

A NOTE ON THE OCCURRENCE OF BLOSSOM-END ROT OF TOMATOES AT ANURADHAPURA, 1937

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BLOSSOM-END rot of tomatoes is common in Ceylon and often causes considerable losses in places where tomatoes are grown extensively. Its appearance is well-known to tomato growers, but, to avoid confusion, a short description of the symptoms of the disease is given below.

As the name of the disease implies, the injury occurs at or very close to the stigma or blossom-end of the fruits. It never originates from any other part of the fruit or plant. The disease first appears as a water-soaked area at or near the blossom-end of the fruit, *i.e.*, the part furthest away from the stalk. This water-soaked area soon darkens and enlarges rapidly in a constant widening circle until the fruits begin to ripen. The result on the ripening fruit is a dark brown or black sunken area which may involve as much as half the fruit. The sunken tissue is usually hard and leathery but secondary organisms may sometimes gain an entrance into the disease tissue and cause a soft rot.

Blossom-end rot of tomatoes was first described by Galloway (1888) but its cause was not discovered for many years. Brooks (1914) carried out extensive trials and experiments and concluded that the disease was not due to the action of bacteria or fungi but that it was a physiological disease associated chiefly with the water-content of the soil, and that manuring with certain types of manures increased the incidence of the disease. He showed that the incidence of the disease was greatest when plants were in a condition of great activity and that continued excessive watering or a sudden check in the water-supply induced the disease.

Other workers have, since that time, confirmed the observations of Brooks and have amplified them. Chamberlain (1933) stated "In his country (New Zealand) it appears that the disease is usually due to lack of moisture, since the condition generally occurs in the fields where the plants are grown on light sandy soil, being often confined to dry, sandy or gravelly ridges. Crops which have been regularly irrigated and are then left for a period without water suffer the heaviest losses. Vigorously grown sappy plants are the most susceptible." He showed that the removal of plants from shaded to unshaded portions of greenhouses also induced the disease.

There is no record of data concerning the disease in Ceylon and, when it was learned that an elaborate spacing and manurial trial was being carried out at the Experiment Station, Anuradhapura, during the *maha* season, 1936-37, the co-operation of the field staff was sought and secured in obtaining figures of the incidence of the disease.

EXPERIMENTAL

The experiment consisted of four randomized blocks of eight 1/45 acre plots. The whole area received a basal dressing of ten tons of compost. The variety of tomato grown was Marglobe. In the experiment two spacings of the plants, *viz.*,

(a) 3 feet by 1 ft. 6 in.

(b) 3 feet by 1 ft.

were combined with the following four manurial treatments :—

(c) unmanured control

| | | | |
|-------------------------|----|----|--------|
| (x) sulphate of ammonia | .. | .. | 1 cwt. |
| superphosphate | .. | .. | 3 cwt. |
| muriate of potash | .. | .. | 1 cwt. |

| | | | |
|-------------------------|----|----|--------|
| (y) sulphate of ammonia | .. | .. | 1 cwt. |
| superphosphate | .. | .. | 2 cwt. |
| muriate of potash | .. | .. | 1 cwt. |

| | | | |
|-------------------------|----|----|----------|
| (z) sulphate of ammonia | .. | .. | 1 cwt. |
| superphosphate | .. | .. | 3 cwt. |
| muriate of potash | .. | .. | 0.5 cwt. |

Each of the randomized blocks therefore contained the eight plots *ac*, *ax*, *ay*, *az*, *bc*, *bx*, *by* and *bz*.

The plots with the wide and narrow spacings contained 153 and 225 plants respectively; of these the outside rows were omitted to overcome border effects leaving 105 and 161 observed plants in the two sets of plots respectively.

The tomato plants were staked and pruned down to a single stem. This was found to reduce the intensity of attack by leaf-spot or leaf-blight, caused by *Septoria lycopersici*, which was severe on the young plants before they were staked and pruned.

