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DEPARTMENT OF THE ARMY
Fort Detrick
Frederick, Maryland
In 1961, climatic conditions were entirely different from those of the preceding years (1). The warm and dry summer impeded the spread of rice blast disease. It occurred in many places, but only in the form of strictly localized foci.

We studied two important outbreaks: one in a nursery, the other in a harvest crop. The preceding years, 1959 and 1960, were characterized not only by strong attacks by the mold, favored by meteorological conditions of high humidity and below normal temperatures, but also by faulty cultural practices (excessive use of nitrogen fertilizer).

In 1961, rice-growers directed their attention to the rate of nitrogen fertilizers applied. In general, the rate of application was more reasonable, especially because of some vegetative accidents which occurred unexpectedly in 1960. The most typical of these accidents was the retarded flowering of late rice varieties and, as a consequence, a lack of flowers because of a lack of warmth.

Meteorological Conditions

In Table 1 there are shown typical data of the periods during which the rice was attacked by the mold Piricularia. I have reported the air temperatures (maximum and minimum), hygrometry, winds and rainfall, especially rain falling in the area of St. Simon. The data were obtained through

(1) see Bull. Inf. Rizic. No. 63, 1959, No. 75, 1961
the courtesy of the Faculty of Agriculture at Arles and the Agricultural Services of Bouches-du-Rhône (2) [Rhône Delta].

An examination of the table reveals a period between June 3 and September 30, which was characterized by lack of rain and elevated temperatures at the same time. These factors inhibited the spread of rice blast disease. On the contrary, they favored the growth of rice plants.

**Hygrometry**

Charts of Table 1 show maximum and minimum values. They do not indicate the duration of each value, especially the duration of maxima. These maximum values are very often equivalent to 100. During periods of precipitation, the minima often remain elevated, i.e. above 80% relative humidity.

During the dry periods mentioned already earlier, the minima of the relative humidity were sufficiently low for inhibiting the spread of rice blast disease.

**Wind**

The main cause of drought in the summer is the mistral or northwind. This wind quickly dries out the atmosphere. It blows often, immediately following a rain and, as a consequence, reduces the effect of the rain. This explains why especially in the month of May many rains fell in sufficient amounts, but were not followed by plant epidemics.

**Successive Attacks of Rice Blast**

*Piricularia* requires a relative humidity above 90% in order to grow. If the humidity remains sufficiently low during the year, a spectacular epidemic will not develop. However, two important outbreaks were observed. These outbreaks were not confined to nurseries. At the time of planting out many seedlings had on their leaves typical necrotic lesions of rice blast disease. The mold caused a certain devastation, but without any great repercussions. In general, those leaves which had lesions were dead, drowned or floating about, because of the outbreak which had occurred during the transplanting step. The location at the surface of the water constituted a focus of infection, but the climatic conditions did not permit a spreading of the disease.

We have grouped in Table 2 the meteorological conditions which accompanied rainfalls. It may be seen that rain is not the only factor responsible for plant infections, but it is an indispensable element. Furthermore, humidity has to remain high for a sufficiently long period to enable old lesions to produce new spores which then infect new plant parts.

(2) We thank Mr. Clave, chief engineer, director of Agricultural Services, Bouches-du-Rhône; also, Mr. Bompard, engineer, Agricultural Services, Arles, who graciously supplied me with data gathered by them.
April 21 was a good example. There occurred an important rainfall of 33.7 mm with a heavy cover of clouds and a relative humidity of over 88% for a 24-hour period, which permitted sporulation and infection.

On July 12, on the contrary, rainfall was apparently sufficient and was followed by sunshine and mistral, but the relative humidity did not reach 90% and was, therefore, insufficient for spreading the infection.

