A relatively small number of tests have been made upon late season Valencias (1935) and the present season (1935–36) Washington Navel oranges. The results indicate a situation closely resembling that for grapefruit with perhaps a slightly greater tendency to show initially positive curves.

In a cursory manner the special respiratory test has been made upon apples, pears, grapes, tomatoes, lettuce, and other fruits and vegetables. The responses were frequently very interesting and suggested that the method might have a wider application than to citrus, as a simple and rapid test of maturity or vitality.

The work of correlating the types of pressure curves obtained from fruit with its likely subsequent behavior on the market is very great. The practical value of the method can be determined only through its trial by many workers upon different varieties of fruit and in different localities. This situation is taken as justification for this preliminary report.—E. M. Harvey and G. L. Rygg, Bureau of Plant Industry, U. S. Department of Agriculture, Pomona, California.

BEHAVIOR OF STOMATA OF IRRIGATED WHEAT PLANTS

Introduction

It is known that stomata respond very markedly to environmental changes, especially to variations in the water supply, but their reaction is often very complicated. The writers have studied the stomatal movements of irrigated wheat plants in order to determine the possibility of using certain characteristic changes as indices of different irrigation procedures, and especially for the determination of the time of acute necessity for irrigation.

The work was carried on during the summer of 1933 in the Volga district at the Valuika Agricultural Experiment Station.

Materials and methods

The soft wheat, Erythrospermum 0841, sown on April 26, was the material used in our investigation.

The degree of opening of the stomata was determined by the alcoholic method of Lloyd. Counts were made, with a microscope, of the number of stomata that were fully open, half open, slightly open, and completely closed. A fully opened stoma was about twice as large as one half open, and these, in turn, three times larger than those slightly open. The total opening for all the stomata was calculated by multiplying the percentage of fully opened stomata by 10, the half opened by 5, and the slightly opened by 1.6. Thus, if all the stomata were completely open, the greatest number

1 A more detailed account of the results obtained in this investigation will be presented in another paper.
Counts of the stomata were made seven times during the day: at 5, 7, 9, and 12 A.M., and 2, 4, and 6 P.M.

Investigation

Observations on stomatal behavior

A record was made of the weather, the amount of moisture applied to the wheat plants, and their stage of development. The following observations were made of the effect of these factors on the degree of stomatal opening on June 16, 22, and 30.

June 16.—The day was cloudy. The soil (about 60 cm. deep) under the plants that were irrigated on June 1 still contained 2 to 3 per cent. available water; the soil under the control plants was so dry that it almost reached the wilting coefficient. The plants were at the beginning of head formation. Table I gives the calculated amount of stomatal opening at various hours during the day, and the average for the day.

<table>
<thead>
<tr>
<th>Irrigation</th>
<th>Calculated amount of stomatal opening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 A.M.</td>
</tr>
<tr>
<td>Non-irrigated (control)</td>
<td>177</td>
</tr>
<tr>
<td>Irrigated on June 1</td>
<td>898</td>
</tr>
</tbody>
</table>

The stomata of the irrigated plants were open the entire day on June 16; the stomata of the non-irrigated plants opened for a short time early in the morning and were opened but very little during the remainder of the day.

June 22.—The early morning of June 22 was cloudy, but the weather was clear after 9 A.M. There was a 0.7 mm. rainfall on the day preceding which slightly moistened the upper layer of soil. Two groups of plants were studied: one group which was irrigated on June 1, and the other irrigated on June 1 and 19. The plants were in bloom when the observations on stomatal behavior were made (table II).

The small amount of rainfall on the day preceding June 22 seemed to cause the control plants to open their stomata rather wide in the forenoon, but in the afternoon the stomatal apertures became narrower.

The behavior of the stomata in the group of plants irrigated on June 1, which, according to determinations of the soil moisture, had exhausted nearly all of the water supplied, was different from that of the non-irrigated control plants. Their stomata were closed even earlier in the day than
TABLE II
CONDITION OF STOMATA ON JUNE 22

<table>
<thead>
<tr>
<th>Irrigation</th>
<th>5 A.M.</th>
<th>7 A.M.</th>
<th>9 A.M.</th>
<th>12 M.</th>
<th>2 P.M.</th>
<th>4 P.M.</th>
<th>6 P.M.</th>
<th>AV. FOR DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-irrigated (control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigated on June 1</td>
<td>196</td>
<td>785</td>
<td>911</td>
<td>305</td>
<td>367</td>
<td>407</td>
<td>251</td>
<td>460</td>
</tr>
<tr>
<td>Irrigated on June 1 and 19</td>
<td>908</td>
<td>979</td>
<td>933</td>
<td>906</td>
<td>972</td>
<td>908</td>
<td>893</td>
<td>928</td>
</tr>
</tbody>
</table>

Those of the control plants. This was possibly due to the greater development of their transpiring surface.

