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# Compatibility of phosphate solubilizing fungi with agro chemicals

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ABSTRACT

Compatibility of Phosphate solubilizing fungi with agrochemicals were tested *in vitro*. The results indicated that *Aspergillus niger* and *Aspergillus flavus* were not compatible with fungicides *i.e.* thiram, carbendazim, mancozeb and propiconazole and herbicides *i.e.* glyphosate, quizalfop-ethyl and fenoaxaprop p ethyl, whereas COC + streptocycline, streptocycline and insecticides *i.e.* cypermethrin, emamectin benzoate and imidacloprid were found compatible.

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## INTRODUCTION

The continuous use of chemical fertikizers to increase soil fertility and crop productivity often resulted in unexpected harmful effects, particularly leaching of nitrate into ground water, rendering soils unsuitable for cultivation, soil salinity, diminishing C:N ratio in soil,degradation of soil microbial echology and soil health. Soil ecology and soil biota are important factor to produce quality food material. Microbial inoculants are promising components to play a role in soil health management

Increase in cost of fertilizers and worldwide energy crises, low purchasing power of farmers, increase in cost of production restricted the use of chemical fertilizers alone as a source of plant nutrient. Under such condition it has become alternative to use all available resources of plant nutrients including micro organisms like PSM for sustainable soil fertility and productivity. These PSM have ability to increase stress tolerant capacity in plant and induce disease resistance against soil borne pathogens. 'P' solubilizing capacity of PSM varies with soil and soil condition. Therefore, use of efficient isolates is necessary. Hence, here the attempts were made to isolates efficient 'P' solubilizing micro-organisms from rhizosphere of various weeds occur in sorghum and cotton and studies were undertaken to test the compatibility of different PSF isolates with agrochemicals in laboratory.

## MATERIAL AND METHODS

In present study attempts were made to isolate various phosphate solubilizing micro-organisms from rhizosphere of some weeds occuring in sorghum and

cotton crops. The soil samples were collected from Yeola taluka of Nashik district and Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Research Farm Akola, for studying their compatibility with agrochemicaks.

**Isolation of Phosphate solubilizing micro organism (Sanjotha *et al.*, 2011) :**

The soil samples were collected from rhizosphere region of different weeds of sorghum and cotton. These samples were subjected for isolation and enumeration of phosphate solubilizing fungi on a PDA medium. Serial dilution plate technique was used for enumeration of fungal population and the results are expressed as a fungal population per gram of soil sample. The cultures of isolated fungi were identified as per routine morphological, physiological, and biochemical tests.

**Compatibility of phosphate solubilizing fungi by poisoned food technique (Rathod *et al.*, 2010) :**

Poisoned food technique was carried out to test compatibility of phosphate solubilizing fungi with agrochemicals. For this purpose Potato dextrose agar medium was prepared and equally distributed in 250 ml conical flask and sterilized in autoclave. The required quantity of each of fungicide was added in sterilized lukewarm ($45^0$C) PDA separately so as to obtain desired concentration. Flask containing poisoned medium was shake well to have even and uniform distribution of fungicide. About 20ml of melted poisoned PDA was poured in each sterilized Petriplate and allowed to solidify. These Petriplates were inoculated by test fungus separately. Six mm disc of one week old fungus culture was cut with a sterilized cork borer, lifted and transferred aseptically in the centre of a Petriplate containing the medium poisoned with test fungicide. The control plates were kept where the culture disc were grown in same condition on PDA without fungicide. Treated plates were incubated at room temperature ($27\pm2^0$C) for a period of seven days. Colony diameter was recorded in mm and per cent of mycelial inhibition was calculated as per formula given below based on the average of colony diameter.

$$PI\,(\%) = \frac{C - T}{C} \times 100$$

where,

PI = Per cent inhibition

C = Growth in control plate

T = Growth in treatment plates

## RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

**Compatibility of phosphate solubilizing fungi (*Aspergillus niger* and *A. flavus*) with fungicides and antibiotics :**

The phosphate solubilizing fungi were isolated from rhizospher soil of weed of cotton and sorghum. Compatibility of phosphate solubilizing fungi were tested *in vitro* by using commonly fungicides *viz.,* Thiram, Carbendazim, Mancozeb and Propiconazole and antibiotic *viz.,* Streptocycline and in combination with COC + Streptocycline by adopting "Poisoned Food Technique" given by Rathod *et al.* (2010).

The results indicated that 100 per cent growth inhibition of *Aspergillus niger*-20 and *A. niger*-5 was observed with thiram(0.3%), carbendazim(0.1%), mancozeb (0.25%) and propiconazole (0.05%). All tested fungicides with different concentration showed detrimental effect on growth of *A. niger*-20 and *A. niger*-5. In case of COC (0.25%) + streptocycline (100 ppm) inhibited growth of *A. niger*-20 and *A. niger*-5 *i.e.* 38.34 per cent and 53.6 per cent, respectively, whereas streptocycline (100 ppm) alone did not show any detrimental effect on growth of both *A. niger* isolates. From the result it is concluded that all the fungicides were not compatible with tested organisms, however COC + streptocycline and streptocycline were compatible with *A. niger* isolates.

