Crown Temperature of Whitmar Wheatgrass as Influenced by Standing Dead Material

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Abstract

The impact of standing dead material upon the crown temperature, yield, and crude protein concentration of Whitmar wheatgrass was studied. During the day standing dead material significantly lowered temperature in the crown but influenced temperatures during the night only slightly. Herbage yield of new growth was greater and its crude protein concentration lower on plots with than without standing dead material.

Within the Great Basin and adjacent range areas, earliness of grass growth is of prime importance to the range and ranch manager. Introduction of the rest-rotation grazing system into these areas has created concerns about the effects of the standing dead material on spring growth in the rested pasture. Also, because of the need for information for environmental impact analyses, the effects of herbage removal or its planned retention should be examined closely.

Sauer (1978) concluded that standing dead material apparently was beneficial to bluebunch wheatgrass (*Agropyron spicatum* (Pursh) Scribn. and Smith) because it significantly increased weight and leaf length. He pointed out that his results contrasted to those of Uresk et al. (1976), who found that yield was reduced within standing dead material. However, he suggested that possibly the wildfire effect in the latter study overshadowed the presence or absence of standing dead material. Reduced production and vigor has been inferred by Tueller and Tower (1979) from unused and stagnated herbaceous stands inside exclosures in Nevada. Burton et al. (1951) concluded that old growth in ungrazed areas reduced light within the grass canopy and the shade lowered yield, crude protein, and plant minerals P, Ca, and Mg. Kamm et al. (1978) reported that inside longterm exclosures new growth was decreasd 19% lower than the outside and crude protein concentration of the new growth also was lower.

This study examined the impact of standing dead material on early spring temperatures at the crown of the grass and estimated the herbage yield and crude protein concentration of the new growth.

Materials and Methods

Four macro-plots (30 × 60 ft) seeded in rows 2 ft apart with Whitmar wheatgrass (*Agropyron inerme* (Scribn. and Smith) Rydb.) were divided and the plot halves randomly allotted to: (1) standing dead material remaining in place and (2) standing dead material removed. To maintain a near normal vegetation structure over winter, 8 ft of standing dead material of each of the two center rows of four plots were wired between wood lathes and staked into position. The herbage so staked was then severed at the crown. On March 1, when the snow pack had disappeared from the rows of the untreated plots, the clipped and staked standing dead vegetation was removed from the two central rows and the standing dead of the remaining rows in each of those four plots were clipped and removed.

Unshielded mercury-in-glass thermometers were positioned at random (2/plot) in the center row of each plot to sense the temperature at the plant crown level (Fig. 1). On March 2-3, April 14-15, and May 19-20, the thermometers were read hourly during the day and every 2 hours during the night. Concurrent air temperature was measured at a height 4 ft above the ground except for an 8-hr period on March 2 due to thermometer breakage.

On May 20, 5 ft of the two central rows of all plots were harvested at the crown level. In plots with standing dead material, the new growth was separated by hand. All new growth was oven dried and weighed; nitrogen concentration of each sample was determined by the Kjeldahl method.

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Results

New growth was already present on March 1 when the standing dead material was removed from half of the plots. Snow depth between rows was 5 to 6 inches, and in the early morning and late evening hours the grass rows were partially or fully shaded by the snowbank.

In early March crown temperature from 1000 to 2400 hours, in rows without standing dead material, was higher than with the standing dead material (Fig. 2). At the 1100 and 1200 hours treatment, mean differences approached significance at the 0.05 level and mean differences were 14 and 15° F, respectively. However, during the night and early morning, crown temperature was only a few degrees higher with than without standing dead material.

The snow pack had dissipated by mid-April and treatment effect had increased noticeably (Fig. 3). At 0900 and at 1200 to 1700 hours temperatures within rows were significantly ($P<0.05$) higher without than with standing dead material. During the daytime hours these temperature differences ranged from 4 to 22° F. Standing dead material did provide better heat retention during the night; however mean temperature differences were small and nonsignificant ($P>0.05$).

