan Grass	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required per 100 lbs. Milk	10.4	89.8	9.5	80.4	10.1	87.7
Nutrients Required per lb. Butterfat	2.24	19.4	2.26	19.2	2.22	19.1

TABLE X.—(Continued)

	1930					
	Alfalfa		Sweet Clover		Sudan Grass	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required per 100 lbs. Milk	9.9	84.9	9.1	77.9	7.9	77.9
Nutrients Required per lb. Butterfat	2.38	20.4	2.25	19.2	2.25	19.2

TABLE X.—(Continued)

	1931							
	Alfalfa		Sw. Cl. No. 1		Sw. Cl. No. 2 Past.		Sw. Cl. Av.	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required per 100 lbs. Milk	7.9	64.5	9.8	83.7	8.8	75.1	9.37	80.1
Nutrients Required per lb. Butterfat	2.24	18.2	2.41	20.6	2.35	20.1	2.39	20.4

TABLE X.—(Continued)

	AVERAGE					
	Alfalfa 5 yrs.		Sw. Cl. 4 yrs.		Sudan Gr. 3 yrs.	
	Prot.	T.D.N.	Prot.	T.D.N.	Prot.	T.D.N.
Nutrients Required per 100 lbs. Milk	9.13	77.1	8.59	72.0	9.7	83.4
Nutrients Required per lb. Butterfat	2.22	19.0	2.19	18.4	2.23	19.1

It will be noted from Table IX. that sweet clover has produced more protein and total digestible nutrients per acre than alfalfa every year that it has been pastured and that on the average it has produced 211 pounds T. D. N. and 39.3 pounds of protein more per acre than alfalfa. In 1928 sudan grass ranked above both alfalfa and sweet clover but, as has been mentioned before, this was an especially unfavorable year for the latter crops. When the average of all years is taken sudan grass has produced 72 pounds of T. D. N. and 26.5 pounds of protein less per acre than alfalfa. These results are in accordance with the comparative milk and butterfat production obtained from each crop.

If T. D. N. are converted to their equivalent in corn we find that sweet clover averaged 258 pounds of corn more per acre than alfalfa and that alfalfa averaged 88.5 pounds of corn more per acre than sudan grass.

Nutrients Required per Hundred Pounds of Milk and per Pound of Butterfat

There is no marked difference between the amount of nutrients required to produce 100 pounds of milk or a pound of butterfat on the various pastures. However, Table X. shows that on an average for all years sweet clover had the lowest requirements and sudan grass the highest.

Rainfall and Temperature.—Inasmuch as rainfall and temperature play an important part in determining the productiveness of a pasture from one season to another the rainfall and temperature records (12) have been obtained for the five years through which this experiment has run.

Table XI. shows the amount of rainfall for each month during the year and the total amount for the year. The amount of rainfall during the growing season, which was considered to be March 1 to September 1, is also recorded.

TABLE XI.—Amount of Rainfall

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total W	Grow'g Season
1927	.14	.35	.83	4.04	4.29	1.46	4.88	.35	1.98	.49	.49	1.10	20.40	15.85
1928	.09	.30	.44	.96	.53	2.97	2.69	4.52	1.37	1.68	.78	.15	16.48	12.11
1929	.96	.45	.68	3.32	2.11	1.12	3.25	2.33	4.80	2.41	.04	.07	21.58	12.81
1930	.42	.40	.25	1.25	2.04	1.68	.27	1.50	3.38	1.84	2.01	.10	15.14	6.99
1931	.03	.04	.30	1.33	.63	2.42	1.62	3.24	2.00	1.11				

Table XIII. is in the form of a summary for the first five years of this experiment and includes only information contained in other tables.

Table XIV shows the net return per acre for alfalfa, sweet clover, and sudan grass pasture for each year and includes an average of all years. Sweet clover ranks above alfalfa in net returns per acre each year it was pastured and when an average of all years is taken it shows \$3.39 higher net return per acre than alfalfa. Sudan grass ranks \$3.53 below alfalfa.

The prices used in making the above comparisons are listed under Table XIV.

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TABLE XIII.

