



## Society for Range Management

---

Effect of Clipping Interval on Botanical Composition of Subterranean Clover and Its Associated Plants

Author(s): A. H. Murphy, M. B. Jones and R. M. Love

Source: *Journal of Range Management*, Vol. 23, No. 3 (May, 1970), pp. 196-199

Published by: [Allen Press](#) and [Society for Range Management](#)

Stable URL: <http://www.jstor.org/stable/3896387>

Accessed: 08/04/2013 12:32

---

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



Allen Press and Society for Range Management are collaborating with JSTOR to digitize, preserve and extend access to *Journal of Range Management*.

<http://www.jstor.org>

mined for root weight to higher clipping height. Highest root weight, highest dry-weight of forage, and highest efficiency of water use (Table 3) were obtained from the 30-cm clipping height. Thus, water-use efficiency, forage dry-weight, and root weight were decreased when clipping height was decreased.

#### Literature Cited

- BENNETT, O. L., AND B. D. DOSS. 1963. Effects of soil moisture regime on yield and evapotranspiration from cool-season perennial forage species. *Agron. J.* 55:275-278.
- BENNETT, O. L., B. D. DOSS, D. A. ASHLEY, AND V. J. KILMER. 1964. Effects of soil moisture regime on yield, nutrient content, and evapotranspiration of three annual forage species. *Agron. J.* 56:195-198.
- BURTON, G. W., G. M. PRINE, AND J. E. JACKSON. 1957. Studies of drought tolerance and water use of several southern grasses. *Agron. J.* 49:498-503.
- HOBBS, Z. H., K. K. KROGMAN, AND L. G. SONMOR. 1963.

- Effects of levels of minimum available soil moisture on crop yield. *Can. J. Plant Sci.* 43:441-446.
- KELLER, W. 1954. Water requirement of *Dactylis glomerata* L. in the greenhouse as influenced by variation in technique and their interaction. *Agron. J.* 46:495-500.
- LETEY, J., AND G. B. BLANK. 1961. Influence of environment on the vegetative growth of plants watered at various soil moisture suctions. *Agron. J.* 53:151-153.
- LUEBS, R. E., AND A. E. LAAG. 1967. Nitrogen effect on leaf area, yield, and nitrogen uptake of barley under moisture stress. *Agron. J.* 59:219-222.
- STANHILL, G. 1957. The effect of differences in soil-moisture status on plant growth: A review and analysis of soil moisture regime experiments. *Soil Sci.* 84:205-214.
- WRIGHT, L. N. 1962. Root weight and distribution of blue panicgrass, *Panicum antidotale* Retz., as affected by fertilizers, cutting height, and soil-moisture stress. *Agron. J.* 54:200-202.
- WRIGHT, L. N. 1962. Effects of management practices on forage yield and percent protein in blue panicgrass, *Panicum antidotale* Retz. *Agron. J.* 54:413-416.



## Effect of Clipping Interval on Botanical Composition of Subterranean Clover and Its Associated Plants<sup>1</sup>

A. H. MURPHY, M. B. JONES, AND R. M. LOVE

*Specialist and Superintendent, Agronomist,  
Hopland Field Station, University of California,  
Hopland, California; and  
Professor of Agronomy, University of California, Davis.*

### Highlight

The use of subterranean clover (*Trifolium subterraneum*) as a livestock feed for range pastures in California is receiving widespread acceptance; best use interval information is needed. A clipping interval of 1-, 2-, 4-, and 6-weeks and no clipping was compared to determine the effect of clipping interval on botanical composition. No consistent difference in the botanical composition of subclover resulted from clipping interval, after the first two years. The unclipped treatment was mostly grass while the composition of subclover diminished each year until none was present in the sixth year. Clipping reduced the percentage of grass and the interval did not make any consistent difference. Composition of forbs in the unclipped treatment was markedly increased by clipping; however, the interval produced no consistent difference. Yields taken in the sixth clipping year showed only minor difference due to clipping interval.

