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# Bulletin No. 31 - Time to Harvest Lucerne. Mulching.

J. W. Sanborn

# THE UTAH

# AGRICULTURAL COLLEGE

# EXPERIMENT STATION.

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# BULLETIN No. 31.

## TIME OF HARVESTING LUCERNE.

J. W. SANBORN.

The opinion has prevailed in scientific as well as in practical circles, that hay cut before or during bloom is more valuable, pound for pound, than when cut at a later period, and it is even maintained that the gross product per acre is more valuable. The old assumption, now somewhat modified, that as plants mature a part of the starch and sugar is converted into fibre, and that the nutrition of the stem is moved into the seed, led to the belief that early-cut hay was both more digestible and more valuable than that cut at a later period. The writer conducted experiments in New Hampshire for four years on the influence of the time of cutting on the value of timothy hay, with the result that the hay cut from eight to fifteen days after bloom was equally as valuable, if not more valuable, than the hay cut in bloom. Scientific men at once claimed that this must be an error. Subsequent experiments by others, however, have demonstrated the correctness of the position then taken, so far as timothy hay is concerned. The same was found in part to be true of clover. The experiments in question showed that hay cut after bloom weighed much more per acre than when cut in bloom.

The explanation of that fact is now made more clear in the light of recent investigations in the chemistry of plant growth. It has been shown that the amides (partially organized

protein) decrease in percentage after bloom through conversion into actual protein. It is also shown that the various forms of carbohydrates exchange ratios with each other; that not all that was formerly termed fat has been found to be fat, and that the proportion of actual fat varies at different stages of growth. So of other elements involved in plant growth. In brief, a plant while in a state of growth has a part of its materials in a state of solution in the sap of the plant instead of being organized into its final form. The problems involved in the chemical changes of plants at various stages of growth, are such that only a feeding experiment can determine the actual values at the several stages. Our feeders cut lucerne before it arrives at full bloom, and even earlier, because it is said to be more palatable, less fibrous, and because three crops instead of two can be cut by this method.

It is important to ascertain whether as much nutrition per acre can be secured in two crops as in three, and should it appear that lucerne cut slightly after bloom is as nutritious as cut in bloom, and that as much is secured from two cuttings as from three, it would economize the cost of harvesting this crop. The question is a very important one.

In an attempt to settle the question we divided the ground into six series of plats, each cutting being duplicated.

The first lot was cut before the lucerne came into bloom; the second lot in early bloom; and the third lot completely out of bloom. Second and third crops were cut from these areas, as shown in the table.

Table I gives the growth of the cattle on the lucerne cut on the dates mentioned.

## TABLE I.

### WEIGHTS OF CATTLE.

| Dates | | First Crop | | | Second Crop | | |
|---|---|---|---|---|---|---|---|
| | | Early Cut | Medium Cut | Late Cut | Early Cut | Medium Cut | Late Cut |
| Preliminary Period | Average, November 27, 28, 29 | 2129 | 2133 | 2179 | 2140 | 2058 | 2159 |
| | December 4 | 2153 | 2156 | 2190 | 2146 | 2090 | 2180 |
| | " 11 | 2140 | 2166 | 2202 | 2174 | 2084 | 2174 |
| Average, Dec. 18, 19, 20 | | 2193 | 2221 | 2256 | 2213 | 2117 | 2208 |
| December 25 | | 2216 | 2226 | 2276 | 2236 | 2160 | 2218 |
| January 1 | | 2230 | 2206 | 2278 | 2224 | 2152 | 2206 |
| " 8 | | 2228 | 2214 | 2264 | 2246 | 2180 | 2218 |
| " 15 | | 2282 | 2214 | 2302 | 2274 | 2184 | 2224 |
| " 22 | | 2260 | 2228 | 2354 | 2242 | 2162 | 2176 |
| " 29 | | 2304 | 2242 | 2316 | 2286 | 2208 | 2232 |
| February 5 | | 2326 | 2216 | 2316 | 2296 | 2256 | 2226 |
| " 12 | | 2342 | 2268 | 2336 | 2332 | 2274 | 2246 |
| Average, Feb. 19, 20, 21 | | 2340 | 2264* | 2318 | 2354 | 2259 | 2240 |
| Gain from December 20 to February 21 | | 147 | 43 | 62 | 141 | 142 | 32 |
| Gain per day per steer from Dec. 20 to Feb. 21. | | .778 | .234 | .328 | .743 | .751 | .169 |

Fed mixed hay preliminary period.
*110 lbs. mixed hay included.

