Rogue Valley Harvest Schedule Trials: 1990 - 1992

Summary

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Introduction

Alfalfa continues to be an important crop in the Rogue River Valley of SW Oregon. There are significant areas of deep, moderately well drained or well-drained soils that are well suited to alfalfa production. It is sometimes grown without irrigation, but maximum yields are obtained with irrigation.

A typical schedule is to cut the first harvest in late May, with the second cutting about 5 weeks later in early July, the third cutting another 5 weeks later in mid-August, and the last cutting another 5-6 weeks later in late September. In most years, irrigation is not required nor is it beneficial prior to the first cutting due to the typical rain showers during April and May that are sufficient for growth and can interfere with hay curing after cutting. However, in some years, warm and dry April and early May weather allows for more vigorous spring growth and good hay curing conditions in early May. Some growers decide to take an early first harvest in these situations, with the hope that they may realize a greater seasonal yield by perhaps making five harvests before fall rains come, or at least to stretch out the regrowth time intervals between harvest dates, and thus perhaps increase yields of other cutting dates during the summer.

The objective of this study was to compare various alfalfa harvest schedules to see if alternatives to the standard schedule would result in greater seasonal yield or differences in forage quality.

1990 Results

Materials & Methods

An existing alfalfa field was used in this study at the Southern Oregon Research & Extension Center, near Central Point, OR. The field had been planted in April, 1989 with alfalfa variety WL-320, purchased locally from a commercial source. Seven cutting schedule treatments were laid out across the field in a randomized complete block design with 4 replications. Individual yield plots were 198 ft by 6 ft. Plots were cut, cured, and baled using small commercial farming equipment, and yield was calculated on a dry-weight basis. The effect of harvest schedule on forage quality was approximated by noting forage maturity for each cutting schedule.

In 1990 and subsequent years, the experimental areas were fertilized and irrigated according to standard local practice. This typically included application of mixed granular fertilizer during the winter to supply 0-90-180-90 lb/ac of N, K₂O, P₂O₅, and S, respectively. Experimental areas also received an herbicide application each December. This was a tank mix of diuron @ 1.6 lb a.i/ac plus paraquat @ 0.78 lb ae/ac plus

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1 Brand names of herbicides used in this experiment are mentioned for the convenience of the reader only, and do not imply registration or recommendation for use by the author or Oregon State University.
surfactant, applied through a tractor-mounted boom sprayer. Irrigation was not applied prior to first cutting in any year. Between cuttings (between 2nd and 3rd, and between 3rd and 4th cuttings), the plot areas were irrigated, typically twice at 4.8 inches per application, unless unusual weather made a particular irrigation event unnecessary or unworkable given the cutting schedule. In the one case where five cuttings were made (treatment 4 in 1990), an additional irrigation was applied after the 4th cutting.

The seven treatments for 1990 are listed in Table 1. As compared to a typical or "standard" schedule for this region, the treatments examined the effect of an early first cutting, a late fourth cutting, extended regrowth period between first and second or third and fourth cuttings, as well as an optional fifth cutting. Because fall regrowth is sometimes significant, but seldom utilized, a simulated late fall “grazing” treatment was also performed, and its effect on regrowth and yield the following spring was measured to see if fall grazing could be of any benefit in certain situations.

Results & Discussion

First Cutting

Not surprisingly, the early first cutting date for treatments 2, 3, 4, 5, and 7 decreased yield compared to the later first cutting date for treatments 1 and 6 (Fig. 1).

Second Cutting

The second cutting yields were maximized by either of two situations: 1) The long (57 day) regrowth period for treatments 2 and 7, or: 2) The later regrowth period for treatments 1 and 6 (Fig. 1). Although these two treatments had the same length of time to regrow as did treatments 3, 4, and 5, the day length was longer and temperatures were warmer for treatments 1 and 6 (from June 4 to July 16) compared to treatments 3, 4, and 5 (May 7 to June 18). In effect, the yield produced from 42 days of regrowth from early June to mid- July was statistically the same as 57 days of regrowth from early May to early July.