Wani and Taskeen (2011) studied the effect of systemic and non-systemic fungicides on *A. niger* and reported that among systemic fungicides, carbendazim brought about highest reduction followed by hexaconazole, bitertanol and myclobutanil, respectively. Among non-systemic fungicides, the mancozeb was found the most effective followed by captan and zineb, respectively. The higher concentrations (1000 ppm and 2000 ppm) of all the fungicides proved more effective than lower concentrations (125 ppm and 500 ppm).Similar result also found by Rathod *et al.* (2010) and Sen and Charaya (2010) reported that *Aspergillus sulphureus*, *Aspergillus niger* and *Fusarium moniliforme* were tolerant to copper (copper sulphate) at high concentration

*i.e*. 400 ppm.

**Compatibility of PSF *Aspergillus niger* with herbicides and insecticides :**

*In vitro* effect of herbicides and insecticides on growth of *Aspergillus niger* isolates was tested.The herbicides *viz.*, Glyphosate (0.6%), quizalfop-ethyl (0.2%) and fenoxaprop-ethyl (0.2%) and insecticides *viz*., cypermethrin (0.03%), emamectin benzoate (0.04%) and Imidacloprid 0.03 per cent were used to test theircompatibility against *A. niger*-20 and *A. niger*-5 stains.

**Table 1 : Compatibility of PSF *Aspergillus niger* with fungicides and antibiotics**

| Tr. | Fungicides and antibiotics | Conc. | *A. niger*-20 | | *A. niger*- 5 | |
|---|---|---|---|---|---|---|
| | | | Colony diameter in (mm) | Per cent growth inhibition (%) | Colony diameter in (mm) | Per cent growth inhibition (%) |
| $T_1$ | Thiram 75 % WP | 0.3% | 0.00 | 100 | 0.00 | 100 |
| $T_2$ | Carbendazim 50 % WP | 0.1% | 0.00 | 100 | 0.00 | 100 |
| $T_3$ | Mancozeb 75% WP | 0.25% | 0.00 | 100 | 0.00 | 100 |
| $T_4$ | Propiconazole 25% EC | 0.05% | 0.00 | 100 | 0.00 | 100 |
| $T_5$ | COC 50 % WP + Streptocycline | 0.25% +100 PPM | 55.33 | 38.64 | 41.76 | 53.6 |
| $T_6$ | Streptocycline | 100PPM | 90 | 0 | 90 | 0 |
| $T_7$ | Control | | 90 | | 90 | |
| | 'F'- Test | | Sig | | Sig | |
| | S.E. ± | | 0.08 | | 0.27 | |
| | C.D. (P = 0.01) | | 0.34 | | 1.16 | |

**Table 2 : Compatibilityof PSF *Aspergillus niger* with herbicides and insecticides**

| Tr. | Herbicides and insecticides | Conc. | *A.niger*-20 | | *A. niger*- 5 | |
|---|---|---|---|---|---|---|
| | | | Colony diameter in (mm) | Per cent growth inhibition (%) | colony diameter in (mm) | Per cent growth inhibition (%) |
| $T_1$ | Glyphosate 41% SL | 0.6% | 42.66 | 52.60 | 35.06 | 61.04 |
| $T_2$ | Quizalfop - ethyl | 0.2% | 0.00 | 100 | 0 | 100 |
| $T_3$ | Fenoxapro- ethyl 9.3% EC | 0.2% | 0.00 | 100 | 0 | 100 |
| $T_4$ | Cypermethrin 25 % EC | 0.03% | 90 | 0 | 90 | 0 |
| $T_5$ | Emamectin benzoate 5 % SG | 0.04% | 90 | 0 | 90 | 0 |
| $T_6$ | Imidacloprid 17.8 % SL | 0.3% | 0.00 | 100 | 0 | 100 |
| $T_7$ | Control | | 90 | | 90 | |
| | 'F'- Test | | Sig | | Sig | |
| | S.E. ± | | 0.12 | | 0.48 | |
| | C.D. (P = 0.01) | | 0.49 | | 2.01 | |

**Table 3 : Compatibilityof *Aspergillus flavus*-2with fungicides and antibiotics**

| Treatments | Fungicides and antibiotics | Concentration (%) | Mean colony diameter (mm) | Per cent growth inhibition (%) |
|---|---|---|---|---|
| $T_1$ | Thiram 75 % WP | 0.3 | 0.00 | 100 |
| $T_2$ | Carbendazim 50 % WP | 0.1 | 13.43 | 34.64 |
| $T_3$ | Mancozeb 75% WP | 0.2 | 0.00 | 100 |
| $T_4$ | Propiconazole 25% EC | 0.05 | 0.00 | 100 |
| $T_5$ | COC 50% WP + Streptocycline | 0.25 + 100 PPM | 13.76 | 33.04 |
| $T_6$ | Streptocycline | 100 PPM | 17.66 | 14.06 |
| $T_7$ | Control | | 20.55 | |
| | 'F'- Test | | Sig | |
| | S.E. ± | | 0.33 | |
| | C.D. (P = 0.01) | | 1.43 | |

