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RESEARCH ARTICLE

# Effects of fungicides, plant extracts and bio agent on downy mildew of isabgol (*Plantago ovata* Forsk.)

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ABSTRACT

Isabgol (*Plantago ovata* Forsk.) is important medicinal plant. Isabgol crop suffers a lot due to fungal diseases. Among all diseases, downy mildew caused by *Peronospora plantaginis* Underwood is the most important and wide spread disease, which appears in severe form every year and causes extensive damage to the crop. Therefore, *in vivo* evaluation of eight fungicides, phytoextracts, and one bio-agent for management of downy mildew disease was carried out which revealed that, seed treatment (ST) with Metalaxyl (3g/kg seed) followed by three foliar sprays of Metalaxyl MZ (0.1 %) at 15 days interval initiating from appearance of disease was the most effective treatment with the least disease intensity (10.76 %) and yield increased by 26.02 per cent over control, followed by Fosetyl-AI (0.2 %) and Copper oxychloride (0.2 %) which recorded 14.00 and 15.25 per cent disease intensity with 18.01 and 16.42 per cent increase in yield over control, respectively.

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## INTRODUCTION

Isabgol (*Plantago ovata* Forsk.) crop suffers a lot due to fungal and bacterial diseases, but fungal diseases are predominant. Damping-off of seedlings, wilt, downy mildew and powdery mildew are the major fungal diseases. Among these, downy mildew is the most important and wide spread disease which appears in severe form every year and causes extensive quantitative as well as qualitative damage to the crop and makes the cultivation of isabgol crop unprofitable (Rathore and Pathak, 2002). Downy mildew causes considerable reduction in seed yield and yield attributes of isabgol. It is reported to be caused by *Peronospora alta* Fuckel (Kapoor and Chowdhary, 1976), *Pseudoperonospora plantaginis* Underwood and *Peronospora plantaginis* Underwood (Desai and Desai, 1969). *Peronospora plantaginis* is a commonly prevailing pathogen of isabgol downy mildew in Gujarat.

## MATERIALS AND METHODS

Field experiment for management of downy mildew of isabgol was conducted at BACA, AAU, Anand in Randomized Block Design (RBD) with 12 treatments each replicated thrice. Sowing of GI-2 variety as susceptible in all plots was carried out by drilling method with seed rate 4 kg/ha and spacing 30 × 5 cm in previously opened and fertilized furrow. For even distribution of the seeds in the furrows, seeds were well mixed with sand. After drilling of seeds, the debris of infected plants of isabgol containing oospores were drilled in the same furrow for providing a source of inoculums and then covered with soil. Finally each plot was irrigated carefully. Management of downy mildew of isabgol was carried out with common seed treatment of Metalaxyl (Apron 35 SD) @ 3 g/kg seeds followed by foliar sprays of seven fungicides [*i.e.* Metalaxyl MZ (Ridomil MZ 72 WP) @ 0.1 %, Copper oxychloride (Blitox 50 WP) @ 0.2 %, Fosetyl – AI (Aliette 80 WP) @ 0.2 % Mancozeb

(Dithane M - 45) @ 0.2 %, Chlorothalonil (Kavach 75 WP) @ 0.2 %, Hexaconazole (Contaf 5 EC) @ 0.005 %, Penconazole (Topaz 10 EC) @ 0.05%], two plant extracts [*i.e.* Neem (10 %), Tulsi (10 %)] and one bio-agent [*i.e. Trichoderma viride* @ $10^6$ cfu/ml] for three times at an interval of 15 days commencing from appearance of disease in the experimental area. The data, collected for all the treatments were subjected to the statistical analysis by adopting 'analysis of variance' techniques as described by Panse and Sukhatme (1967).

## RESULTS AND DISCUSSION

Field evaluation of fungicides, plant extracts and bio-agent against downy mildew of isabgol revealed that all the treatments were found significantly effective over control for the management of the disease. However, the least incidence of downy mildew (10.76 %) was observed in the plots treated with seed treatment (ST) (3 g/kg seeds) + three foliar sprays of Metalaxyl MZ (0.1 %) showing 69.28 per cent disease reduction over control (Table 1). ST + three foliar spray of Fosetyl-AI (0.2 %) and ST + three foliar spray of Copper oxychloride (0.2 %) were next best effective treatments followed by ST + three foliar sprays of Mancozeb (0.2 %). *Trichoderma viride,* Neem leaf extract, Tulsi leaf extract and Hexaconazole (0.005 %) coupled with ST recorded 25.36, 26.65, 28.10 and 28.28 PDI and 27.60, 23.92, 19.78 and 19.25 per cent

