A TECHNIQUE FOR HERBAGE MANAGEMENT STUDIES UNDER CONTROLLED LOW TEMPERATURE

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Any plant breeding programme needs efficient selection criteria. To evaluate selection criteria in grass breeding and to correlate performance in the differing environments of the breeder's plots and in swards, the response of the grass plant to factors affecting its yield and the components of yield is being studied, Lazenby and Rogers.

Part of our experimental series has been concerned with the study of the growth of grass in winter. It was thought desirable to study the effect on production, under winter conditions, of a range of managements. Interpretation of results collected from the field is made difficult because of the unpredictability of the natural climatic environment. To achieve a standard set of climatic conditions and therefore make it possible to obtain repeatable results, use was made of a refrigerated cabinet in which an attempt was made to approach winter conditions of light and temperature. In the field, winter soil temperatures do not fluctuate so much as those of the air and, therefore, independent control of air and soil temperatures in the cabinet was provided.

The cabinet used had internal measurements of 200 × 90 cm. Air stratification was prevented by a continuously running internal fan. A bank of fluorescent tubes with a total capacity of 1200 watts, raisable for access to the cabinet, was suspended over a triple-glazed, counterbalanced lid. During this experiment the plants received a day length of 12 hours, with a light intensity of 480–500 foot-candles (0.044 cal./cm.² min.) (Figure 1). A thermostat controlled air temperature; the night temperature, set at 1°C, over-night lapped by 1½ hours each end of the photoperiod whilst the day temperature was allowed to rise to 15°C. Within the cold cabinet, a box of expanded polystyrene, 5 cm. in thickness, was constructed, complete with a soil warming cable embedded in sand in the base of the box. Six inches of soil covered the sand and a rod thermostat controlling soil temperature was buried 4 cm. below the soil surface. Provision was made to reduce heat exchange between soil and air by the use of polyzote expanded beads on the soil surface. The thermostat was set to prevent the soil temperature falling below −1°C.; it was not in operation, therefore, in the major period (5 months) of the investigation. However, it did function during the last month of the experiment when a test was made to determine whether the cutting treatments had affected the resistance of plants to low temperatures and when the night air temperatures were controlled at −9°C.

The 4 cutting treatments used comprised all combinations of 2 frequencies (plants defoliated when their mean tiller length reached 10 cm. or 20 cm.) and 2 severities (tillers cut back to 5 cm. or 2.5 cm.). The performances of 2 selections of Festuca arundinacea, a North Temperate variety, S.170, and a North African ecotype from Algeria, were compared. The 4 cutting treatments, each split for variety, were replicated twice, giving a total of 16 subplots. Seedlings at the 3rd leaf stage were square planted at a spacing of 5 cm., each subplot with 28 plants.

Table 1—Dry weight and tiller numbers for various cutting treatments.

<table>
<thead>
<tr>
<th>Cutting treatment mean tiller length, cm.</th>
<th>No. of harvests</th>
<th>Accumulated mean dry weight per plant (g.)</th>
<th>Mean no. tillers per plant (final harvest)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A  B  Total</td>
<td>A  B  Total</td>
<td>A  B  Total</td>
</tr>
<tr>
<td>10</td>
<td>2.5 2 4</td>
<td>0.23 0.18 0.41</td>
<td>14.6 7.6 22.4</td>
</tr>
<tr>
<td>10</td>
<td>5.0 11 10</td>
<td>0.49 0.47 11.14</td>
<td>41.5 23.8 64.3</td>
</tr>
<tr>
<td>20</td>
<td>2.5 6 5</td>
<td>0.46 0.37 0.51</td>
<td>34.1 14.0 48.9</td>
</tr>
<tr>
<td>20</td>
<td>5.0 6 5</td>
<td>0.76 0.50 1.26</td>
<td>53.7 17.7 71.4</td>
</tr>
</tbody>
</table>

Variety totals 20 24 2.10 1.32 154.1 62.9

Cutting treatment totals (C) 0.141* 12.45**
Least significant differences 0.133** 10.45**
Variety totals (V) significance of difference **

* 0.1% level, ** 1% level, *** 5% level.

1 School of Agriculture and Plant Breeding Institute, respectively, Cambridge, 1960–61.


Figure 1—Low-temperature cabinet with light source above.

Figure 2—Typical plants (Festuca arundinacea) grown under 4 cutting treatments as shown above each pair of plants (tiller length when cut and length of stubble in cm.). A—North African ecotype, B—North temperate variety, S.170.