The results are not in accord with my experiments with timothy hay, and not fully in accord with those made with red clover. Whether the table represents the influence of relative nutritive value of lucerne cut at the several periods, or whether it is one of the accidents of the experiment I am unable to say; but the earliest cut lucerne, both of the first and second crops, did better than the latest cut, while for the second crop the result was almost identical, whether it was cut early or cut at a medium period.

The amount consumed is the final determining factor, and this is found in Table II:

## TABLE II.

FEED, LUCERNE.

| Feed. | First Crop | | | Second Crop | | |
|---|---|---|---|---|---|---|
| | Early Cut | Medium Cut | Late Cut | Early Cut | Medium Cut | Late Cut |
| Total fed | 3100 | 3100* | 3100 | 3100† | 3100 | 3100 |
| Waste | 234.75 | 476.5 | 184.75 | 163.25 | 72.75 | 374 |
| Total eaten | 2865.25 | 2623.5 | 2915.25 | 2936.75 | 3027.25 | 2726 |
| Amount eaten per day, per steer | 15.16 | 14.33 | 15.42 | 15.53 | 16.02 | 14.42 |
| Cost of feed per day, per steer, $5 ₱ ton, in cents. | 3.79 | 3.58 | 3.85 | 3.88 | 4.00 | 3.60 |

* 110 pounds mixed hay included.
† 495 pounds mixed hay included.

This table shows no material difference in the amount eaten, except that which was cut in bloom was not so well eaten as that early cut or that cut later, an accident probably in the appetite of the particular lot fed. For the second crop it is noticed that the late cut was not relished, but again the medium cut, or that cut in bloom, was better than that early cut.

On the whole the amount eaten was so nearly equal as to seem not to have had the determining influence noted, but on the whole rather strengthens the tendency of the first table in favor of early cut lucerne.

The next table gives the time of cutting and the yield per acre. This is a very important factor. Farmers have long been in doubt whether by cutting three crops they receive more per acre than when cutting two crops. If they do not receive more they are at the expense of the extra time in cutting, and probably with the slightly deleterious influence of excessive cutting. The table shows that the late cut lucerne in two crops gave as large a yield as when cut early and three crops taken. The only advantage that occurred from cutting three crops was the superiority in its nutritive effect. That medium cut, or cut at bloom, also yielded as much as when cut early.

On the whole the balance of effect is favorable to the early cutting, due to the superior nutritive effect; but as it is not in accord with experiments heretofore conducted by the writer with timothy, and not in full accord with experiments with red clover, it is believed the conclusions should be suspended until further experiments verify the results of this.

Furthermore, experiments in slaughtering cattle and study of composition as affected by food, lead to the belief that the flesh of those receiving early-cut hay contains more water and less fat. This factor requires investigation.

## TABLE III.

| Cutting | First Crop | | | Second Crop | | | Third Crop | | | Total Yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cut | Weighed | Yield per Acre, Lbs. | Cut | Weighed | Yield per Acre, Lbs. | Cut | Weighed | Yield per Acre, Lbs. | |
| Early cutting. | June 22 | June 26 | 3558 | July 31 | Aug. 3 | 2130 | Oct. 5 | Oct. 10 | 1494 | 7182 |
| Medium " | July 3 | July 6 | 3411 | Aug. 17 | " 22 | 2871 | " " | " " | 876 | 7158 |
| Late " | " 17 | " 20 | 4095 | Sep. 9 | Sep. 13 | 3027 | ..... | ..... | ..... | 7122 |

SUMMARY.

