Effect of Fire on Seeded Forage Species[1]

BURGESS L. KAY

Assistant Specialist in Agronomy, Department of Agronomy, University of California, Davis

FIGURE 1. Photo taken at the time of first measurement, July 1957. Note the excellent stand of rose clover and hardinggrass. This area was covered with manzanita and oak brush 8 to 15 feet high before control burning and seeding in 1950.

Control-burning of brushlands and subsequent seeding with perennial grasses and annual legumes is a common range improvement practice in California. A reburn of the area is commonly employed to control brush sprouts and seedlings. Sprouting brush will produce seed by the third year following burning, and seedlings generally produce seed by the fifth year. It is highly desirable to kill the brush plants before they produce seed. Reburning is a commonly used method for accomplishing this. Subsequent burns or spot applications of chemicals may be desirable to control the remaining brush. (Love, Sumner and Osterli, 1952). Seeded areas may also be accidentally burned. Hence, it is desirable to know what effect burning has on the forage species used in seeding range land.

The work reported here was conducted in an effort to measure the effect of fire on some of the forage species commonly used in seeding California brushlands after burning. The study area was located 30 miles east of Redding on Blue Mountain at an elevation of 2200 feet. Brush species present were non-sprouting manzanita *(Arctostaphylos sp.)*, black oak *(Quercus kelloggii)*, blue brush *(Ceanothus integerrimus)*, buck brush *(C. cuneatus)*, and poison oak *(Rhus diversiloba)*. Blue Mountain was control-burned on August 10, 1950. Excellent removal of brush resulted. The study area was broadcast seeded to a mixture including hardinggrass *(Phalaris tuberosa* var *stenoptera)*, orchardgrass *(Dactylis glomerata)*, tall fescue *(Festuca arundinacea)*, and rose clover *(Trifolium hirtum)*. Current recommendations recognize these as among the best suited species for seeding in this area and encourage the use of hardinggrass and annual clovers as the backbone of the seed mix (Bentley, et al. 1956). The plots were primarily designed to measure the effect of burning on hardinggrass. The method of analysis was similar to that described by Canfield (1942). Thirty-seven permanent lines were measured on July 9, 1957.

A ten foot measuring stick was placed between two permanent steel stakes, and the position and intercept distance of each perennial grass crown was measured. The remaining intercept distances were recorded as predominantly rose clover or predominantly annual grass. Intercept distances were measured to the nearest one-half inch.

Blue Mountain was reburned on August 10, 1957 to control the brush sprouts and seedlings which had appeared since the 1950 burn. Many tree and brush snags which had accumulated since 1950 were consumed.

Hardinggrass and Rose Clover

At the time of burning hardinggrass stems were green at the base. Rose clover was dry and the seed was shattering. The lines were measured again on September 6 of the following year. Hardinggrass bunches increased in crown diameter, from 13 percent ground cover immediately before the burn to 16 percent one year after burning. Rose clover declined from 80 percent ground cover before burning to 74 percent after burning.

The number of hardinggrass plants recorded varied slightly. The lines crossed 93 hardinggrass plants in 1957, and 105 in 1958 after the plants had been burned. This variation appears to be due to fluctuations of the plant perimeters in relation to the line, and not to the establishment of new plants or loss of old plants. No one year old plants were observed on the transects. Fuel conditions were light, as this was essentially a grass burn. Burning temperatures were not expected to exceed 150° to 200° F., or to do little damage to seed (Bentley and Fenner 1958).

To investigate the effect of heavy fuel concentration and intense fire on plant survival dead brush was placed on 4 additional lines as pictured in figure 2. The fuel accumulations were placed in August 1955. By August 1957 dry grass from two seasons of growth had accumulated around the heavier fuel. Thus the stage

[1] *The aid of ranchers Walter B. Aldridge and Warren Flournoy is gratefully acknowledged.*

Table 1. Mean Percent Ground Cover of Seeded and Resident Species Before and After Burning with Light and Heavy Fuels. Burned August 10, 1957 (100% Density).

Species	Light Fuel Conditions[1] (No Fuel Added)		Heavy Fuel Conditions[2] (Fuel Added)	
	July 9 1957	Sept 6 1958	Aug 3 1955	Sept 6 1958
Hardinggrass	13	16	19	26
Orchardgrass	Trace	....	....	....
Tall Fescue	Trace	Trace	....	....
Rose Clover	79	74	58	69
Annual Grass	8	10	23	5

[1] Sample based on 37 - ten foot transects.
[2] Sample based on 4 - ten foot transects.

Table 2. Mean Number of Perennial Grass Plants Recorded Before and After Burning[1] with Light and Heavy Fuels.

Species	Light Fuel Conditions (No Fuel Added)		Heavy Fuel Conditions (Fuel Added)	
	July 9 1957	Sept 6 1958	Aug 3 1955	Sept 6 1958
Hardinggrass	93	105	11	10
Orchardgrass	1	1	....	....
Tall Fescue	3	0	....	....

[1] Area burned August 10, 1957.

was set for an intense fire. The artificial placement of fuel simulated conditions where brush snags accumulate after an original fire.

The results were similar to burning with lighter fuels. The eleven hardinggrass plants recorded in the 1955 sampling were reduced to ten, but the total intercept increased from 19.0 to 24.4 percent.

