Cheatgrass Coloration—A Key to Flammability?

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Highlight

The drying rate of cheatgrass was studied on four plots in western Montana and northern Idaho. The characteristic color changes in cheatgrass while it is curing (from green to purple to straw color) are proposed as an indicator of impending flammability because these colors are generally correlated with progressive drying of plants.

Range management objectives are both benefited and hampered by cheatgrass (*Bromus tectorum* L.). The plant is currently important in terms of soil stabilization and forage production (Stewart and Hull, 1949). Conversely, its presence in any significant quantity constitutes a serious fire hazard.

Cheatgrass was introduced into eastern North America from Europe about 1850. It invaded the West just before the turn of the century. A recent survey indicates that the plant now occurs on at least 60 million acres in the 11 Western States; it is most abundant in the sagebrush-grass type in the Columbia and Great Basins (Hull, 1965). In Nevada alone, wildfires burn thousands of acres of cheatgrass range each year, destroying or damaging perennial grasses, sagebrush, and other plants (Fleming et al., 1942). Other observations indicate that a cheatgrass fire can reduce early forage the following spring and that repeated fires injure the soil and inhibit forage production over an extended period of years (Pechanec and Hull, 1945).

Habitat and growth characteristics of cheatgrass make this plant a fire hazard that has a high potential for accelerating the spread of fire. These characteristics can be delineated as follows because the plant:

1. Produces large quantities of highly viable seed that usually develop dense stands.
2. Provides a flammable link between open grasslands and forests.
3. Grows primarily in the 6- to 22-inch precipitation zones characterized by severe fire weather.
4. Cures early in the fire season.
5. Ignites readily during dry periods because of its finely divided stems and pedicels.
6. Responds readily to changes in atmospheric moisture because of this fine structure.

An understanding of the relative flammability of cheatgrass at varying stages in its life cycle is necessary to the management and protection of ranges on which it occurs. The objective of this study was to determine whether the characteristic color changes that take place while cheatgrass is curing are indicative of flammability. Because moisture content is the most important single factor influencing cheatgrass flammability, the investigation centered on an analysis of the drying rate of the plant as related to coloration.

Materials and Methods

Four stands of cheatgrass were used as study areas. The areas were sampled as follows:

Area No.	
	1964
1	West. Mont. (north exposure)
2	West. Mont. (south exposure)
3	West. Mont. (south exposure)
	1965
2	West. Mont. (south exposure)
3	West. Mont. (south exposure)
4	N. Idaho (level bench)

Area No. 1 was not sampled in 1965 because the density of the cheatgrass was very light. Area No. 4, consequently, was added to the sampling schedule in 1965.

