DEVELOPMENTS IN BLISTER BLIGHT CONTROL

IV. SMALL SCALE ASSAY OF FUNGICIDES

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The experimental methods for determining the degree of protection afforded by a fungicide as described in previous papers of this series, while giving a completely satisfactory assessment of the efficiency, are both time and space consuming and require an appreciable number of field staff. For instance, the comparison of four experimental dusts against two commercially available fungicides described in paper III (Park, Webster and Jennings, 1956b) required a tea field of 8 acres, a dusting gang of four every 6 days, three pluckers at similar intervals, with three field assistants on each of the dusting and plucking days. These methods are necessary for a complete assessment; however, with the shortened technique described below, we were able to do a preliminary screening of a larger number of compounds and treatments with considerable reduction in acreage and labour. Certain treatments included in the No. 6 field experiment (Park, Webster and Jennings, 1956a) were repeated in this small scale trial in order to get a comparative assessment of the validity of the new technique.

In order to apply the appropriate spray volume for the small plots, it was necessary to design a total delivery hand sprayer, to which any desired commercial nozzle could be attached, to be operated from the pressure tank of a knapsack sprayer.

Copper fungicides alone have proved economically satisfactory in the control of blister blight, but the possibility of excessive residues in the made tea when the recommended intervals between treatment and plucking are not maintained makes it desirable to find substitutes. The high cost of the raw material is also an encouragement to find low-copper or non-copper alternatives. In the screening programme to be described were one organic (non-copper) fungicide and two antibiotics. Each was applied at 2 or 3 dosage rates which were likely to be economically competitive with the standard copper fungicides. In addition, from the various treatments applied it was possible to make some tentative comparisons of various properties of copper fungicides whch have been said to affect efficiency.

St. Coombs No. 8 field experiment. Small scale trials

OBJECTS:—1. To develop the preliminary screening test.

2. To observe the effect of reduced dosages of standard fungicides.
3. To compare cuprous oxide fungicides with copper oxychlorides (cf. Paper II).
4. To compare 'Wet Blitox' at the equivalent of ½ copper rate with standard fungicides.

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5. To determine if the adhesive used in 'Wet Blitox' is equally efficient with cuprous oxide.
6. To compare an organic copper adhesive formulation with standard fungicides.
7. To assess the fungicidal efficiency of two new cuprous oxides.
8. To study the effect of particle size on the efficiency of both copper oxychloride and cuprous oxide.
9. To assess the efficiency of an organic fungicide and two antibiotics against blister blight.

LAYOUT AND DESCRIPTION OF METHOD:—A block in St. Coombs No. 8 field, unprotected section, pruned in June 1953 and skiffed in April 1955, was used for this experiment. 11 rows of 20 bushes each were divided up into 51 plots of 4 bushes (in the row), and the plots were grouped in 3 blocks, each of 17 plots, labelled A, B, C. The plots in each block were numbered according to the treatment applied, giving 3-fold replication of the randomised treatments. No guard rows were allowed, as the spray from the total-delivery hand sprayer, represented in figure 1, was sufficiently directional not to lead to drift. 68 cc. of the spray of the appropriate concentration was measured into the hand sprayer. This was then connected to the lance of a knapsack sprayer and the whole contents of the spray vessel were sprayed evenly on the plot of 4 bushes. This is approximately equivalent to 15 gallons per acre.

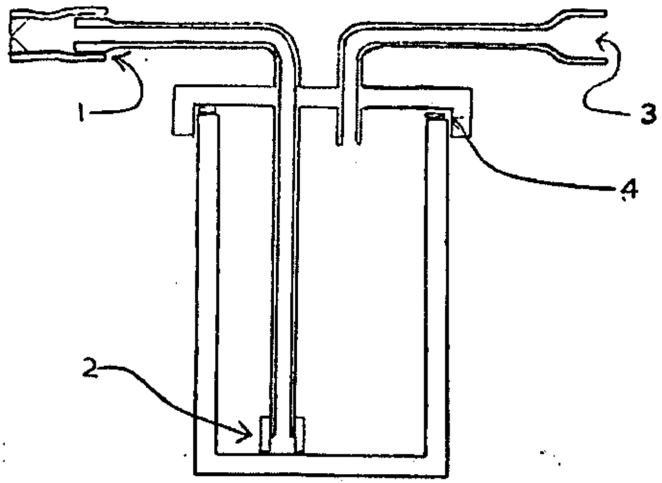

Fig. 1. Sectional diagram of total delivery hand sprayer.

(1) Commercial spray nozzle (Birchmeyer sapphire-lined) screwed to outlet. (2) Rubber tube sleeve, to ensure as complete delivery of spray liquid as possible. (3) Screw connection to spray lance. (4) Screw-threaded connection with leather gasket between lid and vessel for easy filling.