The value of subterranean clover (*Trifolium subterraneum*) as a pasture plant for California

annual ranges has been adequately documented by several research workers (Love et al., 1955; Williams et al., 1957), yet proper grazing management of this clover to insure maximum productivity is often in doubt.

Subclover has growth habits that often differ from those of many other pasture species, presenting a different management problem. For example, one factor that is responsible for the persistence of subclover with close grazing is its capacity to assume a prostrate growth habit and thereby sustain sufficient photosynthetic leaf tissue (Rossiter, 1966). Another factor is its ability to bury its seed in the ground, insuring perpetuation under close stocking use. In a defoliation experiment by Rossiter (1961), more than half of the seed produced was buried below the ground surface.

Growth of subclover is usually initiated with the first inch of rainfall. In the North Coast area of California, where the current study was conducted, this amount of rainfall can usually be expected anytime from October to November, and infrequently as early as September. Usable forage is not available until at least the first trifoliate leaf has developed, which will depend on the temperature. Green subclover forage is rarely available outside the period from November to May. Greenwood et al. (1967) found that the earlier the date of the first rain, in southwestern Australia, the earlier the date of subclover germination, the longer the life span, and the greater the production of dry matter.

In a review of grazing systems in Australia, Rossiter (1966) indicated that legumes and broadleaf herbs became dominant over grasses when stocking

<sup>1</sup> Received May 12, 1969; accepted for publication October 27, 1969.

was at rates of 4 to 5 sheep per acre. The same plants also became dominant when undergrazed pastures were mowed for hay. For good subclover stands in a pasture of orchardgrass and subclover in Oregon essential practices were reported by Hedrick (1964) to be close grazing or clipping at the 2-inch height, combined with adequate phosphate fertilizer. He used only a maximum of three grazing or clipping periods per season over a five-year span, however. In another study with subclover as a pasture constituent, Jones and Winans (1967) have established that clipping and grazing subclover at the same interval has the same effect on the stand. In commercial livestock production on subclover pastures in the North Coast area of California, continuous stocking is practiced during most of the growing season.

The purpose of this experiment was to determine the effect of clipping interval on the botanical composition of a subclover-grass-forb sward and to obtain the maximum percentage of clover. Yields were determined in the final year to measure the influence of six years of clipping.

### Methods

The study was conducted at the Hopland Field Station of the University of California, in Mendocino County, in the North Coast area of California. The soil is characterized as Laughlin fine sandy loam, 24–36" in depth, with a southwesterly exposure on a 10% slope.

Five years earlier the plot area had been used for study of a range mixture comprising annual grasses: annual ryegrass (*Lolium multiflorum*) and soft chess (*Bromus mollis*); perennial grass: hardinggrass (*Phalaris tuberosa* var. *stenoptera*); and annual legumes: crimson (*Trifolium incarnatum*), rose (*T. hirtum*), and subclovers. At the end of that study, in June 1960, the plant composition was 46% subclover, 25% other clovers, 10% annual grasses, 17% forbs, and 2% perennial grass.

Treatments in the present study consisted of four different clipping intervals (1-, 2-, 4-, and 6-weeks) and one unclipped treatment, in a Latin square design, each plot 47 feet long and 8.6 feet wide. Clipping was used instead of grazing as being more appropriate for this plot design. The vegetation was clipped with a rotary mower to an average height of  $\frac{3}{4}$ " and the cut residue was removed from the plot at each cutting. Yield measurements in 1967 were taken with a collection bag on a rotary mower on a strip 1 $\frac{3}{4}$  feet wide by 47 feet long. Clipping was begun in each growing season when the subclover plants had developed the first true trifoliate leaf. This date varied from November 18 to January 4, as follows:

Growing year	Date clipping commenced	Date first effective inch of rainfall
1961–62	Jan. 3, 1962	Nov. 20
1962–63	Nov. 21, 1962	Oct. 10
1963–64	Nov. 18, 1963	Oct. 12
1964–65	Dec. 9, 1964	Oct. 28
1965–66	Dec. 22, 1965	Nov. 12
1966–67	Jan. 4, 1967	Nov. 12

Clipping was terminated when about half of the subclover was in flower, usually the first or second week of May.