Third Cutting

The regrowth period for all seven treatments was virtually identical, and there was no significant difference in yield (Fig. 1). It was interesting that the treatments regrowing from mid June through late July (treatments 3, 4, 5) had the same yield as those regrowing from mid July to late August (treatments 1, 6). Mid-summer heat typically reduces alfalfa yield, and this may have been the controlling factor.

Fourth & Fifth Cutting

As was the case for the second cutting, day length and regrowth period were both important. The greatest yield occurred for treatment 5, where regrowth period was longest (48 days), and that period occurred during the relatively longer days of late July to mid September (Fig. 1). The importance of day length was shown where treatments 3 and 4 (32 days of regrowth from late July to late August) had significantly greater yields than treatments 6 and 7 (48 days of regrowth from mid or late August until late September or early October). The minimal benefit of the shorter day length in late
September are shown when comparing treatments 2 and 7. The regrowth period for both started on August 10, but extended 16 days longer into late September for treatment 7. The yield, however, was not different between the two treatments. Treatment 1, with the same regrowth period length as treatments 2,3,4 had the lowest fourth cutting yield of all, probably due to the later time period when that regrowth occurred compared to treatments 2,3,4. The late 5th cutting for treatment 4 added very little to its overall yield due to the short regrowth period and short day length during that time, and did not result in a significantly different yield as compared to treatment 3. (Also note that, for whatever reason, treatment 4 had a slightly greater, yet statistically insignificant, yield than treatment 3 for every cutting, which somewhat masks the negligible contribution of treatments 4’s 5th cutting to the total yield).

**Yearly Total and Practical Considerations**

Treatment 6, with its standard first cutting and delayed 4th cutting, had the greatest annual yield of all treatments (Fig. 1). However, alfalfa cutting after about Oct. 1 is a very risky practice, due to the potential for fall rain and the slow drying conditions (due to short days and heavy dew), which requires hay to be left in the field 6-8 days to cure even under good conditions. Treatments 1,4,5,7 followed in a tightly bunched group. Each had an advantage for one of the cuttings, and the desirability of one schedule over the other depends on production needs such as delivery schedule and relative quality. For the treatments which were cut in early May, this also depends on good drying weather at that time. Often, spring rains persist until late May, making it difficult to time the first cutting so as to allow the full 5-7 days drying time required at that time. For the reasons mentioned above, a 5th cutting (treatment 4) is possible only when good drying conditions exist both in early May and in October. Treatments 2 and 3 yielded the least overall, indicating that an early first cutting was not advantageous, even with a longer regrowth period after first cutting (treatment 2) unless there was also a longer than standard regrowth period at some point later in the season.

**Fall Regrowth and Grazing Potential**

Small areas (3 ft x 50 ft) within the larger yield plots were cut close to the ground on November 20, 1990. These were dried and weighed to simulate the effect of allowing livestock to graze down the fall regrowth. Not surprisingly, the four treatments whose last harvest occurred in late September or in October (treatments 1,4,6,7) had very little fall regrowth (Fig. 2). Treatments 3 and 5 had the most fall regrowth, consistent with their late August or mid September final harvest date. It is interesting that treatment 2 fell in between the two groups in both absolute and statistically significant terms. Its final harvest date was similar to treatment 5, yet its fall regrowth was significantly less. The main difference between treatment 2 and 5 prior to the fourth cutting is the longer regrowth period between the third and fourth cuttings for treatment 5. Perhaps this resulted in increased carbohydrate storage in the roots that allowed the alfalfa in treatment 5 to regrow more quickly than treatment 2 during the short, cool days of fall.

To measure the effect of late fall simulated grazing, yields were measured from the same areas the following spring on May 22, 1991. There was no significant difference
between the fall “grazed and “non-grazed” areas for a particular treatment (Fig. 2). The pattern among the cutting schedule treatments followed the pattern of the late fall simulated grazing harvest, with treatments 3 and 5 having the largest 1991 first cutting yield, and treatments 1 and 7 the lowest). This pattern was slightly more enhanced for the plots that had received the late fall simulated grazing cut compared to those that didn’t. This suggests that an extended regrowth period after the fourth cutting could improve the ability of the plants to store carbohydrate reserves in the roots and thus begin growing more vigorously the following spring. This effect did not seem to be affected at all by a late fall simulated grazing, indicating that such carbohydrate storage was complete by late November, and thus unaffected by cutting the above-ground biomass at that time.