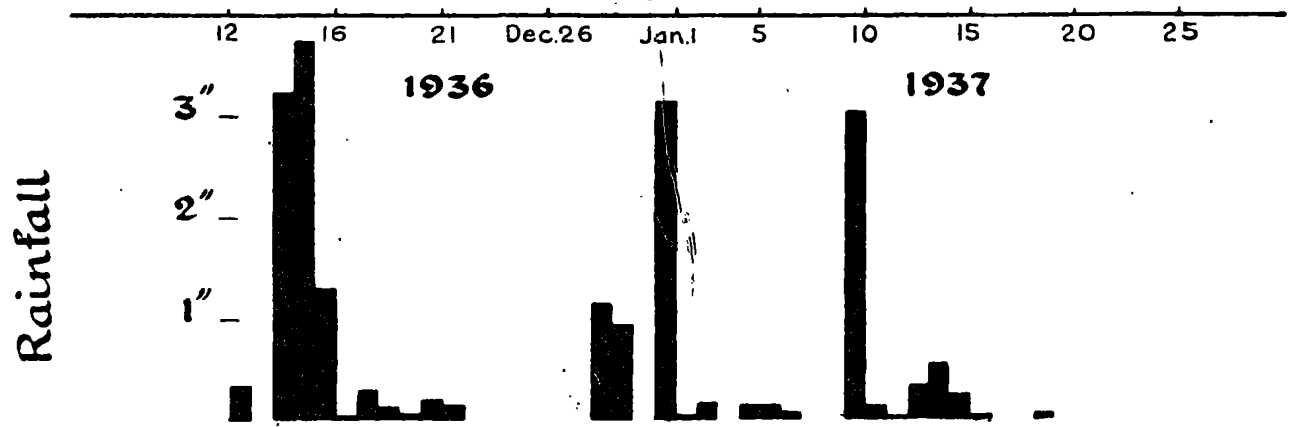
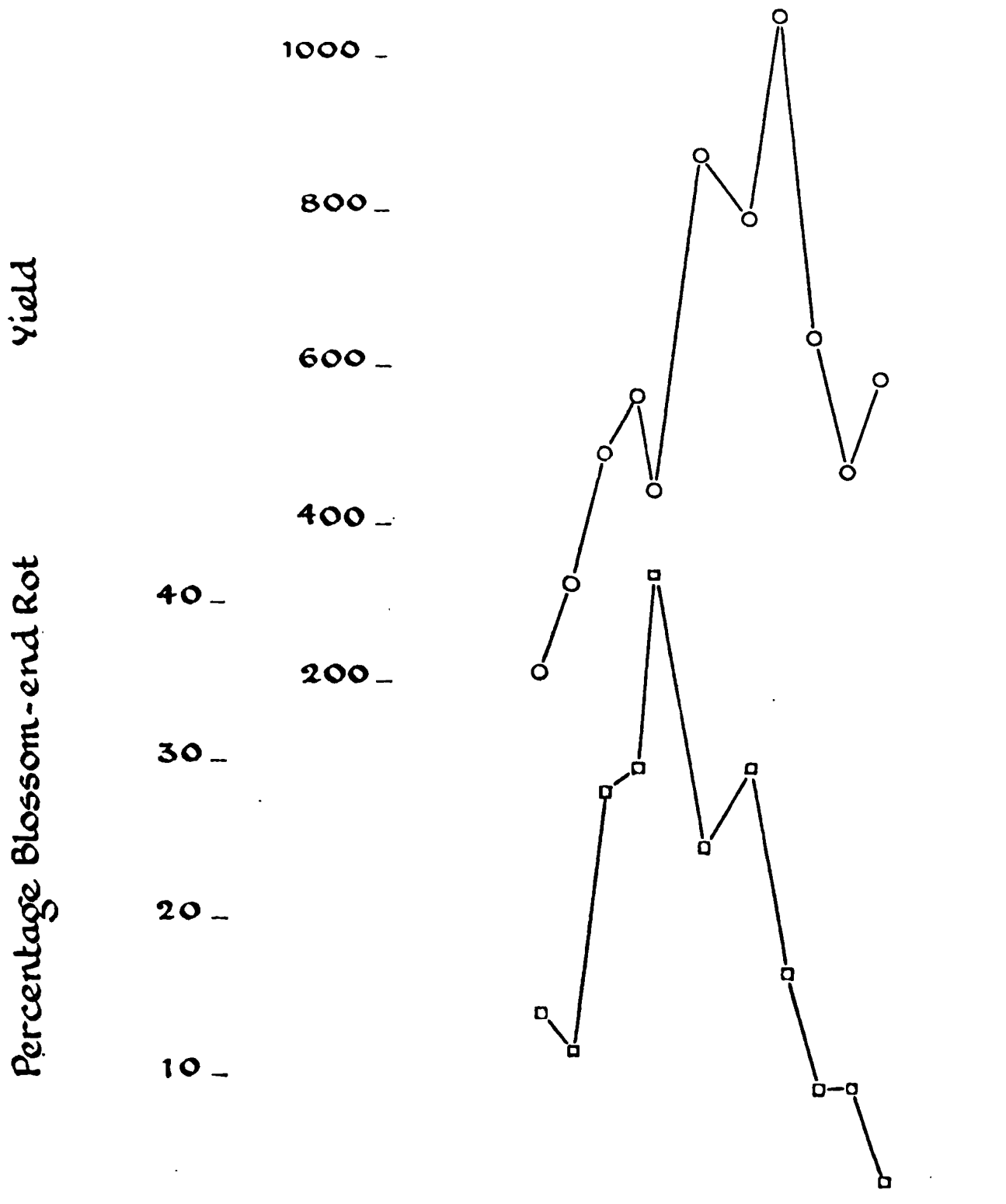
Fruits were picked when they were ripe, and during the cropping season, which lasted from 2nd January, 1937 until 23rd January, 1937, pickings were made at intervals of from one to three days, but mainly every two days.