Rainfall varied from 24 $\frac{1}{2}$  inches, in the 1963–64 season, to 43 inches in the 1964–65 season. When fall rains started germination well in advance of heavy frost (in late November), subclover was generally more abundant than when germination was late.

Vegetative composition was determined by the step-point method of Evans and Love (1957), with a total of 60 points per plot. The components of vegetation were segregated into annual grass, forbs, and subclover. Hardinggrass, although present, was of too limited an amount on all clipping treatments to be used in the vegetative analyses. For statistical analysis the various vegetative components were transformed by the formula  $X = \sqrt{X + 0.5}$ .

At the beginning of each growing season the entire experiment had a uniform application of single superphosphate of 500 lb/acre.

## Results and Discussion

### Subclover

The clipping frequencies, 1-, 2-, 4-, and 6-weeks, made no consistent difference in the amount of subclover although there was less in two out of six years where clipping was done once every 6 weeks. When the clover was clipped often, it grew close to the ground, flowered, and set seed below the cutting height. The 6-week clipping resulted in a higher growing plant when cut, sometimes causing the removal of tops and flowers at critical times, thus the clover composition remained lower for the first two years before becoming similar in composition to the other clipping intervals (Fig. 1).

The forage in the unclipped treatment consisted of about 10% clover in the first year and decreased consistently each year until virtually no clover remained in the sixth year. This demonstrated that subclover could not be maintained in the stand without clipping or grazing use. In a two-year study Jones and Evans (1960) indicated that the percentage of subclover in a stand was markedly reduced when left ungrazed compared to a grazed subclover stand. This data would suggest that grazing for maximum subclover percentage could be achieved with frequent or continuous use.

### Annual grasses

Species of annual grasses present include soft chess, ripgut (*Bromus rigidus*), foxtail fescue (*Festuca megalura*), and six-week fescue (*F. dertonensis*).

The 1-, 2-, and 4-week clipping interval generally reacted similar in most years and always with less grass than the unclipped treatment. The 6-week clipping interval was different from the other treatment in four of six years reflecting the interaction of climate and stage of growth at clipping.

The highest percentage of annual grasses was consistently found in the unclipped treatment, 70

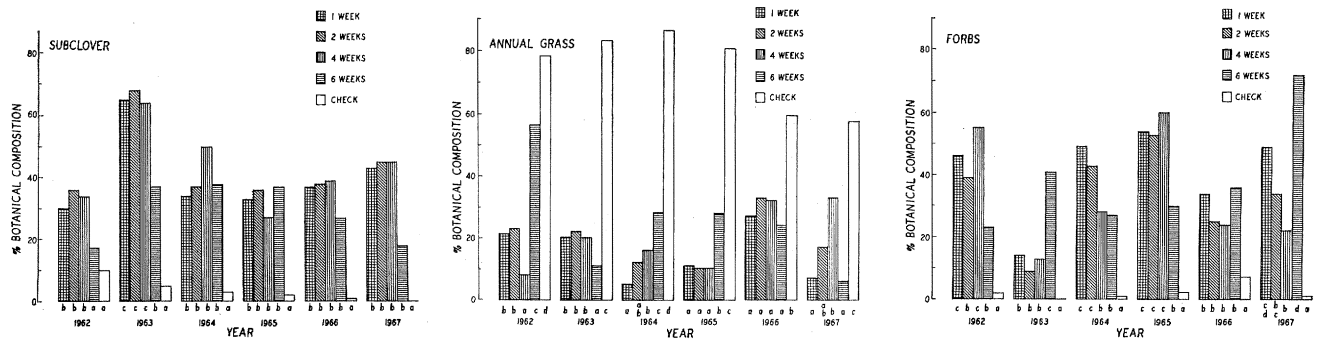


FIG. 1. Percent composition of subclover, annual grasses, and forbs by clipping treatments, 1962–1967 inclusive (Within years columns with the same letter are not significantly different at the 5% level).

to 80% composition in the first four years. Similar results were reported by Talbot et al. (1939) on areas protected from grazing where grasses increased in composition from 2 to 99% in 6 years.