In general, there occurred several rainy periods which were sufficiently widely separated by warm and dry periods which prevented the spread of the disease. In fact, formation of conidia is always abundant on freshly-formed lesions before necrosis develops. On the contrary, when the necrosis of infected spots is in an advanced stage, the number of conidia is much reduced. It is the spacing of the rainfalls and highly humid periods which permit the development of necrosis and, as a consequence, sporulation and infection.

The conditions of the year merely confirmed the well-known requirement of Piricularia for high relative humidity, because this year, with its droughts, did not permit strong attacks of rice blast disease. The two outbreaks observed corresponded to two distinctive rainy periods.

Behavior of Varieties

Most rice varieties were susceptible to rice blast. In one nursery, all plants were destroyed during an attack. For reasons already stated above, the disease did not spread out. At the end of the growing season, both late and early varieties were harvested late. All of them had been attacked by rice blast disease, but without any consequences for the harvest, because of the growth phase in which the plants were attacked. The last infection of the season merely created a means of transmitting a seed infection into 1962. Likewise, at the start of October, we observed an attack by Piricularia on the variety "Cesariot", which had been left in the field for seed formation.

The variety "Balilla" was also attacked, but only after the formation of kernels. Such an infection had but small consequences.

In conclusion, this year has been sufficiently normal (with a dry and warm summer). Apparently, the early varieties harvested when ripe escaped attacks. Their respective resistance against rice blast disease has been discussed.
Key to Table 1. [on preceding page]
(a) rainfall
(b) wind
(c) hygrometry
(d) spread of rice blast
(e) April
(f) May
(g) June
(h) July
(i) August
(j) September
(k) October

Key to Table 2. [on following page]
(a) rainfall
(b) sky
(c) Wind N= north
(d) hygrometry
(e) temperature °C
(f) minimum - maximum
(g) April
(h) May
(i) June
(j) July
(k) August
(l) September
(m) October
(n) cloudy
(o) sunny
(p) hazy
(q) no report
(r) neither sporulation nor infection
(s) sporulation and infection
(t) no sporulation
(u) sporulation in sheltered locations, no infection: dry atmosphere
(v) sporulation and infection in sheltered locations
(w) sporulation
(x) infection
(y) sporulation: without infection
Table 2. Meteorological conditions which accompanied different rainfalls and the consequences for the spread of rice blast