1991 Results

Materials & Methods

For rotational reasons, the field that was used for the alfalfa harvest schedule test in 1990 could not be used during 1991. Instead, a similar trial was laid out and installed on a nearby field, also with four replications in a randomized complete plot design. Individual yield plots were 6 ft by 200 ft, and were harvested and baled using the same equipment as had been used in 1990. This new field had been planted in 1990 with variety WL-320.

Only five harvest schedule treatments were included in 1991 (Table 2). The two treatments requiring a final harvest in October in 1990 (treatments 4 and 6) were not repeated in 1991, as those schedules would not be practical in most years. The first cutting date for the early first cut treatments was two days later than the analogous harvest date in 1990, but due to weather, the first cutting for the “standard” treatment was eleven days earlier in 1991 as compared to 1990. These two factors combined so that the first harvest date of the “early” and “standard” treatments were nearly two weeks closer together in 1991 than they had been in 1990.

Results & Discussion

First Cutting

Not surprisingly, the standard schedule (treatment 1) had a greater yield at first cutting than the other treatments due to the longer spring growth period (Fig. 3).

Second Cutting

Not surprisingly, the longer regrowth period for treatments 2 and 5 compared to 3 and 4 resulted in a larger yield at second cutting (Fig. 3). What is more interesting is that the yield from those two treatments, which had 54 days regrowth after first cutting, were almost exactly the same as the second cutting yield of treatment 1, which had only 39 days regrowth between the cuttings. It appeared that the longer and warmer days between first and second cutting for treatment 1 (late May to early July) were much more favorable to growth than the analogous periods for treatments 3 and 4 (early May to mid June). This was a similar result to that seen in 1990 for second cutting results.
**Third Cutting**

Even though the regrowth period between second and third cutting was identical for all five treatments, yield for treatments 3 and 4 still lagged somewhat behind the others (Fig. 3). No explanation is apparent for this effect.

**Fourth Cutting**

The longer regrowth between third and fourth cutting for treatments 4 and 5 resulted in significantly greater yield as compared to the other three treatments. The 52 day regrowth period for treatment 4 occurred during a period of slightly longer days than was the case for treatment 5, which may have resulted in the significantly greater yield for treatment 4.

**Yearly Total and Practical Considerations**

The standard schedule (treatment 1) had a significantly greater yield than all other treatments (Fig. 3). The added yield due to the growth in May before first cutting, as well as favorable growth in late May and June between first and second cutting, were too large for any of the other treatments to make up. If an extended regrowth period is possible during the season, it is clear that a longer regrowth period is more beneficial early in the season rather than late in the season (compare treatments 2,4,5). Weather clearly influences scheduling decisions, especially for the first and fourth cutting, but making an early first cut is not necessarily any better than allowing normal spring growth and taking the first cut later in May.

**Fall Regrowth and Grazing Potential**

Smaller areas (3 ft x 50 ft) within the larger yield plots were cut on November 25, 1991, to simulate late fall grazing. There was very little difference in the fall simulated “grazing” yield for any of the summer harvest schedule treatments (Fig. 4). It was a bit surprising that fall regrowth was not greater for treatment 3, which had been cut for the last time on Aug. 28, at least two weeks earlier than any of the others. The only statistically significant difference was between treatment 4 and 5. Both had a 52 day regrowth period between third and fourth cutting, but that regrowth period occurred 15 days earlier for treatment 4 compared to treatment 5. Perhaps the combination of the long regrowth before the fourth cutting and the slightly earlier time frame was enough for treatment 4 to make a quicker initial leaf regrowth using increased root reserves after the fourth cutting (as compared to treatments 1,2,3), while taking advantage of the somewhat better growing weather in mid to late September (as compared to treatment 5), resulting in the pattern of fall regrowth seen. After yield plots were cut to simulate grazing, the entire experimental area was mowed close to the ground to minimize carryover effects between treatments and “grazed” vs. “non-grazed” areas for the following year’s comparisons.
1992 Results