### Forbs

The broadleaf species most frequently found were broadleaf filaree (*Erodium botrys*), red-stemmed filaree (*E. cicutarium*), smooth cats-ear (*Hypochoeris glabra*), red maids (*Calandrinia caulescens* var. *menziesii*), fiddleneck (*Amsinckia douglasiana*), and baby blue-eyes (*Nemophila menziesii*).

No consistent differences were apparent for any of the clipping intervals during the six years, therefore it can be expected that other factors, such as climate, were more dominant in influencing composition change than the clipping intervals. In a similar Hopland location Heady (1961) observed, in an annual range study, that changes in composition of different forage species are to a large extent correlated with weather fluctuations. In the unclipped treatment the forbs reacted somewhat similar to the subclover with their composition being less than 10% in all years of the study.

### Miscellaneous plant categories

Although hardinggrass and Lana vetch (*Vicia dasycarpa*) were not used in the statistical analysis, reaction of these plants to treatment was noted. Large tall clumps of hardinggrass developed in the unclipped treatment contributing considerable litter over the six-year period. Seedling plants were not evident. Thus, the hardinggrass population was made up of plants present when the study was initiated. On the clipped treatment hardinggrass was not found in the 1-week clippings during the last four years and less than 5% composition in all other clipping intervals.

Lana vetch was not evident until the last three years and only on the unclipped treatment where it caused the percentage of annual grass to be lower. In the final year, 1967, composition of this

vetch species was 25%. Vetch grows well in association with taller growing grasses and cereal crops, in contrast to the other forbs and legumes in the study, thus it was well adaptable to survive with the tall grasses and the litter accumulation.

### Plant yield

In the final year of clipping, forage yield samples were taken from January 5 to May 10, 1967, to determine how clipping treatment had influenced yield (Table 1).

When yield was determined by accumulating forage yields from the first clipping date (January 5, 1967) to the last date (May 10, 1967), only at the clipping date of April 26 was there a difference (significant at the 10% level) between the 1-, 2-, and 4-week intervals.

Total seasonal yield (in lb/acre, dry weight) was 2,046 for 1 week, 2,388 for 2 weeks, 1,787 for 4 weeks, and 2,578 for 6 weeks (no significant differences). These yields are lower than yields of subclover-grass stands sampled by Jones (1967) in a nearby area with only three harvests (where he clipped yields to ground level, compared with our  $\frac{3}{4}$ -inch clipping height). Jones had subclover yields varying from 3,200 to 7,500 pounds per acre dry yield, depending on treatment and year.

The clipping interval study indicated that high

Table 1. Yield (lb/acre, oven dry weight) for 1966–67 growing year when clipped to  $\frac{3}{4}$  inch height at four time intervals.

Period ending	Accumulated yield				L.S.D.
	1-week	2-week	4-week	6-week	
2–15	153	275	—	261	N.S. <sup>1</sup>
3–1	260	465	451	—	N.S.
3–29	818	1,114	1,149	1,145	N.S.
4–26	1,362	1,678	1,787	—	213 lbs.
5–10	2,046	2,388	—	2,578	N.S.

<sup>1</sup>N.S. = Not significant.

percentage subclover plant populations were most rapidly achieved and maintained when the interval was 1-, 2-, or 4-weeks but the frequency did not result in any significant difference in yield. The results suggest that livestock grazing at frequent intervals, on subclover-grass pastures, would produce the optimum percentage of subclover.