	1927		1928			1929		
	Alfalfa	Sweet Clover	Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Sweet Clover	Sudan Grass
Length of Pasture Season—Days	98.	98.	63.	63.	63.	89.	88.	63.
Cow Days per Acre per Season	122.7	159.7	84.5	102.8	144.7	194.7	192.2	137.8
No. of Cows per Acre per Season	1.25	1.63	1.34	1.63	2.33	2.18	2.18	2.18
Milk per Acre—lbs.	3942.	4940.	1427.	1787.	2911.	3177.	3848.	2508.
Butterfat per Acre—lbs.	145.	179.	61.	75.	126.	147.	161.	115.
Milk per Acre per Day—lbs.	40.2	50.4	22.6	28.3	46.2	35.7	43.7	39.8
Butterfat per Acre per Day—lbs.	1.48	1.83	.97	1.19	2.0	1.64	1.83	1.82
Average loss body wt. per head—lbs.	17.	80.	8.	33.	63.	68.	80.	61.
Loss of body wt. per Acre—lbs.	21.3	130.	10.7	53.8	146.7	148.2	174.4	132.9
Grain Fed per Acre—lbs.	597.	750.	94.	109.	304.	495.	569.	334.
Grain Fed per 100 lbs. Milk	15.1	15.1	6.5	6.1	10.4	15.5	14.7	13.3
Grain Fed per lb. Butterfat	4.1	4.1	1.54	1.45	2.4	3.36	3.53	2.9
Silage Fed per Acre—lbs.	532.	693.	1052.	1348.	1656.			
Silage Fed per 100 lbs. Milk	13.5	14.0	73.7	75.4	53.4			
Silage Fed per lb. Butterfat	3.6	3.8	17.2	17.8	13.1			
Hay Cut per Acre—lbs.	629.	872.			1900.			

NOTES—

- (1) Sweet Clover Plot No. 1—Pastured all season no hay being cut.
- (2) Sweet Clover Plot No. 2—Pasture obtained on Sweet Clover Plot No. 2 after the hay had been cut.
- (3) Production which would have been obtained from the nutrients in the hay cut on Sweet Clover Plot No. 2 had they been consumed as pasture—Calculations based on

TABLE XIV.—Net Return per Acre of Sudan

	1927		1928		
	Alfalfa	Sweet Clover	Alfalfa	Sweet Clover	Sudan Grass
Value of Butterfat Produced per Acre	\$43.50	\$53.70	\$18.30	\$22.50	\$37.80
Value of Skimmilk Produced per Acre	7.10	8.90	2.60	3.20	5.20
Value of Hay Produced per Acre	3.15	4.35			9.50
Total Value of Produce per Acre	53.75	66.95	20.90	25.70	52.50
Value of Grain Fed per Acre	8.95	11.25	1.41	1.63	4.56
Value of Silage Fed per Acre	1.20	1.55	2.37	3.03	3.73
Value of Weight Lost per Acre	1.06	6.50	.54	2.69	7.34
Total Cost per Acre	11.21	19.30	4.32	7.35	15.63
Net Value of Pasture per Acre	42.54	47.65	16.58	18.35	36.87

NOTES—

- (1) Sweet Clover Average for 4 years but includes only Plot No. 1 for 1931.
- (2) Sweet Clover Average for 4 years, the 1931 figure used being the average of Plot

—Summary

1930		1931						AVERAGE			
Alfalfa	Sudan Grass	Alfalfa	S.C.I. (1) No. 1 Past.	S.C.I. (2) No. 2 Past.	S.C.I. (3) No. 2 Hay	S.C.I. (4) No. 2 Total	S.C.I. (5) Av. No. 1-2	Alfalfa 5 yrs.	S.C.I. (6) No. 1 4 yrs.	S.C.I. (7) No. 1-2 4 yrs.	Sudan Grass 3 yrs.
62.	25.	42.	52.	19.	12.	31.	41.5	70.8	75.2	72.6	50.
178.7	62.5	69.4	113.7	65.3	41.2	106.5	110.1	130.0	142.0	141.1	115.
2.88	2.50	1.65	2.18	3.43		3.43	2.8	1.85	1.9	2.05	2.34
3422.	1408.	1775.	2125.	1431.	902.	2333.	2229.	2748.6	3174.9	3200.9	2275.9
142.	57.	62.4	86.	53.3	33.6	86.9	86.4	111.5	125.1	125.2	99.2
55.2	56.3	42.3	40.9	75.3		75.3	58.1	39.2	40.8	45.1	47.4
2.29	2.26	1.49	1.65	2.8		2.8	2.22	1.57	1.63	1.77	2.03
72.	53.	13.	34.	15.	4.5	19.5	26.9	35.4	56.6	54.7	59.
207.3	132.5	22.	75.3	50.	16.9	66.9	71.1	81.8	108.5	107.4	137.7
648.	258.	261.	286.2	210.5	133.6	344.1	315.1	418.9	428.5	435.8	298.6
18.9	18.3	14.7	13.46	14.7		14.7	12.87	14.14	12.29	12.14	14.0
4.56	4.52	4.17	3.33	3.95		3.95	3.64	3.55	3.1	3.17	3.27
								317.	510.	510.	552.
								11.5	16.1	16.1	24.25
								2.84	4.1	4.1	5.6
								126.	218.		633.