TABLE I
FIELD RECORDS OF YIELDS

| <i>Treatment</i> | | | <i>Total yield of fruits</i> | <i>Blossom-end Rot</i> | |
|------------------|----|----|----------------------------------|------------------------|---------------------------------------|
| | | | | <i>Totals</i> | <i>Percentages of total yield</i> |
| <i>ac</i> | .. | .. | 612 | 122 | 19·9 |
| <i>ax</i> | .. | .. | 732 | 151 | 20·6 |
| <i>ay</i> | .. | .. | 598 | 106 | 17·7 |
| <i>az</i> | .. | .. | 669 | 149 | 22·3 |
| <i>bc</i> | .. | .. | 972 | 189 | 19·4 |
| <i>bx</i> | .. | .. | 921 | 186 | 20·2 |
| <i>by</i> | .. | .. | 1,055 | 244 | 23·1 |
| <i>bz</i> | .. | .. | 869 | 147 | 16·9 |
| Total | .. | .. | 6,428 | 1,294 | 20·13 |

In table I are given the total yields and the total numbers of fruits affected with blossom-end rot, in the various treatments, for the whole cropping season. The figures from the various replicates were unfortunately lumped together and the data are in consequence not amenable to statistical analysis. The tomatoes affected with blossom-end rot comprised 20·1 per cent. of the total crop.

The numbers of tomatoes picked and the numbers of fruits attacked by blossom-end rot at successive pickings are given



Slipch. by Survey Dept. Cayman I. S. S.

Figure 1.—The Relation between Blossom-end Rot of Tomatoes and Rainfall

in table II. These figures are plotted in figure I together with the rainfall data. The relevant rainfall figures are also given in table III.

TABLE II
FIELD RECORDS OF YIELDS AT DIFFERENT PICKINGS

| <i>Dates of picking 1937</i> | <i>Total Nos. of fruits picked</i> | <i>Blossom-end Rot Totals</i> | <i>Percentages of total yield</i> |
|----------------------------------|--|-----------------------------------|---------------------------------------|
| Jan. 2 | 210 | 31 | 14.8 |
| „ 4 | 326 | 39 | 12.0 |
| „ 6 | 489 | 137 | 28.0 |
| „ 8 | 563 | 167 | 29.6 |
| „ 9 | 440 | 184 | 41.8 |
| „ 12 | 873 | 214 | 24.5 |
| „ 15 | 789 | 232 | 29.4 |
| „ 17 | 1,052 | 171 | 16.3 |
| „ 19 | 637 | 58 | 9.1 |
| „ 21 | 465 | 43 | 9.2 |
| „ 23 | 584 | 18 | 3.1 |
| Total | 6,428 | 1,294 | 20.13 |