TREATMENTS

1. 'Blitox' (F.P.C. Ltd.) (50% copper as COCl) at 6 ozs. per 15 gallons per acre (= 0.17 gm/68 cc/plot).
2. 'Perenox' (I.C.I. Ltd.) (50% copper as Cu_2O) at 6 ozs. per 15 gallons per acre (= 0.17 gm/68 cc/plot).

3. 'Collavin Pur' (50% copper as Cu_2O) at 6 ozs. per 15 gallons/acre (= 0.17 gm/68 cc/plot).

4. 'Collavin Pur' + adhesive at equivalent of 1.5 oz. Cu per 15 gallons per acre.

5. 'Blitox' + adhesive ('Wet Blitox') at equivalent of 1.5 oz. Cu per 15 gallons/acre.

6. Adhesive formulation based on copper napthenate at equivalent of 1.5 oz. Cu per 15 gallons/acre.

7. Experimental fungicide HD160 at 0.24 oz/15 gallons/acre (= 0.007 gm/ 68 cc./plot).

8. Experimental fungicide HD160 at 2.4 oz./15 gallons/acre (= 0.068 gm/ 68 cc./plot).

9. Colloidal copper oxychloride at equivalent of 2 oz. Cu/15 gallons/acre.

10. 'Blitox' at equivalent of 2 oz. Cu/15 gallons/acre.

11. 'Perenox' at equivalent of 2 oz. Cu/15 gallons/acre.

12. 'Cupfer Oxydul Ultra' (Schering A.G.) at equivalent of 2 oz. Cu/15 gallons/acre.

13. 'Griseofulvin' at 0.12 oz. a.i./15 gallons/acre (= 0.18 cc. liquid concentrate/68 cc./plot.)

14. 'Griseofulvin' at 0.36 oz. a.i./15 gallons/acre (= 0.53 cc. liquid concentrate/68 cc./plot).

15. 'Griseofulvin' at 1.1 oz. a.i./15 gallons/acre (= 1.6 cc. liquid concentrate/68 cc./plot).

16. 'Streptomycin' at 0.60 oz. a.i./15 gallons/acre (= 0.27 gm. 15% technical/68 cc/plot.

17. 'Streptomycin' at 2.4 oz. a.i./15 gallons/acre (= 1.09 gm. 15% technical/ 68 cc./plot).

These treatments were applied at 7 daily intervals, commencing on 1st July and sample plucking was 6 days after each spraying; 8 complete rounds were taken. The total flush from each plot was plucked, including third leaves, and 33 shoots were selected at random from this flush sample for blister counts on the third leaves. The sum of the results from the three replicates of each treatment were expressed as total blisters on 100 shoots and as a percentage infected shoots in an analogous way to that described in paper I of this series (Webster and Park, 1956). The made tea from leaf treated with the adhesive formulation No. 6 was taint tested a number of times during the experiment.

Results.—1. The mean results for the 17 treatments from assessments 3-8 inclusive are shown as block diagrams in figures 2 and 3. For an explanation of the significance of these diagrams reference should be made to paper II of the series (Park, Webster and Jennings, 1956a).

2. Formulation No. 6 did not result in taint of tea.

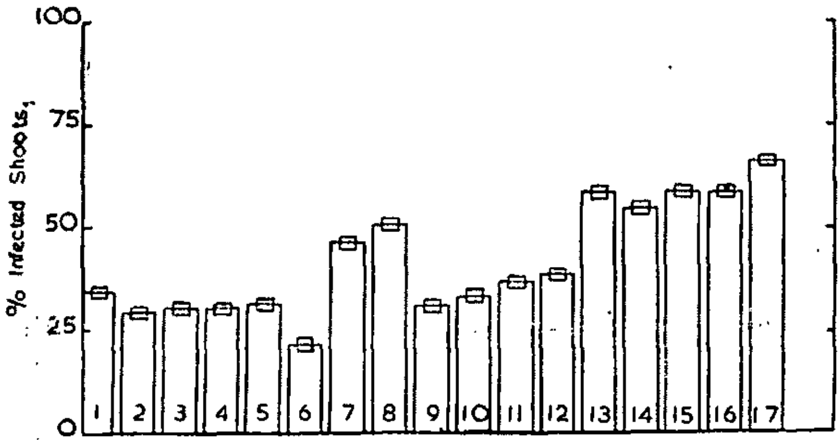

Fig. 2. Block diagram representing the comparative degree of control, based on percentage infected shoots, gained with treatments 1 — 17. The small blocks represent standard errors at 5% level.