1. Early-cut lucerne gave a greater gain than late-cut lucerne.

2. As large a crop was received from two cuttings as from three, whether the first cutting was at an early period or at a medium period of its growth.

3. As early-cut hay gave a slightly better gain, the balance of the experiment favors early cutting.

4. It is assumed, not known, that the character of the growth from early-cut lucerne would not be as substantial as from the late-cut.

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## MULCHING.

Mulching is covering the soil with some material that will prevent evaporation of moisture. The material generally used is straw. In a trial by the writer in the rainy section of this country it was found that a mulched area during a period of prolonged drouth, contained 150,000 lbs. more water per acre than an unmulched area, and yielded 50 bushels more of potatoes. The ground was soft beneath the mulch; the moisture apparently uniform to the surface, and the potatoes grew practically on the surface, some of them being in plain sight when the straw was removed. The ground, of course, did not require cultivation, and it was very easy digging the potatoes.

We hoped to find in the arid region that mulching the ground before the moisture from the winter snows and spring rains had been evaporated would retain a sufficient amount of water to produce a fair crop. To ascertain this point, plats were laid out in 1890.

Plat 50 received one irrigation, Plat 51 two irrigations, and Plat 52 three irrigations, each plat being mulched. Plat 53 was irrigated three times, but not mulched; Plat 54 unirrigated but mulched, Plat 55 unirrigated and unmulched. The thought involved in these experiments was to ascertain the value of mulch-

ing in lessening the number of times of irrigating, and to ascertain whether any gain was made on the mulched over the unmulched area. Unfortunately the experiment is laid out on a section where the rock subsoil comes near the surface, and the results have been disappointing, and in fact practically valueless. It will be transferred to a more favorable area of the farm. I include the tables without comment upon them:

## TABLE I.

YIELD OF POTATOES IN BUSHELS PER ACRE, 1890.

| Year | 50 One Irrigation, Mulched | | 51 Two Irrigations, Mulched | | 52 Three Irrigations, Mulched | | 53 Three Irrigations, Not Mulched | | 54 Unirrigated, Mulched | | 55 Unirrigated, and Unmulched | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Merchantable | Small | Merchantable | Small | Merchantable | Small | Merchantable | Small | Merchantable | Small | Merchantable | Small |
| 1890 ..... | 12.5 | 20.83 | 25.33 | 22.16 | 25.33 | 16.33 | 24.33 | 19. | 27. | 19. | 48.66 | 30. |
| Total per acre.. | 33.33 | | 47.49 | | 41.66 | | 43.33 | | 39.33 | | 78.66 | |

## TABLE II.

YIELD OF CORN AND FODDER, POUNDS PER ACRE, 1891, (GREEN WEIGHT.)

| Date | 49 One Irrigation, Mulched | 50 Two Irrigations, Mulched | 51 Three Irrigations, Mulched. | 52 Three Irrigations, Not Mulched | 53 Not Irrigated. Mulched | 54 Not Irrigated, Not Mulched |
|---|---|---|---|---|---|---|
| 1891 ..... | 2400 | 3100 | 4200 | 4400 | 2200 | 3100 |

## TABLE III.

YIELD OF WHEAT PER ACRE, 1892 AND 1893.

| Date | Two Irrigations Mulched | | Three Irrigations Mulched | | Three Irrigations Not Mulched | | Not Irrigated Mulched | | Not Irrigated Not Mulched | | One Irrigation Mulched | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wheat | Straw | Wheat | Straw | Wheat | Straw | Wheat | Straw | Wheat | Straw | Wheat | Straw |
| 1892 | 10. | 12.40 | 10.33 | 480 | 14. | 2360 | 4.33 | 740 | 3. | 2320 | 6.66 | 800 |
| 1893 | 6.5 | 710 | 8.17 | 810 | 9.5 | 930 | 1. | 440 | 1.33 | 320 | 2.33 | 460 |
| Average | 8.25 | 975 | 9.25 | 645 | 11.25 | 1645 | 2.66 | 5.90 | 2.16 | 1320 | 4.49 | 630 |

## TABLE IV.

MOISTURE, 1893, SEVEN DAYS AFTER IRRIGATING.

