Control of Seedling Blight of Rice caused by *Fusarium moniliforme* Sheld (*Gibberella fujikuroi* (Saw) Wr.)

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Introduction

POOR GERMINABILITY of the seed and post-emergence seedling diseases of rice are caused by several seed and soil borne fungi. Among these *Helminthosporium oryzae.* Breda de Haan, *Piricularia oryzae* Cav. and *Fusarium moniliforme* Sheld. (*Gibberella fujikuroi* (Saw) Wr.) are to a large extent seed transmitted and are of economic importance in Ceylon. Primary infection of seedlings by these fungi may be prevented by seed disinfection with suitable materials. A great variety of organo-mercury formulations, copper compounds and fungicides containing thiram have been tested by several workers against seed-borne organisms of cereals and their relative effectiveness in controlling seedling diseases ascertained. In the present investigation a number of more recent proprietary seed dressings have been tested against *F. monoliforme* (*G. fujikuroi*) and the phytotoxic properties of these materials and their effect on root and shoot growth ascertained.

Historical

A considerable measure of control of the primary infection of *F. moniliforme* (*G. fujikuroi*) has been obtained by Ito and Kimura (1931) by disinfection of the seed with formalin. Subsequently Ito (1932) reported that the conidial death point of *F. moniliforme* (*G. fujikuroi*) subjected to mercuric chloride and formalin was 0.1 per cent. and 0.7 per cent. respectively. The use of formalin, however, requires great care as a slight increase in the concentration may adversely affect germination of the seed. Thomas (1933) tested a number of wet and dry seed disinfectants and concluded that most of the treatments reduced primary infection to a considerable extent. He obtained promising control of the disease with the commercial seed dressings Uspulun, Ceresan and Tillantin, Semesan and Granosan. Copper sulphate was inferior to these preparations and inhibited germination of the seed. Sundararaman (1936) obtained better control of the disease with the organo mercury product Ceresan than with copper sulphate or Bordeaux mixture. Peiris (1951) reported that seed dressing with Agrosan GN at 2 ounces per bushel effectively controlled the disease.

Materials and Methods

The following seed dressings were tested :—

Seed Dressing	*Active Ingredient*
Agrosan GN ..	Mixture of phenyl mercury acetate and ethyl mercury chloride
Ceresan ..	Methoxethyl mercury chloride
Tillex ..	Ethyle mercury chloride
Fernasan A ..	bis (dimethylthiocarbomyl) disulphide
Yellow Cuprocide	Cuprous oxide
Perenox ..	Cuprous oxide
Cerenox ..	Systemic fungicide, active ingredient unknown

The seed of the variety *Heenati 309* which is susceptible to attack by *Fusarium moniliforme* (*Gibberella fujikuroi*) was inoculated with a heavy spore suspension of the fungus and air dried for a week at the room temperature. Each fungicide was applied to the seed in a 250 ml. Erlenmeyer flask ; uniform application of the material was ensured by shaking the flask for 2 minutes. The liquid seed disinfectant was applied by the immersion process ; the seed was immersed in the disinfectant for 30 minutes, air dried and stored in conical flasks. The effectiveness of seed protectants was assessed by the following methods :—

1 Laboratory Method. This is based on the Ulster method of testing seeds for the presence of seed-borne organisms described by Muskett and Malone (1941). In this method untreated seed and those treated with fungicides were plated on 2 per cent. dextrose agar at the rate of 100 seeds per treatment and per cent. colonies of *F. moniliforme* (*G. fujikuroi*) produced estimated. The method is especially useful for rapid laboratory evaluation and elimination of unpromising seed protectants. However, conditions obtained in vitro tests were considered too severe for final evaluation and the materials were tested further by the pot culture method.

2 Pot Culture Method. Unsterile clay soil was placed in pots 5½ inches diameter ; the moisture content of the soil was adjusted and maintained at 100 per cent. saturation. Untreated seed and those treated with different protectants was germinated and shown at the rate of twenty-five seedlings per pot. Each treatment was replicated three times and the pots were arranged on a greenhouse bench. The experiment was continued for a period of two weeks ; infected seedlings were periodically removed to prevent secondary infection. The results are given in Table I and II. The results of the pot culture experiment were analysed statistically after transforming the data to the inverse sine scale. The mean equivalent angles thus obtained are shown in the last column of Table I. The mean percentage seedlings diseased and the mean equivalent angles of the protectants irrespective of concentration used is shown in Table II. The analysis of variance of the transformed data is shown at the bottom of Table II.

TABLE I—Effect of Seed Protectants on Emergence and Control of Seedling Blight of Rice caused by *F. moniliforme* (*G. fujikuroi*)

Treatment	*Dosage*	*Per Cent. Emergence*	*Per Cent. Colonies on Agar*	*Mean Per Cent. Seedlings diseased*	*Mean equivalent Angle of Seedlings diseased*
Agrosan GN	2 oz./cwt.	97	0	2·67	5·47
	4 oz./cwt.	96	0	1·33	3·83
	6 oz./cwt.	69	0	0	0
Ceresan Dry	2 oz./cwt.	98	0	0	0
	4 oz./cwt.	76	0	0	0
	6 oz./cwt.	66	0	0	0
Ceresan Wet	½ lb./100 gals.	98	4	1·33	3·83
	1 lb./100 gals.	99	0	1·33	3·83
	1½ lb./100 gals.	99	0	1·33	3·83
Tillex Dry	2 oz./cwt.	99	0	1·33	3·83
	4 oz./cwt.	98	0	1·33	3·83
	6 oz./cwt.	92	0	0	0
Tillex Wet	1¼ fl. oz./13 gal.	99	2	2·67	5·47
	2½ fl. oz./13 gal.	99	0	0	0
	3¾ fl. oz./13 gal.	98	0	0	0
Fernasan A	2 oz./cwt.	95	25	5·33	10·93
	4 oz./cwt.	98	16	2·67	7·67
	6 oz./cwt.	92	8	1·33	3·83
Perenox	2 oz./10 gal.	97	44	18·67	25·40
	4 oz./10 gal.	98	23	13·33	21·40
	6 oz./10 gal.	97	14	8·00	15·53
Yellow Cuprocide	2 oz./cwt.	82	42	18·67	25·40
	4 oz./cwt.	71	38	10·67	18·80
	6 oz./cwt.	88	31	6·67	14·77
Cerenox	150 gms./100 kgs.	100	76	41·33	39·90
	300 gms./100 kgs.	96	76	37·33	37·60
	450 gms./100 kgs.	98	72	37·33	37·57
Control		99	87	58·67	50·10
Significant difference at P = ·05					8·96

TABLE II—Effect of Seed Protectants on Control of Seedling Blight of Rice caused by *F. moniliforme* (*G. fujikuroi*)

Fungicide	*Mean Per Cent. Seedlings diseased*	*Mean equivalent Angle*
Ceresan Dry	0	0
Tillex Wet	0·89	1·82
Tillex Dry	0·89	2·25
Agrosan GN	1·33	3·10
Ceresan Wet	1·33	3·83
Fernasan A	3·11	7·48
Yellow Cuprocide	12·00	19·60
Perenox	13·33	20·78
Cerenox	38·66	38·36
Control	58·67	50·10
Significant difference between control and seed protectants at P = ·05	—	7·32
Significant difference between seed protectants at P = ·05	—	5·24