Crown temperature still differed between treatments in the latter

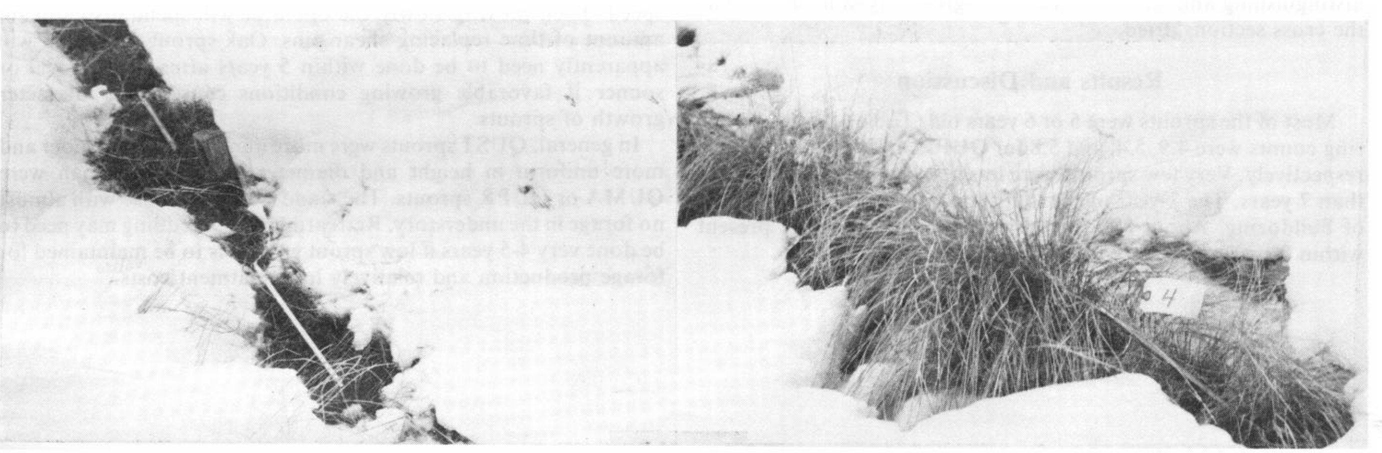

Fig. 1. *Whitmar wheatgrass in early March with standing dead material removed (left) and standing dead present (right).*

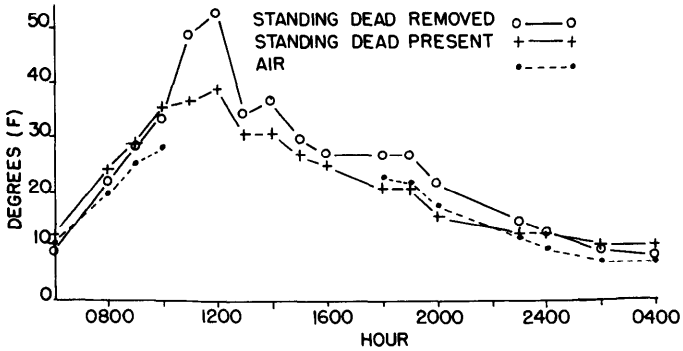

Fig. 2. *Crown an air temperatures on March 2-3 within rows with standing dead material removed and present.*

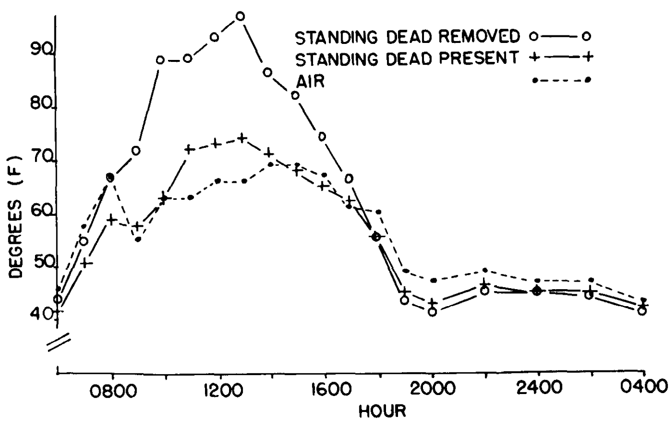

Fig. 3. *Crown and air temperatures on April 14-15 within rows with standing dead material removed and present.*