Materials & Methods

The same area was used for the trial in 1992 as had been used in 1991. The five cutting schedule treatments were also the same in 1992 as in 1991 (Table 3). Due to similar weather conditions, the actual harvest dates in 1992 ended up being very close to the analogous 1991 harvest dates. To again measure fall regrowth potential for the various cutting schedules, a simulated “grazing” harvest was made on December 4, 1992 using the same equipment and methods as in 1991. To measure the effect of summer cutting schedule and fall “grazing” on the next spring’s regrowth, the areas receiving the simulated fall grazing cut were harvested for yield again on April 30, 1993.

Results & Discussion

First Cutting

Not surprisingly, the standard first cutting yielded significantly more than the other four treatments by virtue of the extra 14 days of growth before the first cutting (Fig. 5). This result is essentially the same as in 1991.

Second Cutting

The two treatments with the long interval between first and second cutting had significantly greater yields than the other three treatments (Fig. 5). This was the same result as in 1991 as compared to treatments 3 and 4, but in 1992, treatment 1 did not grow as rapidly between the first and second cutting as it did in 1991, and thus had a significantly lower yield than treatments 2 and 5 in 1992.

Third Cutting

The interval between second and third cutting was essentially identical for all treatments, and thus yield differences were likely due to environmental factors such as day length, temperature, and water stress (Fig. 5). The two treatments with the greatest yield (3 and 4) were growing earlier in the summer (mid June to mid July vs. early July to early August for the other three treatments), and thus experienced longer days and less heat stress. This result is different than that observed in 1991, but seems to be more consistent with known environmental factors than the 1991 results were.

Fourth Cutting

The longer days experienced by treatment 3 between third and fourth cutting were the likely reason for its significant yield advantage compared to treatments 1 and 2, which had essentially the same regrowth period (Fig. 5). Treatment 3 also had virtually the same yield as treatment 4, which had an additional 17 days of regrowth in late August and early September, suggesting that those shorter days added little to yield. Treatment 5 was intermediate between the two groups, benefiting somewhat from the extra 18 days of regrowth compared to treatments 1 and 2, but not being able to make up for the greater growth rate of treatments 3 and 4 which occurred earlier in the season. These results follow a similar pattern to those observed in 1991 with the exception of treatment 3. In
1992, treatment 3 had a relatively greater yield than was seen in 1991, suggesting better growing conditions during late July and early August in 1992 compared to 1991.

**Yearly Total and Practical Considerations**

The differences in annual yield totals were non-significant for all treatments (Fig. 5). The differences between treatments for each cutting were less pronounced in 1992, especially for the first and second cutting, where absolute yield is nearly always greater than later cuttings, and thus contributes most to overall yield values. In addition, the reversal of yield for treatments 3 and 4 for the second cutting and treatment 4 for the third cutting (as compared to 1991), also contributed to the minimal differences observed between treatments for the 1992 annual yield total.

**Fall Regrowth and Grazing Potential**

The overall amount of fall regrowth was lower in 1992 than in 1991 (Fig. 4). In 1992, treatment 3, with its earlier 4th cutting date (Aug. 24) and thus longer fall regrowth period, had a significantly greater yield than the other treatments. The other treatments basically fell in line according to their date of fourth cutting, with treatments 1, 2, 4 (last cut on Sept. 10) having a significantly lower yield than treatment 3, but greater yield than treatment 5 (last cut on Sept. 28). Unlike 1991, the fall regrowth was more clearly affected by the last summer date, rather than length of previous regrowth periods, late summer weather, or other factors, which seemed to come into play in 1991 for treatments 3 and 4 especially.