TABLE III
DAILY RAINFALL RECORDS FROM 11th DECEMBER, 1936 TO 24th JANUARY, 1937
(Rainfall measured at 9 a.m. each day for the previous 24 hours)

| <i>Date December, 1936</i> | <i>Rainfall in.</i> | <i>Date December, 1936</i> | <i>Rainfall in.</i> | <i>Date January, 1937</i> | <i>Rainfall in.</i> |
|--------------------------------|-------------------------|--------------------------------|-------------------------|-------------------------------|-------------------------|
| 11 | 0.44 | 26 | — | 10 | 3.05 |
| 12 | 0.33 | 27 | — | 11 | 0.13 |
| 13 | — | 28 | — | 12 | 0.02 |
| 14 | 3.22 | 29 | 1.17 | 13 | 3.35 |
| 15 | 3.75 | 30 | 0.96 | 14 | 0.58 |
| 16 | 1.30 | 31 | — | 15 | 0.25 |
| 17 | 0.02 | <i>January, 1937</i> | | 16 | 0.04 |
| 18 | 0.30 | 1 | 3.15 | 17 | — |
| 19 | 0.12 | 2 | 0.05 | 18 | — |
| 20 | 0.05 | 3 | 0.18 | 19 | 0.05 |
| 21 | 0.20 | 4 | — | 20 | — |
| 22 | 0.15 | 5 | 0.16 | 21 | — |
| 23 | — | 6 | 0.15 | 22 | — |
| 24 | — | 7 | 0.08 | 23 | — |
| 25 | — | 8 | — | 24 | — |
| | | 9 | — | | |

DISCUSSION

Although it is not possible to analyse the figures statistically it is obvious from a consideration of the figures in table I that the treatments in this experiment had little, if any, effect on the incidence of blossom-end rot. It is possible that the effect of the heavy basal dressing of compost, which was applied to the whole area, had a uniform effect, that the additional doses of artificial fertilizers had no further effect and that the plots might have exhibited differences had the fertilizers been applied to unmanured plots. Other workers have shown that the use of certain fertilizers does increase the incidence of blossom-end rot and the fact that no marked results were obtained in this experiment does not necessarily imply that a similar effect does not occur under Ceylon conditions.

The soil on which the experiment was carried out consists of a shallow layer of loam overlying a compact gravelly pan. Heavy precipitation of rain leads to temporary water-logging of the surface soil owing to the initial impermeability of the compact gravel. It has been observed, however, that rapid drainage soon succeeds a period of water-logging and it is thought that this is due to the establishment of capillary columns through the gravel layer which, when complete, result in rapid drainage of the surface layer of soil. A sequence of two or three days of soil saturation followed suddenly by relative dryness is accordingly not unusual.

The intense insolation which occurs in Anuradhapura also contributes to the rapid drying up of the soil.

It will be seen from table III and from figure 1 that the rainfall during the maturing of the tomatoes was heavy but irregular. It will be seen that the very wet days, 14th to 16th December, were followed by a period with relatively light rainfall and that six days of dry weather intervened between the 22nd December and the heavy rains of 29th December, 1936, to 1st January, 1937. Irregular precipitation like this would produce marked changes in the water-content of normal soils and the changes produced in the soil of the experimental plots must have been considerable. It has been shown by Brooks and other workers that marked fluctuations in the water content of the soil leads to the incidence of blossom-end rot of

tomatoes and it is therefore not surprising that the average percentage of diseased to total fruits was about 20 per cent. and that, at one picking, as many as 40 per cent. of the fruits were attacked by blossom-end rot.

No detailed interpretation of the curves in figure 1 is attempted here. From an isolated set of observations as are herein recorded it is not possible to conclude definitely that the maximum occurrence of blossom end rot is correlated with the sudden fluctuation from wet to dry soil conditions which took place about a fortnight previously. It is, however, thought that the relationship is sufficiently significant to be worthy of record. The collection of the data herein presented was suggested primarily to note the effect of artificial fertilizers on the incidence of this and other diseases. As has been pointed out above, negative results were obtained on this point but the relationship between weather and the consequent water-content of the soil and the incidence of blossom-end rot appears to be sufficiently close to warrant the collection of further data for the complete elucidation of the problem. Tomatoes may well become an important rotation crop of villagers in Anuradhapura district and elsewhere and a disease which has been shown in this experiment to render 20 per cent. of the fruits economically valueless may prove to be a limiting factor in the successful cultivation of the crop.

ACKNOWLEDGMENTS

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