<table>
<thead>
<tr>
<th>Date</th>
<th>Pluie</th>
<th>Temp</th>
<th>Hygrométrie</th>
<th>Température</th>
<th>(f) Evolution du champignon</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 avril</td>
<td>21</td>
<td>N</td>
<td>couvert</td>
<td>82 — 100</td>
<td>7° — 12°</td>
</tr>
<tr>
<td>17 avril</td>
<td>25.2</td>
<td>N</td>
<td>soleil</td>
<td>70 — 100</td>
<td>7° — 12°</td>
</tr>
<tr>
<td>21 avril</td>
<td>33.7</td>
<td>N</td>
<td>couvert</td>
<td>88 — 100</td>
<td>11° — 13°</td>
</tr>
<tr>
<td>26 avril</td>
<td>17.5</td>
<td>N</td>
<td>soleil</td>
<td>39 — 100</td>
<td>7° — 17°</td>
</tr>
<tr>
<td>16 mai</td>
<td>3.6</td>
<td>N</td>
<td>nuageux (p)</td>
<td>36 — 100</td>
<td>11° — 22°</td>
</tr>
<tr>
<td>17 mai (h)</td>
<td>0</td>
<td>N</td>
<td>soleil (o)</td>
<td>39 — 100</td>
<td>11° — 23°</td>
</tr>
<tr>
<td>18 mai</td>
<td>15.9</td>
<td>N</td>
<td>nuageux (p)</td>
<td>78 — 100</td>
<td>8° — 14°</td>
</tr>
<tr>
<td>25 mai</td>
<td>0.8</td>
<td>N</td>
<td>couvert (n)</td>
<td>58 — 99</td>
<td>12° — 16°</td>
</tr>
<tr>
<td>26 mai (h)</td>
<td>0</td>
<td>N</td>
<td>nuageux (p)</td>
<td>45 — 100</td>
<td>10° — 22°</td>
</tr>
<tr>
<td>27 mai</td>
<td>44.5</td>
<td>N</td>
<td>couvert (n)</td>
<td>73 — 100</td>
<td>12° — 24°</td>
</tr>
<tr>
<td>28 mai</td>
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<td>nuageux (p)</td>
<td>51 — 81</td>
<td>8° — 16°</td>
</tr>
<tr>
<td>30 mai (h)</td>
<td>0</td>
<td>N</td>
<td>couvert (n)</td>
<td>67 — 100</td>
<td>3° — 17°</td>
</tr>
<tr>
<td>31 mai</td>
<td>9.6</td>
<td>N</td>
<td>couvert (n)</td>
<td>75 — 100</td>
<td>12° — 19°</td>
</tr>
<tr>
<td>1er juin</td>
<td>31.4</td>
<td>N</td>
<td>nuageux (p)</td>
<td>62 — 100</td>
<td>9° — 19°</td>
</tr>
<tr>
<td>27 juin (l)</td>
<td>5.3</td>
<td></td>
<td>soleil (o)</td>
<td>(sans) (q)</td>
<td>17° — 25°</td>
</tr>
<tr>
<td>12 juillet</td>
<td>14.5</td>
<td></td>
<td>soleil (o)</td>
<td>&lt; 90</td>
<td>13° — 25°</td>
</tr>
<tr>
<td>12 août</td>
<td>7.7</td>
<td>N</td>
<td>couvert (n)</td>
<td>62 — 100</td>
<td>15° — 22°</td>
</tr>
<tr>
<td>1er sept</td>
<td>0</td>
<td>N</td>
<td>couvert (n)</td>
<td>89 — 100</td>
<td>14° — 22°</td>
</tr>
<tr>
<td>4 sept.</td>
<td>27.7</td>
<td>N</td>
<td>nuageux (p)</td>
<td>63 — 100</td>
<td>14° — 24°</td>
</tr>
<tr>
<td>5 sept.</td>
<td>8.3</td>
<td>N</td>
<td>couvert (n)</td>
<td>57 — 130</td>
<td>12° — 22°</td>
</tr>
<tr>
<td>20 sept.</td>
<td>11.3</td>
<td>N</td>
<td>couvert</td>
<td>69 — 100</td>
<td>12° — 15°</td>
</tr>
<tr>
<td>1er oct.</td>
<td>18.4</td>
<td>N</td>
<td>couvert</td>
<td>69 — 100</td>
<td>9° — 14°</td>
</tr>
<tr>
<td>3 oct.</td>
<td>1.2</td>
<td>N</td>
<td>nuageux (p)</td>
<td>72 — 100</td>
<td>7° — 17°</td>
</tr>
<tr>
<td>4 oct.</td>
<td>0</td>
<td>N</td>
<td>nuageux</td>
<td>62 — 100</td>
<td>13° — 23°</td>
</tr>
<tr>
<td>5 oct.</td>
<td>0</td>
<td>N</td>
<td>nuageux (p)</td>
<td>66 — 100</td>
<td>11° — 21°</td>
</tr>
<tr>
<td>6 oct.</td>
<td>92.2</td>
<td>N</td>
<td>couvert (n)</td>
<td>76 — 100</td>
<td>12° — 17°</td>
</tr>
<tr>
<td>7 oct.</td>
<td>7.3</td>
<td>N</td>
<td>couvert</td>
<td>67 — 100</td>
<td>9° — 16°</td>
</tr>
</tbody>
</table>

Hygrométrie provided daily maximum values which almost always are equivalent to 100. These values were obtained during the night. From the point of view of plant pathology, the importance is the duration of the maximum value and whether or not it allowed sporulation and infection to occur.

[Key to Table on preceding page]