IV. SUMMARY AND CONCLUSIONS

Black spot was observed for the first time at Letaba Estates in 1946 and reached epidemic proportions eight years later.

The disease inflicted serious losses. At one stage the annual losses were estimated at R200,000 at Letaba Estates.

Other workers showed that dead leaves, infected fruit and green leaves with lesions are sources of inoculum. Investigations showed that dead twigs, on the tree or on the orchard "floor" can be an important source of inoculum.

Strong evidence was obtained that ascospores are the most important source of infection. Perithecia on dead leaves ripened rapidly during the summer months, but slowly during winter. Relatively few ripe perithecia were found from July to the end of October. From October onwards the perithecia ripened rapidly.

The seasonal discharge of ascospores were ascertained with a Hirst spore trap which operated in the citrus orchards. Relatively few ascospores were trapped before November, but large numbers were recorded from November onwards.

Under laboratory conditions ascospores were ejected to a distance of 1.2 cm. Low temperatures did not arrest the discharge of ascospores.

Ascospores were only ejected when the perithecia were wetted. In the absence of rain ascospores were never trapped. Although water is an essential requirement for ascospore discharge, spores were not trapped with every rain. The amount of rain did not seem to play an important role in spore liberations. Spores were never trapped during flood irrigations.

Numerous malformed ascospores were observed towards the end of a discharge period.

Ascospores germinated after approximately 15 hours and usually formed appressoria, but not always. Under laboratory conditions ascospores germinated and penetrated citrus leaves through stomata. Mycelium of *P. citricarpa* also penetrated through stomata under artificial conditions. Valencia orange fruits were successfully inoculated with pycnidiospores and ascospores.

Predictions of infection periods were made by examining perithecium development on dead citrus leaves. These predictions were highly successful during the 1961-1962 season.

The infection period lasted from the beginning of November until February. The period from blossoming to end-October was relatively infection-free. The fruit apparently became resistant to infection after February. The incidence of black spot increased rapidly when the fruits reached peack maturity and the temperature increased.

The incidence of black spot was higher in the upper portions of the trees than the lower portions. The incidence of black spot was higher on those fruits that received the most sunlight.

A period of drought during the first four months before harvesting increased the severity of black spot.

Eradication of inoculum on the orchard "floor" gave negative results.

Short spray intervals did not always give better results than long intervals. The success of a spray programme depended on how close a spray had been applied before an infection period.

A few bound copper fungicides gave better results than Bordeaux mixture.

When copper fungicides were used, applications of calcium arsenate had no effect on early maturity of Valencia oranges. Copper fungicides also caused unsightly blemishes on the fruit.

Various organic fungicides were evaluated but only Zineb (Dithane Z-78) Maneb (Dithane M-22) and PMC (Phenyl mercury chloride) showed promise. Dithane Z-78, used in a programme gave satisfactory control, provided a good copper fungicide was used for the last spray application in December and January. The addition of spray-oil to Dithane Z-78 improved the overall control. In a combined spray with Dithane Z-78 calcium arsenate was as effective on early maturity as where calcium arsenate was used alone. Dithane Z-78 caused no blemishes.

Satisfactory control was achieved with a copper-sulphur dust.

Low volume spraying was successful in controlling black spot, when suitable materials were used.

Aerial spraying with copper-in-oil and applied with a fixed wing aircraft gave encouraging results.

When copper plus oil was applied 4½ days after infection only partial control was achieved.

Sprays with an emulsified mineral oil shortly before fruit ripening reduced the incidence of black spot at picking time.

Several fungicides with chemotherapeutic action were evaluated. The results obtained with chemotherapeutants were not nearly as good as those obtained with copper fungicides.

Mineral oils, used as dip treatments, gave almost complete control of post-harvest development of black spot. Fruit treated with mineral oils, often developed a bad flavour. Vegetable oils did not affect the flavour of the fruits, but did not control black spot.

At Letaba, symptoms which are popularly called "melanose", appear on the fruit of all citrus varieties. These symptoms are similar in description to melanose caused by Phomopsis citri. These particular symptoms at Letaba appeared nearly 16 years ago, at approximately the same time when black spot was observed. It was easier to isolate Phoma citricarpa from these lesions, than from any recognised black spot lesion. Isolations were made from "melanose" symptoms on fruit which came from a farm where black spot had never been observed in the past. P. citricarpa grew out of 85% of these isolations but no cultures of Phomopsis citri were obtained. Melanose symptoms were observed on fruit which had been inoculated with pycnidiospores and ascospores of G. citricarpa.

According to Wager (1953) melanose infections take place shortly after petal-drop and the fruit becomes resistant to infection within a few weeks after petal-drop. It was shown that "melanose" symptoms were caused by infection several months after petal-drop at Letaba.

It was several times observed that Navel orange trees in poor condition will show a high incidence of black spot symptoms, but very little "melanose". The healthy trees showed a high incidence of "melanose", but no black spot.

Although time did not permit a thorough study of the "melanose" phenomenon at Letaba, there is considerable evidence so far that "melanose" (or at least some of the symptoms) is caused by G.citricarpa.