RESPIRATION OF CEREAL PLANTS AND GRAINS.*

II. RESPIRATION OF SPROUTED WHEAT.

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Respiration in frost-damaged wheat has been observed by us¹ to be at a higher level than in normal or sound wheat of the same moisture content. This was believed to be due, in part at least, to the higher percentage of dextrose and other simple carbohydrates in the frozen wheat. It then appeared desirable to determine the effect of sprouting upon the respiration of the grain, to ascertain whether or not this form of unsoundness in bulk grain could be expected to affect its keeping qualities.

A quantity of normal hard spring wheat was divided into three portions: one of which was wetted and allowed to sprout for 24 hours in the room at a temperature of ±20°; the second was sprouted under the same conditions for 48 hours; while the third was used in its original state as a control. The sprouted wheats were rapidly dried by spreading them out in a thin layer and blowing air over and through them with an electric fan. They were thus reduced to a moisture content of about 12 per cent. Each of the three samples was divided, and the several portions brought to different percentages of moisture by the addition of varying quantities of water. After standing for 3 days each of these was sealed in a tower, incubated at 37.8°C. for 4 days, and the respired CO₂ determined.

Chemical analysis of the several samples showed the normal wheat to contain 0.16 per cent of reducing sugars (calculated as

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dextrose), while the samples germinated 24 and 48 hours contained 0.59 per cent and 1.11 per cent respectively, the ratios of the three samples being 14.4 : 53.2 : 100 in the order named.

![Graph showing the relative rates of respiration of normal and sprouted wheat.](http://www.jbc.org/)

**Fig. 1.** Graph showing the relative rates of respiration of normal and sprouted wheat.
The quantity of CO₂ respired by each of these samples with different percentages of moisture is shown in Table I and in Fig 1. The latter indicates that at moisture contents of 12 to 16 per cent the sprouted grain respires decidedly more vigorously than the normal grain. At 12.5 to 14 per cent of moisture the ratios are approximately 1:4:10 for the normal, the 24 hour, and the 48 hour sprouted samples, which are not far different from the ratio of their reducing sugar content.

### Table I.

**Respiration of Normal and Sprouted Spring Wheat.**

<table>
<thead>
<tr>
<th>Moisture (per cent)</th>
<th>CO₂ respired per 100 gm. of dry matter in each 24 hrs.</th>
<th>Moisture (per cent)</th>
<th>CO₂ respired per 100 gm. of dry matter in each 24 hrs.</th>
<th>Moisture (per cent)</th>
<th>CO₂ respired per 100 gm. of dry matter in each 24 hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.30</td>
<td>0.216</td>
<td>12.10</td>
<td>0.615</td>
<td>12.10</td>
<td>1.950</td>
</tr>
<tr>
<td>12.27</td>
<td>0.255</td>
<td>13.26</td>
<td>1.454</td>
<td>13.44</td>
<td>4.010</td>
</tr>
<tr>
<td>13.24</td>
<td>0.320</td>
<td>14.36</td>
<td>3.580</td>
<td>14.28</td>
<td>7.032</td>
</tr>
<tr>
<td>14.23</td>
<td>0.680</td>
<td>15.16</td>
<td>10.310</td>
<td>15.87</td>
<td>24.720</td>
</tr>
<tr>
<td>15.33</td>
<td>3.600</td>
<td>16.01</td>
<td>24.270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.94</td>
<td>7.320</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The shapes of the curves are somewhat different as well. Thus we find the acceleration of respiration with increasing moisture to be rather gradual between 12 and 14.5 per cent of moisture in the case of normal wheat, while the sprouted wheats show much greater acceleration between these limits.

These data establish that respiration, and consequently the quantity of heat energy released per unit of time and material, proceeds at a higher rate in sprouted grain than in normal wheat. This would be of significance in commercial storage of bulk cereals, and in grading grain when the grading system takes cognizance of respiration and keeping qualities in storage.
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