Influence of Harvest Management on Level of Carbohydrate Reserves, Longevity of Stands, and Yields of Hay and Protein from Vernal Alfalfa

Cyril A. Kust and Dale Smith

VERNAL alfalfa is a very winter-hardy and bacterial wilt-resistant variety used widely for hay and pasture in the North Central area of the United States. It consistently has yielded as much or more hay and protein per acre as other varieties in field trials conducted throughout Wisconsin. In addition, Vernal can be cut seven times per year at the 1/10-bloom stage in Wisconsin, to obtain high quality hay and silage, without rapidly reducing the longevity of yields from the stand.

Stand maintenance of and hay yields from alfalfa are influenced greatly by the number of harvests taken each year, the interval between harvests (5, 7, 8, 10), and the date of the last cutting in the fall of the year (2, 3, 4, 8, 10). Most of the varieties used were susceptible to bacterial wilt but some were very winter hardy. Therefore, it seemed advisable to determine the manner in which Vernal, a very winter-hardy and wilt-resistant variety, was affected by frequency of and interval between harvests in relation to its capacity to maintain vigorous and high-yielding stands.

MATERIALS AND METHODS

Certified seed of Vernal alfalfa was sown at 10 pounds per acre in April, 1955, with a corrugated-roller seeder on 2 areas of Miami silt loam at Madison, Wis. The soil pH and fertility were adjusted to the recommended levels by topdressing during the fall of each year. The stands were in very good condition in the spring of 1956.

In one area (Experiment I), 4 cutting treatments were applied during 1956 and 1957 in a randomized complete block design with 4 replications. The individual plot size was 27 by 13 feet. The treatments were: A—3 harvests taken at the 1/10 bloom stage prior to September 1 and a fourth harvest taken on October 1; B—3 harvests taken at the 1/10-bloom stage prior to September 1; C—2 harvests taken at the full-bloom stage prior to September 1; and D—2 harvests taken at the full-bloom stage prior to September 1 and a third harvest taken on October 1. In 1958, one harvest was taken on May 29 to measure the residual effects of the 2 previous treatment years.

Hay yields were obtained by weighing the herbage from a 38-inch swath cut through the center of each plot. Visual estimates were made of the percent of alfalfa in the fresh material moisture content was determined by oven-drying samples to constant weight at 140°F. Yields are reported as tons of oven-dry, weed-free alfalfa hay per acre.

Alfalfa herbage was collected from each harvest on each harvest date, oven dried, ground, and analyzed for total nitrogen by the Kjeldahl method (1). Yields of crude protein per acre were calculated from the forage yield samples dried at 140°F. Protein content was determined by the Somogyi method (11).

In Experiment II, 8 treatments, consisting of all combinations of 4 frequencies and 2 heights of cutting, were arranged in a randomized complete block design with 8 replications. Each plot was 13 by 10 feet. Plots were cut 6, 5, 4, or 3 times each year during 1956 and 1957 at intervals of 22, 28, 34, or 48 days, with the first cutting being taken on May 16, May 31, June 11, and August 30, respectively. Plots within each frequency were cut to heights of either 1 inch or 3 inches. No harvests were taken later than the first week in September. In 1958, one harvest was taken on June 11 to measure the residual effects of the 2 previous treatment years.

Hay yields were obtained by hand-clipping the vegetation from within a 2X3-foot quadrat placed twice at random within each plot. The vegetation was then handled in the same manner as described for Experiment I for both hay yields and protein content. Alfalfa plants were collected from each plot with a 6-inch diameter core cutter on November 2 in 1956 and 1957. The plants were then handled in the same manner as in Experiment I to obtain the percent of total available carbohydrates in the storage tissues. In addition, the plants in each soil core were counted and the dry weight of tissue from each core was determined after the plants were trimmed in the laboratory.

RESULTS AND DISCUSSION

Experiment I—Effects of Fall Cutting

The yields of oven-dried forage in tons per acre are presented in Table 1. The yields were not significantly different among treatments in the first harvest year regardless of the number or time of the cuttings. The average yield of all 4 cutting treatments was 4.20 tons per acre. However, plants in treatments that were cut during the fall of the first harvest year (1956) yielded less than those not cut during the fall. The reduction in hay yield in 1957 due to previous fall cutting was greater when 3 cuttings were taken (A) than when 2 cuttings were taken prior to September 1 (D). The detrimental effect of fall cutting also was apparent in the present treatment taken on May 29, 1958. At that time, Treatment B yielded 1.59 tons per acre but Treatment A yielded only 0.54 tons per acre and Treatment C yielded 1.88 tons per acre but Treatment D yielded only 1.33 tons per acre (LSD at 5% level was 0.48). The highest forage yields in 1957 and 1958 were recorded in Treatment E, which yielded 8.17 tons per acre.

Table 1—Yields of forage and protein from Vernal alfalfa in 1956 and 1957 under 4 different cutting treatments.

<table>
<thead>
<tr>
<th>Treatment*</th>
<th>Forage, tons per acre</th>
<th>Protein, tons per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>1957</td>
<td>Total 1956</td>
</tr>
<tr>
<td>A</td>
<td>4.46</td>
<td>1.76</td>
</tr>
<tr>
<td>B</td>
<td>4.02</td>
<td>4.89</td>
</tr>
<tr>
<td>C</td>
<td>3.76</td>
<td>4.72</td>
</tr>
<tr>
<td>D</td>
<td>4.55</td>
<td>3.82</td>
</tr>
</tbody>
</table>

* A = 4 cuts per year (June 6, July 13, August 26, October 1); B = 3 cuts per year (June 6, July 13, August 30); C = 3 cuts per year (June 20, August 29); D = 3 cuts per year (June 21, August 30, October 1). 
Yields not statistically different in 1956. LSD at 5% level was 1.46 tons in 1957 and 1.49 tons for total yields.