EVALUATION OF FUNGICIDAL PROPERTIES OF LIGNIN ACETIC ACID

Part II.—Studies on Treated Jute Seeds in Infested Soil

M.I. Ali, Q.A. Ahmed and M.H. Khundkar

Department of Chemistry, University of Dacca, Dacca, East Pakistan

In view of the promising results obtained in the previous work,[1] elaborate studies were undertaken on jute seeds differently treated with lignin acetic acid for controlling the diseases of jute plants caused by various fungus organisms. Preliminary experiments were carried out with a sample of C.G. variety of *Corchorus olitorius* that showed 14.0% contamination with *Macrophomina*. The seeds were surface sterilized with 0.5% solution of lignin acetic acid as seed protectant and allowed to germinate on wet filter paper in a sterilized petri-plate. The result was satisfactory in so far as these seeds have shown no evidence of toxic effect upon the germination and the extent of the disease was brought down from 14.0 to 2.0%. This inspired further study of the problem, particularly in disease infested soil.

Experimental

The detailed experiments relating to the control of fungal diseases of jute plants were done with only two organisms, *viz.*, *Rhizoctonia sp.* and *Macrophomina phaseoli*, which are reported[2] to cause heavy damage to the seedlings.

I. Preparation of treated seed samples : A sample of C.G. variety of *Corchorus olitorius* was treated with lignin acetic acid in three different ways as described below. Fifteen samples of treated seeds (five for each treatment) and one of untreated seeds were stored for about 6 months for investigation.

Treatment 1 : The alcoholic solution of lignin acetic acid was diluted with distilled water to a large volume to make 0.5% and 1.0% solutions separately. The seeds were surface sterilized with this solution, dried and stored carefully.

Treatment 2 : A 5.0% water suspension of lignin acetic acid was prepared and the seeds were treated with it, dried and stored.

Treatment 3 : A dry powder of lignin acetic acid (6.6 % by wt.) was added to the seeds and mixed up intimately by mechanical means, after which the seeds were stored.

II. Preparation of infested soil : The sterilized soil was kept open for about 7 days to vent the unwanted gases. The soil was then made properly wet and the requisite quantity was taken in several earthen pots. Previously grown fungus organisms* were mixed with the required quantity of sterilized soil by a mechanical process. A ¾ inch layer of this inoculated soil was spread over the sterilized soil previously filled in the pots. The pots—now containing two layers of soil, the upper layer profusely contaminated with the organism and the lower layer without pathogen—were kept aside for 7 days to obtain a uniform distribution of fungus throughout each pot, after which they were ready for sowing.

III. Sowing and collection of data: It was felt necessary to keep 5 pots for each sample of treated and untreated seeds, 10 seeds being sown in each pot. The pots were kept at room temperature (about 27°C.), the requisite quantity of water being supplied regularly. The number of seeds germinated, as well as those dying before and after germination were noted every day for the first 5 days, and thereafter every fifth day. The final results after 30 days are presented in Tables 1, 2 and 3.

From the tables, it seemed that about 10% death always occurred with both treated and untreated seeds in sterilized soil without any pathogen. Sometimes the plants appeared to be healthier with treated seeds. In the case of untreated seeds in *Rhizoctonia* infested soil, the death record was 64% whereas with the treated seeds it has been brought down to 8-12% in different samples. In experiments with *Macrophomina*, on the other hand untreated seeds showed 42% deaths, which were lowered to 26% in the treated seeds. As far as could be observed, lignin acetic acid showed no toxic effect upon the germination.

Discussion

On the basis of statistical probability the results can be tested for significance as follows:—

$$\frac{P_1 - P_2}{\sqrt{\sigma_1^2 + \sigma_2^2}} \geq 2 \text{ for definite significance,}$$

* Test orgunism grown for 7 days in sterilized medium prepared as follows : 100 g. rice-husk ; 2.5 % glucose ; 4.7% ammonium sulphate; and 30 cc. water.

Table 1.—Germination of Variously Treated Jute Seeds in Different Potting Soils.

Nature of inoculum and treatment	1 G	1 PrD	1 PoD	2 G	2 PrD	2 PoD	3 G	3 PrD	3 PoD	4 G	4 PrD	4 PoD	5 G	5 PrD	5 PoD	Remarks
Control sterilized oil, without inoculum and untreated seeds used	10	—	1	10	—	2	10	—	1	10	—	1	10	—	—	G =50 *i.e.* 100% PrD= 0 0 PoD= 5 *i.e.* 10%
Sterilized soil without inoculum and treated seeds (1.0% alcoholic solution)	10	—	1	10	—	1	10	—	1	10	—	1	9	1	1	G =49 *i.e.* 98% PrD = 1 *i.e.* 2% PoD= 5 *i.e.* 10%
Sterilized soil without pathogen and treated seeds (5.0%water solution)	10	—	1	9	1	—	9	1	1	10	—	1	10	—	1	G =48 *i.e.* 96% PrD = 2 *i.e.* 2% PoD= 4 *i.e.* 8%
Sterilized soil without pathogen and treated seeds (6.6% dry powder)	10	—	1	10	—	1	9	1	—	10	—	—	10	—	1	G =49 *i.e,* 98% PrD = 1 *i.e.* 2% PoD= 3 *i.e.* 6%