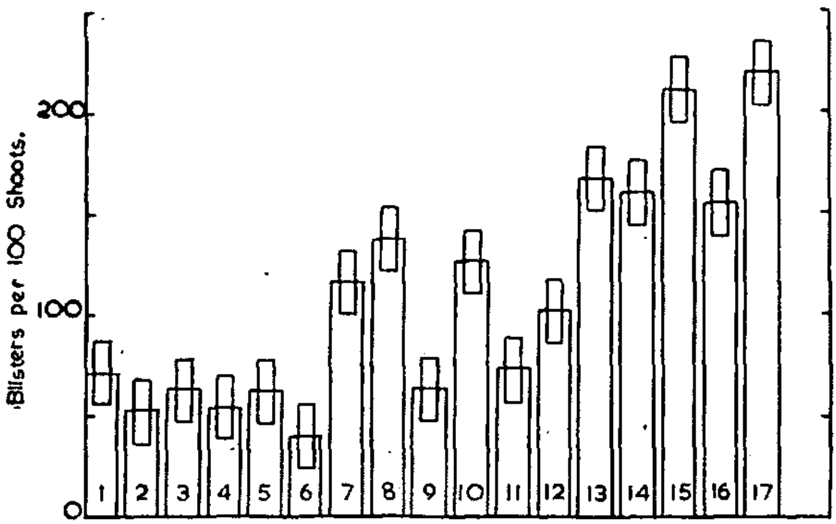

Fig. 3. Block diagram representing the comparative degree of control, based on total blisters per 100 shoots, gained with treatments 1 — 17. The small blocks represent standard errors at 5% level.

Analysis of results.—The statistical analysis of the results of this experiment lead to the following conclusions being drawn:—

1. The protection obtained when the dosage of standard fungicides is reduced from 6 oz. (treatments 1, 2 and 3) to 4 oz. per acre (treatments 9, 10, 11, 12) was somewhat less, but this difference was not significant for some comparisons.

2. There is little or no difference between copper oxychloride and cuprous oxide fungicides (treatments 1 v. 2 and 3; 9 and 10 v. 11 and 12) cf. the similar conclusion listed in paper II of this series.

3. Wet Blitox is practically as efficient as the standard fungicides when applied at the equivalent of half the usual copper rate (treatments 1, 2 and 5) and the adhesive is equally satisfactory with cuprous oxide (treatment 4).

4. The organic copper adhesive formulation is, at half the usual copper rate at least as good as the standard formulations (treatments 6 v. 1 and 2).

5. The new cuprous oxide fungicides were as satisfactory as standard fungicides applied at the same dosage (treatments 3 v. 1 and 2; 12 v. 10 and 11).

6. There is little or no advantage in the use of copper fungicides of colloidal or near colloidal particles (treatment 9), providing the material remains satisfactorily suspended in the sprayer (treatments 9, 10, 11, 12).

7. The experimental organic fungicide was inferior to the standard copper compounds in the control of blister blight, at the dosage rates studied (treatments 7 and 8).

8. The antibiotics (treatments 13-17 incl.) were inferior, at the dosages used, to copper compounds.

Discussion:—The small scale technique for the screening of 17 treatments required one field assistant on two days, together with one spray labourer and one plucker for one day each, and occupied approximately 1/20 acre. Thus its objective of economy of time, labour and acreage of tea was certainly achieved. However, an examination of the results shows that the replicate variations for a number of treatments are wider than is usual with larger plots. Thus for mixed-jat tea a plot size of 4 bushes would appear to be too small and the adoption of a somewhat larger plot size is desirable. The constancy of the block totals and means suggests that 68 bush plots would be completely adequate. Probably some lesser number of bushes could be chosen. The Tea Research Institute will develop the method further in future seasons and 10 bushes seems to be a probable reasonable plot size.

As it was not possible to start this experiment at the beginning of the monsoon, the previously unprotected section of No. 8 field at St. Coombs was selected as the site, in order to have a high blister level and thus a more sensitive assessment of the fungicides. Experience led us to the conclusion that this was an unfortunate choice, since the long attack of blister that this tea had suffered resulted in some bushes producing little or no flush. This no doubt contributed to the wide replicate variations mentioned above. In future experiments a reasonably uniform block of healthy tea will be selected. In addition certainly not less than the 8 assessments used in this case should be used.

Returning to the experiment as reported above, while it is probable that it can be improved, it is clear that, with fungicides shown to be effective against blister blight, it did not give misleading results. The comparison of a standard cuprous oxide fungicide against a copper oxychloride at two dosage levels and the performance of the adhesive formulation Wet Blitox are a close parallel with the corresponding results reported in paper II (Park, Webster and Jennings, 1956a). Thus it is very unlikely that the conclusions drawn regarding the almost ineffective non-copper fungicides are erroneous as a result of imperfect technique.

Conclusions:—A reasonably satisfactory small scale screening method for fungicides against blister blight was developed. All copper-containing compounds were effective, there being some advantage in using the adhesive formulations tried, but little or none in using colloidal materials. Non-copper fungicides were not satisfactory.

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