- Haecker's Feeding Standard (S. D. Bul. 231).
 (4) Production which would have theoretically been obtained from Sweet Clover Plot No. 2 had it been pastured all season and no hay cut.
 (5) Average of (1) and (4).
 (6) Average of 3 previous sweet clover years and Plot No. 1 for 1931.
 (7) Average of 3 previous sweet clover years and (5).

Grass, Sweet Clover, and Alfalfa Pasture.

1929			1930		1931			AVERAGE			
Alfalfa	Sweet Clover	Sudan Grass	Alfalfa	Sudan Grass	Alfalfa	Sw. Cl. No. 1	Sw. Cl. No. 2	Alfalfa 5 yrs.	S.C.I. (1) No. 1 4 yrs.	S.C.I. (2) No. 2 4 yrs.	Sudan Grass 3 yrs.
\$44.10	\$48.30	\$34.50	\$42.60	\$17.10	\$18.72	\$25.80	\$16.00	\$33.45	\$37.53	\$37.56	\$29.76
5.70	6.90	4.50	6.15	2.55	3.20	3.80	2.57	4.95	5.71	5.76	4.09
							5.95	.63	1.09	1.09	3.16
49.80	55.20	39.00	48.75	19.65	21.92	29.60	24.52	39.03	44.33	44.41	37.01
7.42	8.53	5.01	9.72	3.87	3.91	4.29	3.15	6.28	6.42	6.53	4.47
								.71	1.15	1.15	1.24
7.41	8.72	6.65	10.37	6.62	1.10	3.76	2.50	4.09	5.42	5.37	6.88
14.83	17.25	11.66	20.09	10.49	5.01	8.05	5.65	11.08	12.99	13.05	12.59
34.97	37.95	27.34	28.66	9.16	16.91	21.55	18.87	27.95	31.34	31.36	24.42

No. 1 and the "calculated total pasture production" of Plot No. 2—These figures for 1931 are shown in column 5 Table XIII.
 Prices used in the above table are Butterfat, 30c lb.; Skimmilk, 20 cwt.; Hay, \$10. ton; Grain, \$30. ton; Silage, \$4.50 ton; Body Weight, \$5. cwt.

Conclusions and Summary

1. Sudan grass is a short season pasture crop but during the time it furnishes pasture it will carry more cows per acre and consequently will produce more milk and butterfat per acre per day than either alfalfa or sweet clover.

2. Due to their longer pasture season alfalfa and sweet clover will produce more cow days of pasture per acre and will produce more total milk and butterfat per acre for the entire season than sudan grass.

3. The results obtained thus far indicate that sweet clover ranks slightly above alfalfa in the number of cow days and in the amount of milk and butterfat produced per acre.

4. Cows lost more weight per head on sudan grass than on either alfalfa or sweet clover. Alfalfa pastured cows have shown considerably less loss than sweet clover pastured cows.

5. The crops rank as follows in the production of total digestible nutrients per acre for the season. First, sweet clover; second, alfalfa; and third, sudan grass. This same comparative ranking holds true for net profit and for milk and butterfat produced per acre.

6. Sudan grass furnishes most of its pasture during July and August when many other pasture crops are drying up.

7. Cows have shown a slight dislike for sweet clover when first turned in by eating all the grass obtainable before grazing the sweet clover. After the grass supply is depleted, however, they have shown no hesitancy in eating the clover. The same tendency, although less pronounced, has been observed with cows on alfalfa.

8. Less grain was fed per 100 pounds of milk and per pound of butterfat on sweet clover than on either of the other pastures. Alfalfa required the most grain.

9. No bloat has occurred on either alfalfa or sweet clover during this experiment. The rainfall, however, has been below normal during these five years.

10. The sweet clover and alfalfa were seeded with oats as a nurse crop and not pastured the first year. Contrary to the reports of most farmers, we had more difficulty in getting a stand of sweet clover than alfalfa. The sudan grass was seeded just previous to corn planting time, and we never failed to obtain a good stand.

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