**Table 4 : Compatibilityof *Aspergillus flavus- 2* with herbicides and insecticides**

| Treatments | Herbicides and Insecticides | Concentration (%) | Mean colony diameter (mm) | Per cent growth inhibition (%) |
|---|---|---|---|---|
| $T_1$ | Glyphosate 41% SL | 0.6 | 15.26 | 25.74 |
| $T_2$ | Quizalfop-ethyl 5% EC | 0.2 | 0.0 | 100 |
| $T_3$ | Fenoxaprop-ethyl 9.3 % EC | 0.2 | 14.63 | 28.80 |
| $T_4$ | Cypermethrin 10% EC | 0.03 | 19.73 | 3.99 |
| $T_5$ | Emamectin benzoate 5% SG | 0.04 | 19.10 | 7.05 |
| $T_6$ | Imidacloprid 17.8 % SL | 0.3 | 19.33 | 5.93 |
| $T_7$ | Control | | 20.55 | |
| | 'F'- Test | | Sig | |
| | S.E. ± | | 0.57 | |
| | C.D. (P = 0.01) | | 2.41 | |

The results indicated that quizalfop-ethyl(0.2%), fenoxaprop-ethyl (0.2%) and imidacloprid (0.3%) showed 100 per cent growth inhibition of *A. niger*-20 and *A. niger*-5 followed by glyphosate *i.e.* 52.6 and 61.04 per cent growth of *A. niger*-20 and *A. niger*-5 isolates, respectively, whereas in case of insecticides *viz.*, cypermethrin (0.03%) and emamectin benzoate (0.04%) did not show no negative effect on growth of both isolates of *A. niger* strain. It concluded that quizalfop-ethyl, fenoxaprop-ethyl and imidacloprid with tested concentration were not compatible with both the strains of *A. niger.* However glyphosate and tested insecticides were compatible with both the isolates of *A. niger* (Table 2).

Similar results were observed by Hefnawy *et al.* (2012) who concluded that *Aspergillus niger* and *Aspergillus fumigatus* were not affected at lower concentrations of tested herbicides *i.e.* glyphosate and putraline up to 200 mg $l^{-1}$ and at 800 mg $l^{-1}$concentration. Das and Mukharjee (1998 and 2000) reported that the most predominant genera of microorganisms, such as *Bacillus, Micrococcus and Aspergillus* were not affected by most of the insecticides *viz.*, HCH, phorate, carbofuran and fenvalerate at their field application rates (7.5, 1.5, 1.0 and 0.35 kg a.i. $ha^{-1}$), respectively.

The data presented in Table 3 showed that thiram (0.3%), mancozeb (0.25%) and propiconazole (0.05%) were showed 100 per cent inhibition growth of *A. flavus*-2, followed by carbendazim (0.1%) which inhibited 34.64 per cent growth.In case of antibiotics, COC (0.25%) + streptocycline (100 ppm) showed 33.04 per cent growth inhibition, whereas streptocycline (100 ppm) showed 14.06 per cent growth inhibition of *A. flavus*-2. It concluded that among all tested fungicidesthiram (0.3%), mancozeb (0.25%) and propiconazole (0.05%) were not compatible with *A. flavus*-2 while carbendazim (0.1%) and antibiotics *i.e.* COC+ streptocycline (0.25+ 100 ppm) and streptocycline (100 ppm) were moderately compatible with *A. flavus*-2

Sen and Charaya (2010) and Rathod *et al.* (2010) reported the effect of six fungicides on *Aspergillus flavus* by poisoned food technique and concluded that thiram, mancozeb, carbendazim were found to be more inhibite as compared to copper oxychloride, captan and captafol.

The data presented in Table 4 revealed that three herbicides and three insecticides were used to test compatibility against *A.flavus-2.* Among them quizalfop-ethyl (0.2%) showed 100 per cent growth inhibition followed by fenoxaprop-ethyl showed 28.88 per cent growth inhibition, whereas glyphosate (0.6%) inhibited 25.74 per cent growth of *A. flavus*-2. In case of insecticides *i.e.* cypermethrin (0.03%) showed 3.99 per cent, imidacloprid (0.3%) showed 5.93 per cent and emamectin benzoate (0.04%) showed 7.05 per cent growth inhibition, respectively. It showed that quizalfop-ethyl (0.2%) was not compatible and other tested chemicals were compatible with *A. flavus*-2.

Present findings are in line with the findings of Hefnawy *et al.* (2012) who reported that *Aspergillus niger* and *Aspergillus fumigatus* were not affected at lower concentrations of tested herbicides *i.e.* glyphosate and putraline up to 200 mg $l^{-1}$ and at 800 mg $l^{-1}$. The result is on the line of Das and Mukharjee (2000) finding that *Aspergillus* spp. were not affected by most of the insecticides *viz.*, HCH, phorate, carbofuran and fenvalerate at their field application rates (7.5, 1.5, 1.0 and 0.35 kg a.i. $ha^{-1}$).

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