STUDIES IN BLISTER BLIGHT CONTROL.

VI. AN EVALUATION OF SOME COMMERCIALLY AVAILABLE FUNGICIDES FOR THE CONTROL OF BLISTER BLIGHT.

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A relatively small research institute in a corner of the world remote from the main centres of fundamental scientific research is at a grave disadvantage when new concepts of a subject such as crop protection are called for.

Although the application and adaptation of low volume spraying with copper fungicides has met with a highly satisfactory degree of success, especially in view of the difficulties of terrain and weather, the control of blister disease of Ceylon tea demands attention to new approaches to the general problem of the control of fungus disease of plants.

When Koninklijke/Shell Laboratorium offered their co-operation and agreed to send Dr. J. W. Pfaeltzer to work at the Tea Research Institute, the powerful resources of the Shell Laboratories in Amsterdam became linked to our small spearhead in the field.

During the S.W. monsoon of 1950, Dr. Pfaeltzer carried out a very extensive and accurate series of trials with 188 formulations of 58 different fungicides. The experimental area comprised 296 units including the controls.

The brief account which follows concludes with the statement "investigations in progress shew that a number of experimental materials have given a control equal to that of Perenox or Shell Copper but at a lower dosage of active ingredient per acre."

Fundamental research of this nature is not usually spectacular. In the future — how far in the future cannot be estimated — this "lower dosage of active ingredients" may develop into a real advantage in the science of crop protection. Dr. Pfaeltzer has returned to Ceylon to continue this investigation in the south west monsoon period of 1951 and the Tea Industry of Ceylon is greatly indebted to the Shell Company for their invaluable contribution to the more fundamental aspects of research on blister blight control.

Since a large number of fungicides are now commercially available, it is important to evaluate their effectiveness for the control of blister blight. The present report places on record the results of a large scale statistically randomized trial carried out at the Tea Research Institute of Ceylon as part of a much larger co-operative project, which aims at developing economic methods of blister

blight control on tea which is in pluck ; but for obvious reasons these tests have been confined to tea which is recovering from pruning. While the list of fungicides included in this test is by no means complete it does include the more generally available products and in any case includes at least one representative of the several "types" or "groups" of product. Furthermore, the trial was set up at relatively short notice. The non-inclusion of any product should not be regarded, therefore, in any way as a prior judgment on its merits for the control of blister blight.

The trials were made on a specially selected plot at St. Coombs, where severe blister blight had occurred for the last two years and where unsprayed tea bushes failed to form new leaves owing to the extreme severity of the attack. Units of 20 bushes per treatment were adopted and these were completely separated from each other by at least one bush or guard row. The bushes constituting the units to be treated were given the normal pruning on the 9th and 10th of May, 1950, which was about 10 days before the monsoon rains started. All other bushes and guard rows were unpruned.

The unpruned bushes and guard rows provided a uniform source of infection over the whole area. At two weeks after the start of the monsoon more than 50% of the new shoots of these bushes were infected and one week later over 90% were infected, which resulted in a complete inhibition of new leaf growth. It must be concluded therefore that the trials were made under almost ideal conditions and that the infection potential was uniform over the whole area.

Spraying, which was done by means of hand sprayers employing two standard types of nozzle*, was started one month after pruning, at which time 90% of the buds on the pruned bushes were breaking. Sprayings were repeated at weekly intervals.

All materials were applied at the amounts generally recommended by the makers, but the amount of liquid used was invariably 126 litres per hectare (approximately 10 Imperial gallons per acre).

The standard against which all materials were compared consisted of three units which always occurred together, *viz.* —

(1) Unsprayed.

(2) Sprayed with Perenox.

(3) Sprayed with Shell Copper Fungicide.

Fifteen of these composite units were scattered over the entire area. Shell Copper and Perenox were used at a concentration of 0.2%, *i.e.*, about 4 ozs. in 10 gallons of water per acre per application. Although there was obviously only a slight variation in intensity of infection on the unpruned bushes, each treatment was compared with its nearest "control block."

Visual examination of the plots was made after the 4th, 5th, 6th and 7th sprayings, separate attention being paid to the following :—

(a) Infection of the leaf.

