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Interaction studies of copper fungicides with biological environment of soil

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ABSTRACT

Fungicides are one of the essential inputs in the improved technology for increasing crop production through crop protection. Copper fungicides Blitox and Fungimar are used widely as foliar sprays for control of many plant diseases. As major portion of fungicides applied to economically important crops eventually finds its way to soil, may disrupt the activities of microorganisms in the soil and thereby altering the biological equilibrium of soil. It is therefore planned to study the biological health of the soil with the help of viable counts of nine strains of *Rhizobium japonicum* after 21, 30 and 45 days intervals at 100 to 500 ppm concentrations of the two copper Fungicides. Results reveal that Blitox is more compatible than Fungimar to *R. japonicum*.

Key words: Blitox, fungimar *Rhizobium japonicum*, fungicides, viable counts.

INTRODUCTION

With the advent of high yielding crop varieties, the pest problems have become more acute, adversely affecting the crop yields. Fungicides are therefore, one of the major inputs in the improved technology for increasing crop production through crop protection, (Dharival and Singh 1993). A major portion of fungicides applied to economically important crops eventually finds its way to soil or aquatic system. On reaching the soil, the fungicides and /or their degradation products may disrupt the activities of the microorganisms in the soil and thereby alter its biological equilibrium with eventual repercussions in soil health, leading to agro ecological problems of great concern.

As copper fungicides are widely used for the control of many vegetables, fruits and flowering plant diseases, therefore the present study was planned.

MATERIAL AND METHODS

Black cotton soil samples were collected and sterilized in an autoclave for three consecutive days at 121°C for two hours per day, (Agarwal *et al.,* 1986).

Five days old cultures of Bradyrhizobium japonicum having 10 8 cells/ml were added to soil in the ratio of 10 ml of both culture in 100 gms of soil, (Neena, 1992). Calculated quantities of fungicide solution were added to maintain the concentration of 100, 200, 300, 400, and 500 ppm. The contents were mixed thoroughly and packed in low density polythene bags of 200 gauge sealed by electric sealer and kept for 21, 30, and 45 days at 28 $\pm$ 2°C. After completion of desired incubation period soil samples were withdrawn and used for colony counting with the help of colony counter, (Horshall 1956).

RESULTS AND DISCUSSION

The survival studies of isolates of R.japonicum in contact with Fungicides (Blitox and Fungimar) reveal a decrease with respect to increasing the concentration of fungicides from 100 to 500 ppm and also on increasing the time of contact.

At 100 ppm concentration of Blitox fungicides viable counts decrease from 56 x 10^5 to 23 x 10^5, at 200 ppm concentration 56 x 10^5 to 15 x 10^4, at 300 ppm concentration 46 x 10^5 to 93 x 10^4, at 400 ppm concentration from 35x10^5 to 76 x 10^4 and at 500 ppm concentration 26 x 10^5 to 53 x10^4.

Observations with Fungimar Fungicide viable counts decrease from 39 x 10^5 to 9 x 10^5 at 100 ppm, from 29 x 10^5 to 68 x 10^4 at 200 ppm, from 15 x 10^5 to 35 x 10^4 at 300 ppm, from 9 x 10^5 to 26 x 10^4 at 400 ppm, from 93 x 10^4 to 15 x 10^3 at 500 ppm concentration .Observations

Table - 1: Viable counts of various isolates of *Rhizobium japonicum* in contact with Blitox fungicide observations after 30 days

Conc. (in ppm)	Isolate Number CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7A	CH-7B	CH-7C
Control	43×10^5	42×10^5	37×10^5	36×10^5	29×10^5	45×10^5	32×10^5	36×10^5	45×10^5
100	43×10^5	42×10^5	37×10^5	36×10^5	29×10^5	45×10^5	32×10^5	36×10^5	45×10^5
200	32×10^5	33×10^5	26×10^5	29×10^5	18×10^5	34×10^5	28×10^5	27×10^5	35×10^5
300	26×10^5	24×10^5	19×10^5	9×10^5	12×10^5	26×10^5	13×10^5	15×10^5	29×10^5
400	95×10^4	93×10^4	82×10^4	86×10^4	78×10^4	95×10^4	83×10^4	89×10^4	92×10^4
500	82×10^4	86×10^4	72×10^4	67×10^4	65×10^4	74×10^4	74×10^4	62×10^4	83×10^4