Table 2—Germination of Variously Treated Jute Seeds in Soil Infested with *Rhizoctonia sp.*

Nature of inoculum and treatment	1 G	1 PrD	1 PoD	2 G	2 Prd	2 PoD	3 G	3 PrD	3 PoD	4 G	4 PrD	4 PoD	5 G	5 PrD	5 PoD	Remarks
Steelized soil infested with *Rhizoctonia sp.* and untreated seeds.	9	1	7	9	1	6	10	—	5	10	—	5	10	—	7	G = 48 *i.e.* 98% PrD = 2 *i.e,* 4% PoD = 30 *i.e.* 60%
Sterilized soil infested with *Rhizoctonia sp.* and treated seeds (1.0% alcoholic solution)	9	1	—	9	1	—	10	—	1	9	1	1	9	1	—	G = 46 *i.e.* 92% PrD = 4 *i.e.* 8% PoD = 2 *i.e.* 4%
Sterilized soil infested with *Rhizoctonia sp.* and treated seeds (5.0% water suspension)	10	—	—	9	1	—	10	—	1	10	—	—	9	1	1	G = 48 *i.e.* 96% PrD = 2 *i.e.* 4% PoD = 2 *i.e.* 4%
Sterilized soil infested with *Rhizoctonia sp.* and treated seeds (6.6% dry powder)	9	1	—	10	—	—	9	1	—	9	1	—	10	—	1	G = 47 *i.e,* 94% PrD = 3 *i.e.* 6% PoD = 1 *i.e.* 2%

Table 3.—Germination of Variously Treated Jute Seeds in Soil Infested with *Macrophomina.*

Nature of inoculum and treatment	1 G	1 PrD	1 PoD	2 G	2 PrD	2 PoD	3 G	3 PrD	3 PoD	4 G	4 PrD	4 PoD	5 G	5 PrD	5 PoD	Remarks
Sterilized soil infested with *Macrophomina* and untreated seeds	8	2	8	9	1	—	10	—	2	10	—	2	9	1	5	G = 46 *i.e.* 92% PrD = 4 *i.e.* 8% PoD = 17 *i.e.* 34%
Sterilized soil infested with *Macrophomina* and treated seeds (1.0% alcoholic solution)	9	1	2	9	1	1	9	1	2	8	2	2	10	—	3	G = 45 *i.e.* 90% PrD = 5 *i.e.* 10% PoD = 10 *i.e.* 20%
Sterilized soil infested with *Macrophomina* and treated seeds (5.0% water suspension)	9	1	2	9	1	1	10	—	3	8	2	1	10	—	2	G = 46 *i.e.* 92% PrD = 4 *i.e.* 8% PoD = 9 *i.e.* 18%
Sterilized soil infested with *Macrophomina* and treated seeds (6.6% dry powder)	8	2	2	9	1	3	8	2	1	9	1	2	10	—	3	G = 44 *i.e.* 88% PrD = 6 *i.e.* 12% PoD = 11 *i.e.* 22%

G—Number of seeds germinated ; PrD—Pre-emergent death; PoD—Post-emergent death.

where P_1 and P_2 are the proportions of death in the control and the other experiment in question, and σ_1 and σ_2 are the variances of P_1 and P_2 respectively. The value for the above experiments are given in Table 4.

TABLE 4.—SIGNIFICANCE TEST FOR EFFECTIVENESS OF TREATMENT AGAINST RHIZOCTONIA AND MAGROPHOMINA

(Values of $(P_1-P_2)/\sqrt{\sigma_1^2+\sigma_2^2}$ are given)

Type of treatment with lignin acetic acid	*Rhizoctonia*	*Marcophomina*
1 % alcoholic solution	6.36	1.26
5 % water suspension	7.23	1.71
6.6 % dust suspension	7.23	1.02

In view of the above results it appears that all the results obtained against *Rhizoctonia* are significant (*i.e.*, greater than 2), but in the case of *Macrophomina* the results are insignificant or at best barely significant.

Thus we may conclude from our experiments carried out on *Rhizoctonia sp.* and *Macrophomina* infestation in soil that the treatment of seeds with (i) 1.0% alcoholic solution, (ii) 5.0% water suspension or (iii) 6.6% dust of lignin acetic acid is entirely effective in controlling the diseases caused by *Rhizoctonia sp.*, the mortality being brought down from 64% to 8-12%. The results against *Macrophomina*, although promising cannot be constituted as statistically significant.

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References

1. M.I. Ali, Q.A. Ahmed and M.H. Khundkar, Pakistan J. Sci. Ind. Research, **1**, 79 (1958).
2. K.M. Badruddoza, Krishi-Katha, **14**, No. 2, 120 (1954).