(b) Infection of the stems.

(c) Die-back of the young shoots.

(d) Amount of defoliation.

Each of these phenomena was assessed upon a previously agreed degree of attack expressed on a numerical basis.

** Shell/Delft (Luynet nozzle) and "T jet" nozzle.*

This evaluation was carried out independently by four observers, all of them experienced investigators. A final comparison of their results showed a completely satisfactory agreement.

The following conclusions can be stated :—

I. Materials, the control by which was not so good as that given Perenox and Shell copper fungicide.

(a) Elemental sulphur, *e.g.* :—
wettable sulphur "Thiovit" Sandoz.

(b) Thiuram disulphides and dithiocarbamates, *e.g.* :—
tetramethyl thiuram disulphide : "T.M.T.D." Plant Protection,
ferric dimethyl dithiocarbamate : "Ferbam" Du Pont de Nemours,
zinc dimethyl dithiocarbamate : "Ziram" Du Pont de Nemours,
zinc ethylene bis dithiocarbamate (1,000 gms. per ha. = 0.9 lbs. / acre and less): "Zineb" Du Pont de Nemours and "Dithane Z-78" Rohm & Haas,
sodium ethylene bis dithiocarbamate : "Dithane D-14" Rohm & Haas

(c) Polysulphides, *e.g.* :—
polyethylene polysulphide : "Good-rite P.E.P.S." Goodrich.

(d) Calcium thioglycolate — Robinson Bros.

(e) Glyoxalidines, *e.g.* :—A mixture of :—
2-heptadecyl glyoxalidine
2-pentadecyl glyoxalidine
heptadecenyl glyoxalidine
1-hydroxyethyl — 2-heptadecyl glyoxalidine :
"Craig 341B" "Craig 341C" — Carbon and Carbide Cy.

(f) 2, 4-dinitro-6-caprylphenylcrotonate : "Arathane CR1639" Rohm & Haas.

(g) Salicylanilide : "Shirlan" Plant Protection.

(h) Calcium 8-hydroxyquinolinate : "Carpinol" La Quinoleine.

(i) Chlorinated calcium 8-hydroxyquinolinate : "Carpinol C" La Quinoleine.

(j) 2, 3-dichloronaphthoquinone : "Phygon" U.S. Rubber Co.

(k) Tetrachloroparabenzoquinone : "Spergon" U.S. Rubber Co.

(l) N-trichloromethylthiotetrahydrophtalimide : "SR 406" Standard Oil.

(m) Copper oxychloride : "Blitox", Pest Control Ltd.*

(n) "Fungicide 5379" Carbon and Carbide Cy, of unknown composition.

II. Materials which gave a control of the same order as given Perenox and Shell copper fungicide.

(a) Several copper compounds, *e.g.* :—
Bordeaux mixture (1 : 1 : 100) in kg. and litres = about (5 : 5 : 50) in lbs. and Imp. gall.
Cuprous oxide : "Yellow cuprocide" Rohm & Haas. "Copper Sandoz" — Sandoz.
Copper oxychloride : "Coppesan" — Boots. "Cuprokylt" — Universal Crop Protection.

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* *This early sample was from a defective batch. Manufacturers of "Blitox" has since been improved and standardised and the present product is fully the equal of the other copper fungicides referred to in this report. (Ed.)*

Copper hydroxyquinoline : "Bioquin" — Monsanto.

Copper oxychloride and copper-8-hydroxyquinoline mixture : "Vitosan" — Vitax Fertilisers.

(b) Probably polysulphides, e.g. :—

Calciumpolysulphide "Sulfonette"; Copper Mc Dougall & Robertson.

(c) Zinc ethylene bis ithiocarbamate (2000 gr./ha. = 1.2 lbs./acre and more). "Dithane Z-78" — Rohm & Haas.

All copper containing products were diluted up to a copper content of the spraying liquid equal to the standard. With the non-copper containing products the concentration recommended by the manufacturers was used.

While the present report is confined to an evaluation of products which are commercially available, investigations in progress show that a number of experimental materials have given a control equal to that of Perenox or Shell Copper but at a lower dosage of active ingredient per acre.