The group of plants which were irrigated on June 1 and 19 had 10 per cent. available moisture remaining in the soil. Their stomata were uniformly open throughout the day.

JUNE 30.—The entire day of June 30 was cloudy. A rainfall the preceding day moistened the soil very slightly. Observations made on the behavior of the stomata on this day are given in table III.

TABLE III
CONDITION OF STOMATA ON JUNE 30

<table>
<thead>
<tr>
<th>Irrigation</th>
<th>5 A.M.</th>
<th>7 A.M.</th>
<th>9 A.M.</th>
<th>12 M.</th>
<th>2 P.M.</th>
<th>4 P.M.</th>
<th>6 P.M.</th>
<th>AV. FOR DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-irrigated (control)</td>
<td>175</td>
<td>266</td>
<td>250</td>
<td>225</td>
<td>177</td>
<td>173</td>
<td>8</td>
<td>183</td>
</tr>
<tr>
<td>Irrigated on June 1</td>
<td>953</td>
<td>888</td>
<td>782</td>
<td>964</td>
<td>815</td>
<td>397</td>
<td>116</td>
<td>702</td>
</tr>
<tr>
<td>Irrigated on June 1 and 19</td>
<td>972</td>
<td>925</td>
<td>967</td>
<td>905</td>
<td>844</td>
<td>978</td>
<td>935</td>
<td>932</td>
</tr>
</tbody>
</table>

Regardless of the slight rainfall, the non-irrigated control plants had their stomata open but little during the day, and they were closed about 6 P.M. The plants of the group irrigated on June 1, because of the cloudy weather, were still disposing of the remainder of the soil moisture. Their stomata remained open until 12 A.M. After 2 P.M. they gradually began to close. Plants irrigated on June 1 and 19, and therefore having a good supply of water, had their stomata almost fully open during the entire day. Further observations on the plants were discontinued because of a serious attack of rust.
A study of the results of the observations shows that there was a marked difference in the behavior of the stomata of plants grown with and without irrigation, and of the stomata of those grown with various amounts of irrigation. Stomata of non-irrigated plants opened but little, and only early in the morning, while the stomata of plants with a sufficient water supply were fully open throughout the day.

EFFECTS OF STOMATAL BEHAVIOR

The differences in stomatal behavior between the non-irrigated and irrigated plants seem to have affected their assimilation. This was concluded from a comparative study of the recorded dry weights, and yields of grain, of the plants at maturity. The comparative dry weight of 100 plants in the various groups at maturity was as follows: non-irrigated (control) plants, 171 gm.; plants irrigated on June 1,—271 gm.; plants irrigated on June 1 and 19,—358 gm. The comparative yield of grain from each of these three groups was 69, 109, and 130, respectively.

Summary

These experiments on stomatal behavior, in general, show that the degree of opening of the stomata during the day may serve as an index of the amount of water available to the plant. From this study the writers believe that valuable data may be obtained for working out a definite schedule for the irrigation of wheat.—N. A. MAXIMOV and LYDIA K. ZERNOVA, Research Institute of Grain Farming, Saratov, U. S. S. R.

TOXICITY OF MERCURY VAPOR TO GERMINATING TOBACCO SEEDS

Injury to plants caused by mercury vapor has been reported by several investigators, but the danger of accidental poisoning of laboratory material does not seem to be generally recognized. This paper presents a study of toxicity in relation to the area of mercury exposed, the volume of inclosed space remaining constant.

ZIMMERMAN and CROCKER (4) studied the injury by mercury vapor to plants of about 75 genera, tobacco plants being among the few which were found to be comparatively resistant. The degree of injury depended on the amount of metallic surface exposed to the air. KIPP (3) observed an inhibiting effect of mercury from a mercury vapor pump on the respiration of tobacco seeds, but, when the seeds were removed from the apparatus after 66 hours, their viability was not impaired. It was found necessary to introduce a trap between the pump and the germinator in order to avoid this toxic effect.