part of May (Fig. 4). During afternoon hours of 1500 to 1800, temperatures in rows were significantly ($P<0.05$) higher without than with the standing dead material. Between the hours of 2000 to 1200, treatment differences were extremely small.

Mean herbage yields of new growth per 5 ft of row were 120.5 and 156.5 gm for plots without and with standing dead, respectively, and were not significantly different ($P>0.05$). New growth in rows with and without standing dead contained 9.7% and 10.5% crude protein, respectively and the mean treatment difference approached significance at the 0.05 level.

Discussion

The thermometers were not shielded, so possible bias from direct radiation might have affected the readings. In a subsequent study (Unpublished data, Squaw Butte Annual Report, 1969) unshielded and shielded thermometers sensed the surfaces of a silver and black board. On April 19 temperature differences during daylight hours were from 0 to 3° F higher for unshielded than for shielded thermometers. On May 21, temperature difference ranged from 0 to 5° F. Thus, in the field study, comparisons of temperature in early March and April were biased slightly, but the bias could not explain the total difference between treatments on those dates. By mid-May growth was sufficient that the sensing bulb of the thermometer was shielded even on plots without standing dead.

Yield from rows was higher with standing dead material than without. The difference was similar to that reported by Sauer

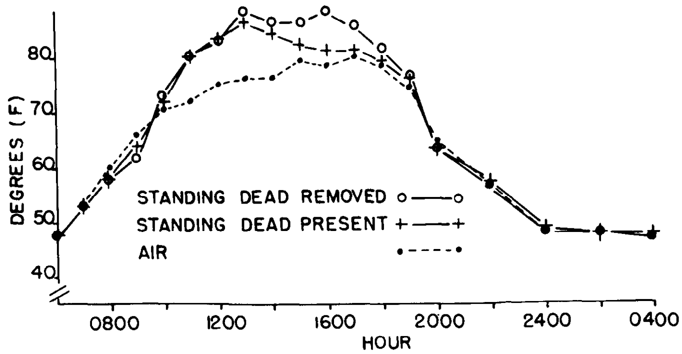

Fig. 4. *Crown and air temperatures on May 17-18 within rows with standing dead material removed and present.*

(1978) but was not significant ($P>0.05$). Crude protein concentration in new growth was lower for plots with than without standing dead material. This difference might be attributable to (1) shading effect of the standing dead, (2) dilution by growth, or (3) increased availability of soil nitrogen in soils that were warmer in plots without standing dead material. The results of this study and that by Sauer (1978) suggested that standing dead material increases production in at least the first year. However, the continuation of increased production from an accumulation of standing dead over the years is questionable according to Kamm et al. (1978), Burton et al. (1951),and Tueller and Tower (1979).

The presence of standing dead material did moderate the microclimate in the plots during March, April, and May and limited the rise in crown temperatures during daytime hours. Only in very early spring were nighttime temperatures consistently elevated within plots with standing dead material and the elevation differences were generally less than 4° F.

The warming of soils during the early spring growth period is generally assumed to be positively related to early grass growth. However, Sneva (1977) found that mean monthly temperature in February was negatively correlated with the May 15 yield of crested wheatgrass and that this negative relation persisted through March. Blaisdell (1958), who studied seasonal development of plants in Idaho, also showed negative relations between the temperature of late winter and early spring development of bluebunch wheatgrass. Thus, it is inferred that exposure of the crown area by removing the standing dead material results in early spring temperature warming that is associated with a detrimental response in the grass.

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