Table - 2: Viable counts of various isolates of *Rhizobium japonicum* in contact with Blitox fungicide observations after 45 days

Conc. (in ppm)	Isolate Number CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7A	CH-7B	CH-7C
Control	35×10^5	36×10^5	29×10^5	25×10^5	23×10^5	32×10^5	29×10^5	28×10^5	39×10^5
100	35×10^5	36×10^5	29×10^5	25×10^5	23×10^5	32×10^5	29×10^5	28×10^5	39×10^5
200	29×10^5	28×10^5	16×10^5	15×10^5	18×10^5	26×10^5	16×10^5	17×10^5	28×10^5
300	13×10^5	15×10^5	9×10^5	8×10^5	93×10^4	17×10^5	95×10^4	93×10^4	19×10^5
400	93×10^4	95×10^4	89×10^4	79×10^4	82×10^4	93×10^4	86×10^4	76×10^4	95×10^4
500	69×10^4	65×10^4	58×10^4	57×10^4	62×10^4	59×10^4	62×10^4	53×10^4	68×10^4

Table - 3: Viable counts of various isolates of *Rhizobium japonicum* in contact with Fungimar fungicide observations after 21 days

Conc. (in ppm)	Isolate Number CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7A	CH-7B	CH-7C
Control	56×10^5	56×10^5	45×10^5	43×10^5	46×10^5	54×10^5	47×10^5	37×10^5	54×10^5
100	39×10^5	38×10^5	30×10^5	28×10^5	29×10^5	38×10^5	27×10^5	28×10^5	36×10^5
200	26×10^5	29×10^5	15×10^5	12×10^5	14×10^5	26×10^5	92×10^4	9×10^5	29×10^5
300	95×10^4	93×10^4	89×10^4	92×10^4	95×10^4	18×10^5	83×10^4	92×10^4	15×10^5
400	83×10^4	79×10^4	63×10^4	68×10^4	62×10^4	98×10^4	65×10^4	69×10^4	9×10^5
500	72×10^4	68×10^4	52×10^4	49×10^4	53×10^4	85×10^4	49×10^4	38×10^4	93×10^4

Table - 4: Viable counts of various isolates of *Rhizobium japonicum* in contact with Fungimar fungicide observations after 45 days

Conc. (in ppm)	Isolate Number CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7A	CH-7B	CH-7C
Control	35×10^5	36×10^5	29×10^5	25×10^5	23×10^5	32×10^5	29×10^5	28×10^5	39×10^5
100	23×10^5	25×10^5	18×10^5	12×10^5	9×10^5	22×10^5	10×10^5	9×10^5	25×10^5
200	13×10^5	9×10^5	93×10^5	89×10^4	92×10^4	15×10^5	79×10^4	68×10^4	19×10^5
300	89×10^4	85×10^4	79×10^4	63×10^4	60×10^4	90×10^5	35×10^4	45×10^4	90×10^4
400	5×10^4	49×10^4	82×10^3	45×10^4	42×10^4	82×10^4	26×10^4	32×10^4	69×10^4
500	39×10^4	28×10^4	15×10^3	36×10^4	26×10^4	53×10^4	9×10^4	91×10^3	25×10^4

suggest that Blitox is more compatible than Fungimar to R. Japonicum. Fungitoxic component of Copper Fungicides is the cupric ion for which little biochemical specificity exists, (Somers E 1961) the strong inhibitory action of Fungimar in comparison to Blitox is attributed to its strong bonding affinity to amino & carboxylic groups .It reacts with protein and acts as an enzyme inhibitor (The agrochemical hand book 1987). Among the strains CH-1, CH-2, CH-6 and CH-7C were observed to give higher counts suggesting better quality strains than others. There is not much difference in the viable counts of organism in the fungicide treated soils and untreated control therefore fungicide treatment can safely be used as a routine.

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