Regrowth in Spring 1993 was measured by cutting the simulated “grazing” areas again on April 30, 1993. Because the “non-grazed” areas were not measured, and the entire experimental area had been mowed shortly after the simulated fall grazing measurements in 1992, no comparison can be made between the effects of “grazing” vs. “non-grazing”, only the effects of the previous year’s harvest schedule.

Spring regrowth was similar for all treatments, indicating that the previous summer’s harvest schedule had no measurable effect on the following spring’s growth (Fig. 4). However, it is interesting that the slight differences in spring regrowth followed the same pattern as the fourth cutting yields the previous summer, the same result as was observed in spring 1991. This suggests that an extended regrowth period after the fourth cutting could improve the ability of the plants to store carbohydrate reserves in the roots and thus begin growing more vigorously the following spring.

**Study Conclusions**

In SW Oregon, the sometimes warm and dry weather experienced in late April and early May make it tempting to take an earlier-than normal first harvest. However, overall yield is usually not improved by this method, because the longer regrowth period this early in the season does not translate into enough of an increased yield, especially for the second cutting, to make up the difference. Similarly, an early first cutting does allow for longer regrowth periods later in the summer as well, but this does not necessarily translate into increased yields at later cutting dates either. Long regrowth periods tend to result in more mature (lower quality) hay no matter when they occur, but the effect seems
more pronounced later in the summer. If weather is favorable for an early first cutting, it may improve curing and baling operations as compared to conditions in late May or early June. However, unless the weather is especially dry and favorable for an early May first cutting, there is no consistent yield benefit to be gained by taking that risk.
Table 1. Alfalfa Harvest Schedule 1990. Southern Oregon Research and Extension Center, Central Point, OR.

<table>
<thead>
<tr>
<th>Treatment Number &amp; Name</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Standard</td>
<td>4-Jun (5% bloom)</td>
<td>16-Jul (5% bloom)</td>
<td>Aug. 23 (5% bloom)</td>
<td>32</td>
<td>Sept. 25 (Early Bud)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Early First</td>
<td>7-May (Late Veg)</td>
<td>3-Jul (Late Bud)</td>
<td>Aug. 10 (Late Bud)</td>
<td>32</td>
<td>Sept. 11 (Mid Bud)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Early All</td>
<td>7-May (Late Veg)</td>
<td>18-Jun (Early Bud)</td>
<td>27-Jul (Late Bud)</td>
<td>32</td>
<td>Aug. 28 (Late Bud)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Early All plus 5th cut</td>
<td>7-May (Late Veg)</td>
<td>18-Jun (Late Bud)</td>
<td>27-Jul (Late Bud)</td>
<td>32</td>
<td>Aug. 28 (Late Bud)</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>5. Early 1,2,3 plus Late 4th</td>
<td>7-May (Late Veg)</td>
<td>18-Jun (Late Bud)</td>
<td>27-Jul (Late Bud)</td>
<td>48</td>
<td>Sept. 13 (Late Veg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Standard 1,2,3 plus Late 4th</td>
<td>4-Jun (5% bloom)</td>
<td>16-Jul (5% bloom)</td>
<td>Aug. 23 (5% bloom)</td>
<td>48</td>
<td>Oct. 11 (Mid Bud)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Early 1st &amp; Late 4th</td>
<td>7-May (Late Veg)</td>
<td>3-Jul (Late Bud)</td>
<td>Aug. 10 (Late Bud)</td>
<td>48</td>
<td>Sept. 27 (Late Bud)</td>
<td></td>
<td></td>
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</tbody>
</table>

Fig. 1. Yields for Alfalfa Harvest Schedule Trial, 1990

For each cutting, treatments with the same letter are not significantly different at P = 0.05 using the protected LSD test.
Fig. 2. Yield for Alfalfa Harvest Schedule 1990-91
Simulated Fall "Grazing" & Spring Regrowth