#### Literature Cited

- EVANS, R. A., AND R. M. LOVE. 1957. The step-point method of sampling—a practical tool in range research. *J. Range Manage.* 10:208–212.
- GREENWOOD, E. A. N., H. L. DAVIES, AND E. R. WATSON. 1967. Growth of an annual pasture on virgin land in southwestern Australia including effect of stocking rate and nitrogen fertilizer. *Aust. J. Agr. Res.* 18:447–459.
- HEADY, H. F. 1961. Continuous vs. specialized grazing systems: A review and applications to the California annual type. *J. Range Manage.* 14:182–193.
- HEDRICK, D. W. 1964. Response of an orchardgrass-subclover mixture in western Oregon to different clipping and fertilizer practices. *J. Range Manage.* 17:147–152.
- JONES, M. B., AND R. A. EVANS. 1960. Botanical composition changes in annual grasslands as affected by fertilization and grazing. *Agron. J.* 52:459–461.
- JONES, M. B., AND S. S. WINANS. 1967. Subterranean clover versus nitrogen fertilized annual grasslands: Botanical composition and protein content. *J. Range Manage.* 20:8–12.
- JONES, M. B. 1967. Forage and protein production by subclover-grass and nitrogen fertilized California grasslands. *Calif. Agr.* 21(10):4–7.
- LOVE, R. M., W. A. WILLIAMS, AND L. J. BERRY. 1955. California range roundup. *Westland Pasture Roundup* 6(3):1–4.
- ROSSITER, R. C. 1961. The influence of defoliation on the components of seed yield in swards of subterranean clover (*T. subterraneum* L.). *Aust. J. Agr. Res.* 12:821–833.
- ROSSITER, R. C. 1966. Ecology of the Mediterranean annual type pasture. *Adv. in Agron.* 18:1–56.
- TALBOT, M. W., H. H. BISWELL, AND A. L. HORMAY. 1939. Fluctuations in the annual vegetation of California. *Ecol.* 20:394–402.
- WILLIAMS, W. A., R. M. LOVE, AND L. J. BERRY. 1957. Production of range clovers. *Calif. Agr. Exp. Circ.* No. 458.



## Fall Gains of Steers Fed Cottonseed Cake on Shortgrass Range<sup>1</sup>

R. E. BEMENT

*Range Scientist, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Fort Collins, Colorado.*

### Highlight

**Cottonseed cake, fed to steers in the fall, increased the efficiency of forage utilization but did not produce sufficient additional gain on shortgrass range to be economically feasible.**

The 28-year (1940–1967) average gain per head for yearling cattle on shortgrass range at Central Plains Experimental Range during the month of October was 14 pounds. Daily gains customarily dropped from 1.14 pounds in September to 0.45 pound in October, yet the energy value of the forage remained high. Hyder (1967) at-

tributed this drop in daily gain to a lower forage intake by cattle during October. He suspected the low crude protein contents of the forage to be the cause of this low forage intake. In 1967 a protein supplement study was conducted to test this assumption.

### Methods

The study was conducted on a half-section pasture at Central Plains Experimental Range located 38 miles northeast of Fort Collins, Colorado. Klipple and Retzer (1959) described the soil as a sandy loam belonging to the Ascalon series. Blue grama (*Bouteloua gracilis* (HBK) Lag. ex Steud.) is the primary herbage species. The 29-year (1939–1967) average annual precipitation at the experimental site was 12.23 inches with an average of 9.03 inches during the period

May 1 to September 30. Total annual precipitation has varied from a low of 4.31 to a high of 22.88 inches. Average annual wind velocity was 6.4 miles per hour. Mean high and low temperatures during the period May 1 to September 30 were 78F and 47F, respectively. The average frost-free period was 135 days.

Twenty yearling Hereford steers, furnished by the Crow Valley Livestock Cooperative, were used to graze the pasture from June 12 through October 29. The steers were weighed at 2-week intervals after a 15-hour overnight shrink. The amount of forage consumed daily by the grazing cattle was determined by using the water-intake method of Hyder et al. (1966). Forage quality, expressed in terms of dry matter conversion rate, was determined for each 2-week period by dividing average daily forage intake by average daily gain.

Winter feeding studies at Central Plains Experimental Range show that it takes approximately two weeks to get long yearling cattle up to a daily intake of two pounds of cottonseed cake. For this reason

<sup>1</sup>This material is based upon a dissertation submitted as partial fulfillment of requirements for a Doctor of Philosophy degree at Colorado State University. Received May 24, 1969; accepted for publication October 11, 1969.