| Date | Three Irrigations, Mulched | | Three Irrigations, Not Mulched | | Unirrigated and Mulched | | Unirrigated, Not Mulched | | One Irrigation, Mulched | | Two Irrigations, Mulched | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth | | Depth | | Depth | | Depth | | Depth | | Depth | |
| | 3 | 12 | 3 | 12 | 3 | 12 | | 12 | 3 | 12 | 3 | 12 |
| June 27 | 10.08 | 12.16 | 10.22 | 13.78 | 5.34 | 7.50 | 1.58 | 5.56 | 9.08 | 12.08 | 11.20 | 11.00 |
| July 19 | 8.52 | 13.24 | 3.66 | 11.02 | 2.66 | 3.76 | 2.22 | 3.10 | 2.44 | 4.02 | 4.34 | 11.72 |
| August 2 | 10.50 | 19.04 | 8.00 | 8.12 | 2.72 | 3.48 | 2.30 | 4.10 | 2.60 | 3.18 | 4.02 | 5.80 |
| Average | 9.70 | 14.81 | 7.29 | 10.97 | 3.57 | 4.91 | 2.03 | 4.25 | 4.70 | 6 42 | 6.52 | 9.50 |
| Plat average | 12.25 | | 9.13 | | 4.24 | | 3.14 | | 5.56 | | 8.01 | |

It will be seen from Table IV, that mulching had a very direct relation to the amount of moisture held in the soil, and that the mulched area was successful so far as its relation to moisture conservation is concerned.

## TABLE V.

TEMPERATURE, 1893.

| Date | Three Irrigations, Mulched | | | Three Irrigations, Not Mulched | | | Unirrigated and Mulched | | | Unirrigated not Mulched | | | One Irrigation Mulched | | | Two Irrigations, Mulched | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth | | | Depth | | | Depth | | | Depth | | | Depth | | | Depth | | |
| | 1 | 3 | 6 | 1 | 3 | 6 | 1 | 3 | 6 | 1 | 3 | 6 | 1 | 3 | 6 | 1 | 3 | 6 |
| June 24, 4 days after irrigation | 65 | 58 | 58 | 64 | 62 | 60 | 80 | 75 | 70 | 75 | 69 | 66 | 59 | 57 | 58 | 61 | 58 | 59 |
| July 17, 5 days after irrigation | 75 | 73 | 69.5 | 97 | 88 | 79 | 103 | 91.5 | 87 | 111 | 100 | 88 | 96 | 95 | 85 | 87 | 91 | 77.5 |
| July 29, 3 days after irrigation | 66 | 65 | 65 | 74 | 68 | 67 | 80 | 78 | 73 | 83 | 79 | 79 | 84 | 81 | 76 | 82 | 76 | 71 |
| Average | 68.7 | 65.3 | 64.2 | 78.3 | 72.7 | 68.7 | 87.7 | 81.5 | 68.7 | 89.7 | 82.7 | 77.7 | 79.7 | 77.7 | 73. | 76.7 | 75. | 69.2 |
| Plat average | 66.06 | | | 73.23 | | | 79.3 | | | 83.36 | | | 76.8 | | | 73.63 | | |

The above table shows a clear and unmistakable relation between mulching and temperature of the soil. This is a well understood fact, and is used by horticulturists in retarding the maturity of fruits that they may be on the market later in the season. The writer has found in other trials that the fluctuation of temperature between night and day is less wide under mulched areas. The lowering of temperature by mulching for sub-tropical plants has proved unfavorable, especially to corn, as corn needs a warm soil.

Further trials on more favorable areas may ultimate in showing that the reduction of the temperature of the soil in this northern climate may sacrifice in this direction all that is gained by the additional amount of water conserved by the operation. I would invite the attention of our farmers, who have no available water supply, to this opportunity to hold in the soil the water of the winter snows and spring rains. It seems probable to the writer from experiments elsewhere conducted by him that on such soils it will be found that mulching will be more or less effective and perhaps economical, though the experiment above does not at all confirm the soundness of this view.