**Table 1: Effect of fungicides, plant extracts and bio-agent on incidence of downy mildew of isabgol under field condition**

| Treatment and concentration (%) | Per cent disease intensity* | Per cent reduction in disease intensity over control |
|---|---|---|
| $T_1$: (ST** + Metalaxyl MZ @ 0.1 %) | 10.76e | 69.28 |
| $T_2$: (ST + Copper oxychloride @ 0.2 %) | 15.25de | 56.46 |
| $T_3$: (ST + Fosetyl-AI @ 0.2%) | 14.00de | 60.03 |
| $T_4$: (ST + Mancozeb @ 0.2%) | 16.15d | 53.89 |
| $T_5$: (ST + Chlorothalonil @ 0.2%) | 23.53c | 32.82 |
| $T_6$: (ST + Hexaconazole @ 0.005%) | 28.28bc | 19.25 |
| $T_7$: (ST + Penconazole @ 0.05%) | 29.65ab | 15.35 |
| $T_8$: (ST + Neem leaf extract @ 10%) | 26.65bc | 23.92 |
| $T_9$: (ST + Tulsi leaf extract @ 10%) | 28.10bc | 19.78 |
| $T_{10}$: (ST + *Trichoderma viride* @ $10^6$ cfu/ml) | 25.36bc | 27.60 |
| $T_{11}$: (ST only) | 30.38ab | 13.27 |
| $T_{12}$: (Untreated Control) | 35.03a | 00.00 |
| S.E. ± | 1.61 | |
| C.V. % | 11.84 | |

*Average of three replications, ** ST= Seed treatment with Metalaxyl (Apron 35 SD) @ 3 g/kg seed, Note: Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Rang Test (DNMRT) at 5 % level of significance

**Table 2: Effect of fungicides, plant extracts and bio-agent on yield of isabgol under field condition**

| Treatment and concentration (%) | Mean yield (kg/ha)* | Per cent increase in yield over control |
|---|---|---|
| $T_1$: (ST** + Metalaxyl MZ @ 0.1 %) | 1226.66a | 26.02 |
| $T_2$: (ST + Copper oxychloride @ 0.2 %) | 1085.66abc | 16.42 |
| $T_3$: (ST + Fosetyl-AI @ 0.2%) | 1106.66ab | 18.01 |
| $T_4$: (ST + Mancozeb @ 0.2%) | 1098.66ab | 17.41 |
| $T_5$: (ST + Chlorothalonil @ 0.2%) | 1011.66bc | 10.31 |
| $T_6$: (ST + Hexaconazole @ 0.005%) | 924.00bc | 1.80 |
| $T_7$: (ST + Penconazole @ 0.05%) | 935.33bc | 2.99 |
| $T_8$: (ST + Neem leaf extract @ 10%) | 965.00bc | 5.97 |
| $T_9$: (ST + Tulsi leaf extract @ 10%) | 932.33bc | 2.68 |
| $T_{10}$: (ST + *Trichoderma viride* @ $10^6$ cfu/ml) | 951.66bc | 4.65 |
| $T_{11}$: (ST only) | 931.66bc | 2.68 |
| $T_{12}$: (Untreated Control) | 907.33c | 0.00 |
| S.E. ± | 54.66 | |
| C.V. % | 9.41 | |

*Average of three replications, ** ST= Seed treatment with Metalaxyl (Apron 35 SD) @ 3 g/kg seed, Note: Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Rang Test (DNMRT) at 5 % level of significance

disease reduction over control, respectively and remained at par with the ST + foliar spray of Chlorothalonil (0.2 %) having 23.53 PDI with 32.82 per cent disease reduction over control. Only ST as well as ST coupled with foliar sprays of Penconazole (0.05 %) was at par with control treatment indicating their failure to reduce downy mildew of isabgol significantly as per Table 1.

**Yield :**

The mean data pertaining to grain yield/ha of isabgol are presented in Table 2. The grain yield ranged from 907.33 to 1226.66 kg/ha in different treatments. Significantly the highest grain yield (1226.66 kg/ha) was obtained in the plots receiving ST + three foliar sprays of Metalaxyl MZ at an interval of 15 days which was 26.02 per cent higher over the control plots. Foliar sprays of Fosetyl-AI, Mancozeb and Copper oxychloride coupled with common ST remained at par with ST + three foliar sprays of Metalaxyl MZ in respect of grain yield parameter. Foliar sprays of Chlorothalonil, Neem leaf extract, *T.viride*, Penconazole, Tulsi leaf extract, Hexaconazole coupled with ST and only ST were at par with ST+ three foliar sprays of Fosetyl-AI with 1011.66, 965.00, 951.66, 935.33, 932.33, 924.00 and 931.66 kg/ha yield, respectively. All these treatments were not significant from the untreated control (907.33 kg/ha) (Table 2).

**Conclusion :**

Field evaluation of eight fungicides, two plant extracts and one bio-agent for disease management revealed that ST (seed treatment with Metalaxyl @ 3g/kg seed) followed by three foliar sprays of Metalaxyl MZ (0.1 %) at an interval of 15 days commencing from appearance of downy mildew in field was the most effective treatment with minimum per cent disease intensity (10.76 %) showing 69.28 per cent disease reduction over control followed by ST + three foliar sprays of Fosetyl-AI (14.00 %) and ST + three foliar sprays of Copper oxychloride (15.25 %). ST + three foliar sprays of Metalaxyl MZ also proved effective with the highest yield (1226.66 kg/ha) showing 26.02 per cent increase in yield over control followed by ST + three foliar sprays of Fosetyl-AI (1106.66 kg/ha) and ST + three foliar sprays of Mancozeb (1098.66 kg/ha). In respect of length of spikes, statistically non-significant results were obtained. However, the maximum length (4.61 cm) of spikes was recorded with ST + three foliar sprays of Metalaxyl MZ.

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