Seeds of hardinggrass and rose clover were collected in the light fuel area before and after the burn to test for viability. Seeds of both species which had been blackened would not germinate: They readily imbibed moisture but did not sprout. Of 52 hardinggrass seeds found that were not blackened 7 germinated. Hardinggrass seed collected before burning germinated 68.5 percent. Two hundred unblackened seeds of rose clover were collected before and again after burning. Hard seed content was 99.5 and 100 percent respectively, a common occurrence in annual clover seed produced under range conditions. A large percentage of the clover seed was blackened and would not germinate. However, sufficient undamaged seed remained to produce a satisfactory, although slightly reduced, stand the year following burning.

Smilo

Smilo *(Oryzopsis miliacea)* is another important perennial for seeding burned brushland. It readily becomes established in rocky soils or under heavy accumulations of dead trees and brush. Fire does not normally carry into the rocky areas. Areas of heavy fuel accumulations such as pictured in figure 3 are subject to more severe treatment. [This area is also on Blue Mountain and subject to the previously mentioned burning program.]

Before burning, 127 mature smilo plants were recorded in a three-foot wide belt transect 200 feet long located in the study area. The area was burned and the plots re-sampled a year later. No live smilo plants remained of the original 127. Smilo remained unburned or only scorched in rocky areas not included in the transect and did not appear to have been damaged.

Wheatgrass

An ungrazed wheatgrass seeding in the sagebrush type of northeastern California was burned at the end of the third growing season. The seeding was a mixture of tall wheatgrass *(Agropyron elongatum)*, crested wheatgrass *(A. desertorum)*, pubescent wheatgrass *(A. trichophorum)* and intermediate wheatgrass *(A. intermedium)*. Total stocking of wheatgrass plants (percent of square feet sampled which contained at least one wheatgrass plant) for the three growing seasons before the fire as well as one season following the fire was sampled by the method described by Hyder and Sneva (1954). Wheatgrass stocking rate for the seasons 1955 - 1957 was 64.5, 62.5, and 65.0 percent respectively. The area was burned in September of 1957. The accumulated mulch of three years growth of cheatgrass *(Bromus tectorum)* produced a hot grass fire. Samples taken on April 22, 1958, the beginning of the fourth growing season showed the area to be 80 percent stocked with wheatgrass plants. The pasture was grazed for the first time in May

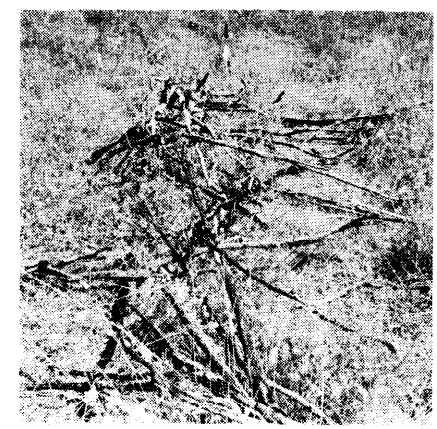

FIGURE 2. Heavier fuels were added to some transects before burning.

and June of 1958 nine months after the fire. Samples taken in July 1958 showed the area to be 90 percent stocked with wheatgrass plants. The 25 percent increase in stocking of wheatgrass plants (from 65 to 90 percent) was primarily due to the rhizomes of the intermediate and pubescent wheatgrass.

Summary

Improved forage species used in reseeding California brush ranges are often burned in follow up brush control fires or by accident. The effect of burning on forage plants varies according to species, time of burning, location and condition of pasture, etc.

Hardinggrass in California appears to be very fire tolerant under the conditions tested. A seven year old stand of hardinggrass increased from 13 percent ground cover before burning to 16 percent ground cover the year following burning.

Rose clover was slightly reduced in density by burning. A large portion of the shattered rose clover seeds were blackened by fire. These would not germinate. However, sufficient undamaged seed remained to produce a satisfactory stand of rose clover.

Smilo in rocky areas did not burn well and was not affected by reburning. However, smilo plants growing in heavy fuel accumulations were all killed by fire.

Wheatgrasses were not damaged by burning at the end of the third growing season. The stand seemed to improve during the fourth growing season due to the rhizomes of intermediate and pubescent wheatgrass produced after burning.

FIGURE 3. *Top.* August 9, 1957. Smilo grows well in areas of heavy fuel accumulations. One hundred twenty seven mature smilo plants were counted on belt transects in this general area at this date. *Bottom.* November 6, 1957. Same area after burning. Counts taken one year after burning show no smilo plants survived this treatment.

LITERATURE CITED

BENTLEY, J. R., L. J. BERRY, D. R. CORNELIUS, R. M. LOVE. 1956. Range Species Recommended for Sowing on Cleared Brushland in California. Forest Research Notes No. 111., Calif. Forest & Range Experiment Station, August 31, 1956.

BENTLEY, J. R. AND R. L. FENNER. 1958. Soil Temperatures during Burning Related to Postfire Seedbeds on Woodland Range. Journal Forestry, Vol. 56:737-740.

CANFIELD, R. H. 1942. Sampling Ranges by the Line Interception Method. Research Report No. 4, Southwestern Forest Range Exp. Sta.

HYDER, D. N. AND F. A. SNEVA. 1954. A Method for Rating the Success of Range Seeding. Journal of Range Mgt. 7:89-90.

LOVE, R. M., D. C. SUMNER, V. P. OSTERLI. (Revised) 1952. Improving California Brush Ranges. California Agricultural Experiment Station Circular 371.