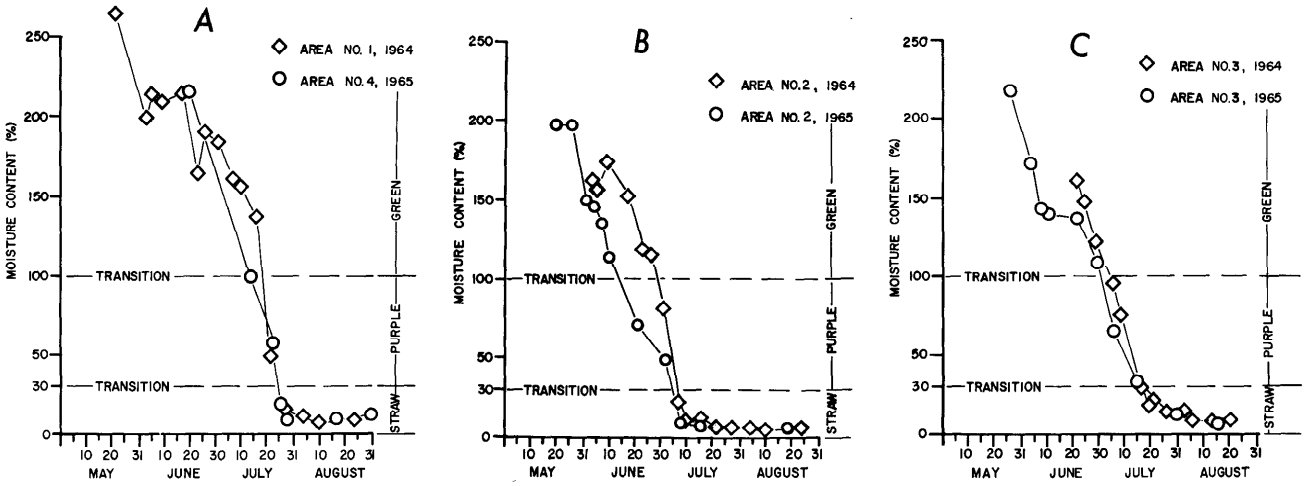

FIG. 1. Moisture content and plant coloration of cheatgrass by month and day at different locations: *A*. Area No. 1, western Montana, north exposure, 1964, and Area No. 4, northern Idaho, level bench, 1965; *B*. Area No. 2, western Montana, south exposure, 1964-65; and *C*. Area No. 3, western Montana, south exposure, 1964-65.

On each sampling day, two or three replications were collected from each area during the early afternoon hours. Cheatgrass samples were clipped at ground level for moisture content determinations to establish drying-rate curves. To avoid the problems associated with free water on the plants, no samples were collected during periods of precipitation.

To minimize moisture loss, samples were placed directly into tared distillation flasks in the field. Moisture content was measured by the xylene distillation method (Buck and Hughes, 1939), and all results were expressed on a dry weight basis. The coloration stage of the samples (green, purple, or straw) was noted and subsequently correlated with the drying rate curves. Plant coloration was described in terms of overall stand appearance and individual plant parts. Flammability was tested on each sampling day by igniting a few clipped plants with a match and determining whether combustion was sustained upon removal of the heat source.

Results and Discussion

The study areas, although located on diversified sites, exhibited similar drying curves (Fig. 1). The calendar dates of curing were different, but the slopes of the curves from spring growth to a cured condition in July were almost identical.

The relation between plant color and moisture content on all areas was as follows:

Plant color	Moisture content (%)
Green	> 100
Purple	30-100
Straw	< 30

The above classification represents the predominant coloration of individual plants. As the transition points of 100% and 30% moisture content were approached, there was a greater degree of color variation within plants. Plant coloration was consistent enough, however, to use as an indicator of moisture content and thereby as an indicator of the flammability of the grass.

Use of coloration as an indicator of flammability requires close-up inspections. A cheatgrass stand may appear purple from a distance, but close-up inspections frequently reveal considerable traces of green remaining in stems, upper leaves, and seed heads. The true onset of the purple stage is indicated by the vivid purpling of all plant parts.

The match test showed that the cheatgrass was not readily ignitible until it reached the straw-colored stage. Even when only a trace of purple remained in individual plants, flaming was marked by the popping sounds associated with the burning of moist material.

The time required for the moisture content to drop from 100% to 30% (and for the plant coloration to change from purple to straw) ranged from 8 days at Area 1 in 1964 to 23 days at Area 2 in 1965; the average was 14 days for all areas.

Exposure of the plots influenced the calendar date on which moisture content of the plants had dropped to 30%. In both 1964 and 1965, cheatgrass on Area 2 (severe south exposure) showed 30% moisture content on July 5; on Area 3 (south exposure receiving some afternoon shade), 30% moisture content was recorded on July 15; on Area 1 and Area 4 (more moist sites) it was recorded on July 25.

Summary and Conclusions

The visual characteristic of cheatgrass most indicative of flammability is coloration. The plant is not readily ignitible when it is in either the green or purple stages. It is only highly combustible when it is straw-colored. The onset of vivid purpling forewarns of hazardous fire conditions within approximately 2 weeks.

Because cheatgrass is an important plant on western rangelands, management must cope with the extreme susceptibility of this grass to large-scale fires. Noting changes in plant coloration may be an efficient means of predicting the rate at which cheatgrass becomes flammable.

LITERATURE CITED

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