<table>
<thead>
<tr>
<th>Treatment Name</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Standard</td>
<td>24-May (Early Bud)</td>
<td>39</td>
<td>2-Jul (Late Bud)</td>
<td>35</td>
<td>Aug. 6 (Late Bud)</td>
<td>37</td>
<td>Sept. 12 (Mid Bud)</td>
</tr>
<tr>
<td>2. Early First</td>
<td>9-May (Mid Veg)</td>
<td>54</td>
<td>2-Jul (Late Bud)</td>
<td>35</td>
<td>Aug. 6 (Late Bud)</td>
<td>37</td>
<td>Sept. 12 (Mid Bud)</td>
</tr>
<tr>
<td>3. Early All</td>
<td>9-May (Mid Veg)</td>
<td>39</td>
<td>17-Jun (Late Veg)</td>
<td>35</td>
<td>22-Jul (Mid Bud)</td>
<td>37</td>
<td>Aug. 28 (Late Bud)</td>
</tr>
<tr>
<td>4. Early 1,2,3 plus Late 4th</td>
<td>9-May (Mid Veg)</td>
<td>39</td>
<td>17-Jun (Late Veg)</td>
<td>35</td>
<td>22-Jul (Mid Bud)</td>
<td>52</td>
<td>Sept. 12 (1% bloom)</td>
</tr>
<tr>
<td>5. Early 1st &amp; Late 4th</td>
<td>9-May (Mid Veg)</td>
<td>54</td>
<td>2-Jul (Late Bud)</td>
<td>35</td>
<td>Aug. 6 (Late Bud)</td>
<td>52</td>
<td>Sept. 27 (1% bloom)</td>
</tr>
</tbody>
</table>
Fig. 3. Yields of Alfalfa Harvest Schedule Test, 1991

For each cutting, treatments with the same letter are not significantly different at $P = 0.05$ using the protected LSD test.

Fig. 4. Simulated Fall "Grazing" Yield in 1991 & 1992, and 1993 Spring Regrowth for Alfalfa Harvest Schedule Trials.

For each cutting, treatments with the same letter are not significantly different at $P = 0.05$ using the protected LSD test.
Table 3. Alfalfa Harvest Schedule 1992. Southern Oregon Research and Extension Center, Central Point, OR.

<table>
<thead>
<tr>
<th>Treatment Number &amp; Name</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
<th>Days Regrowth Between Cuts</th>
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<th>Days Regrowth Between Cuts</th>
<th>Harvest Date (Growth Stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Standard</td>
<td>2-May (1% bloom)</td>
<td>41</td>
<td>2-Jul (Late Bud)</td>
<td>33</td>
<td>Aug. 4 (Late Bud)</td>
<td>37</td>
<td>Sept. 10 (Mid Bud)</td>
</tr>
<tr>
<td>2. Early First</td>
<td>8-May (Mid Bud)</td>
<td>55</td>
<td>2-Jul (5% bloom)</td>
<td>33</td>
<td>Aug. 4 (Late Bud)</td>
<td>37</td>
<td>Sept. 10 (Mid Bud)</td>
</tr>
<tr>
<td>3. Early All</td>
<td>8-May (Mid Bud)</td>
<td>38</td>
<td>15-Jun (Late Bud)</td>
<td>32</td>
<td>17-Jul (Mid Bud)</td>
<td>38</td>
<td>Aug. 24 (Late Bud)</td>
</tr>
<tr>
<td>4. Early 1,2,3 plus Late 4th</td>
<td>8-May (Mid Bud)</td>
<td>38</td>
<td>15-Jun (Late Bud)</td>
<td>32</td>
<td>17-Jul (Mid Bud)</td>
<td>55</td>
<td>Sept. 10 (5% bloom)</td>
</tr>
<tr>
<td>5. Early 1st &amp; Late 4th</td>
<td>8-May (Mid Bud)</td>
<td>55</td>
<td>2-Jul (5% bloom)</td>
<td>33</td>
<td>Aug. 4 (Late Bud)</td>
<td>55</td>
<td>Sept. 28 (1% bloom)</td>
</tr>
</tbody>
</table>

Fig. 5. Yields for Alfalfa Harvest Schedule Trial, 1992.

For each cutting, treatments with the same letter are not significantly different at P = 0.05 using the protected LSD test.