Paraquat—Effects of Growing Season Applications

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Highlight

Paraquat applied at 0.8 lb./acre to the same stand of crested wheatgrass in three consecutive years did not significantly reduce the grass yield in the fourth year. Floral primordia mortality from paraquat application on May 20 ranged from 50 to 87 percent. Further research in application technique and timing in relation to chemical coverage and meteorological conditions are believed needed to assure a consistently high floral primordia mortality, a prerequisite of successful two-crop management.

The residual or accumulative effect from any management treatment on perennial grasses is of vital concern. Two consecutive years of curing range grasses when in anthesis with paraquat (1,1’dimethyl-4,4’-bipyridinium ion) caused no significant reduction in herbage yield (Sneva, 1967). This note gives additional information on the effect of paraquat on crested wheatgrass (Agropyron desertorum (Fisch.) Schult.) yield after 1, 2, and 3 years of growing season treatments.

Management of crested wheatgrass stands for a two-crop system, as proposed by Hyde (1961), requires the removal of apical dominance with sufficient soil moisture remaining to assure a second crop of vegetative stems. He suggested, for this area, that grazing begin about May 1 and terminate about May 20; the stocking rate so adjusted to allow the floral primordia to be elevated and removed. Successful achievement of floral primordia removal requires intimate knowledge of grass growth rate, forage intake by animals, and flexibility in the ranch operation.

Standing vegetation on all plots was removed. Successful achievement of floral primordia removal required intimate knowledge of grass growth rate, forage intake by animals, and flexibility in the ranch operation.

Table 1. Yields (lb./acre) of crested wheatgrass on June 6, 1967 after 1, 2, and 3 years of application of paraquat during the growing season and clipping on May 20.

<table>
<thead>
<tr>
<th>Year</th>
<th>Control</th>
<th>May 20</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
<td>922</td>
<td>776</td>
<td>845</td>
</tr>
<tr>
<td>1964'</td>
<td>934</td>
<td>964</td>
<td>918</td>
</tr>
<tr>
<td>1964, '65</td>
<td>1026</td>
<td>796</td>
<td>910</td>
</tr>
<tr>
<td>1964, '65, '66</td>
<td>960</td>
<td>815</td>
<td>923</td>
</tr>
</tbody>
</table>

Paraquat applied at 0.8 lb./acre in 10 gallons of water plus X-77 added at 0.5% total volume per acre applied once on May 20, June 10, June 20, or June 30 in each of the years 1964, 1965, and 1966. Clipping at ground level on May 20 for positive removal of all elevated floral primordia, and (3) control.

The randomized complete block design contained four replications with data of spray, clipping, and control treatments assigned to whole plots (12 x 108 ft). Subplots (12 x 36 ft) received year treatments of: treated only in 1964, treated in 1964 and 1965, or treated in 1964, 1965, and 1966.

Standing vegetation on all plots was mowed in the fall of each year with a rotary mower. The herbage yield harvested on June 6, 1967 from a 4 x 12 ft area in each subplot measured the accumulative effect of treatments upon production. Treatment means were tested with Duncan’s multiple range test at the 0.05 level of significance.

Effectiveness of May 20 treatments in controlling floral primordia was estimated from the number of reproductive stems present in August, 1965, and 1966 in two, 1 ft² samples randomly located in each subplot. Reproductive stems could not be counted in August 1964 because cattle broke into the experimental area in late July and ate all herbage on the treated plots. Visual estimates of growing point control recorded July 13, 1964 will be used in lieu of enumerated data.

Table 2. Control of floral primordia in each of the three years by clipping or by applying paraquat on May 20 in each year expressed as a percent of the control.

<table>
<thead>
<tr>
<th>Year</th>
<th>Clip</th>
<th>Paraquat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>1965</td>
<td>97</td>
<td>87</td>
</tr>
<tr>
<td>1966</td>
<td>99</td>
<td>64</td>
</tr>
</tbody>
</table>

2 Based on two, 1 ft² samples/plot in August.
Table 2 shows the percent control of elevated growing points in each year by clipping at ground level or by treating with paraquat, both being imposed on May 20 of each year. In two of the three years, nearly all floral primordia were sufficiently elevated above the soil surface to be removed by clipping on May 20. Control of floral primordia with paraquat was poorer than clipping in every year, ranging from 50 to 87%.

Discussion

Paraquat treatments in June, which provide a cured herbage for late season grazing, did not cause a yield depression after three successive years of treatment. This agrees with Hyder (1961) who found clipping treatments during June to have little or no effect upon grazing, did not cause a yield depression, and the chemical treatments.

Poorer control of floral primordia in all years resulted from paraquat treatments than from clipping. Yet, in 1965, paraquat applied on May 20 controlled 87% of the emerged growing points. This suggests that a relatively high degree of control may be possible if those factors influencing paraquat activity are known. Recent studies evaluating temperature, oxygen, humidity, and light combinations (Merkle et al., 1965; Brian, 1966; Putman and Ries, 1968) on the activity of paraquat offer possible solutions for increasing success of field applications.

Herbage removal by clipping during April and May has been shown to depress crested wheatgrass yield significantly in the year following treatment (Hyder, 1961). Lowest residual yields in this study, though not significantly different from the others, resulted from clipping on May 20 in three successive years. A similar depression of yield did not occur from the comparable chemical treatment probably because of the poorer control of the floral primordia.

Experimental Procedure

Two Hereford steers averaging 540 pounds were placed on each type of pasture, one orchardgrass-clover (Dactylis glomerata-Trifolium repens) and one tall fescue-lespedeza and orchardgrass-clover pastures.

The objective of this experiment was to study the relationship of the body weight changes of beef steers grazing orchardgrass-clover and tall fescue-lespedeza with forage intake expressed in different ways. It was postulated that the "animal gain-forage intake" relationship can be improved by removing a maintenance factor from the intake estimates. These data indicated that differences in digestible dry matter intake explained much of the variation in body weight gain of steers grazing both tall fescue-lespedeza and orchardgrass-clover pastures.

Relationship Between Forage Intake and Gains of Grazing Steers

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Highlight

Based on a study utilizing total feces collection to estimate forage intake of grazing animals, the "animal gain--forage intake" relationship can be improved by removing a maintenance factor from the intake estimates. These data indicated that differences in digestible dry matter intake explained much of the variation in body weight gain of steers grazing both tall fescue-lespedeza and orchardgrass-clover pastures.

The objective of this experiment was to study the relationship of the body weight changes of beef steers grazing orchardgrass-clover and tall fescue-lespedeza with forage intake expressed in different ways. It was postulated that the "animal gain-forage intake" relationship should be improved if forage digestibility and animal maintenance requirements were included in the intake measurement, thus obtaining an expression of forage intake more highly correlated with animal gains than forage dry matter intake alone.

Experimental Procedure

Two Hereford steers averaging 540 pounds were placed on each type of pasture, one orchardgrass-clover (Dactylis glomerata-Trifolium repens) and one tall fescue-lespedeza (Pestuca arundina-cesa-Lespedeza striata) and grazed without supplemental feed for five months during the 1967 experiment beginning in June and ending in October. There were five monthly grazing periods for which individual animal gains were calculated. Forage samples representative of available forage in each pasture were taken in the middle of each period. In vitro dry matter digestibility of these forage samples was determined by the method of Tilley and Terry (1963).

Also in the middle of each grazing period, each steer was fitted with a feces collection harness and bag. The feces bags were removed after 24 hours and the wet feces were weighed and dry matter (DM) content was determined.