Oryza Vol. 49(3), 2012 (212-214)

# Evaluation of fungicides and bio-pesticides against sheath rot of rice

**Pramod Kumar, R C Rai and Bimla Rai**
*Rajendra Agricultural University, Bihar, Pusa - 848 125*

## ABSTRACT

*Sheath rot of rice incited by Sarocladium oryzae (Sawada) Gama and Hawksworth is one of the important diseases of rice. Out of eight fungicides tested Saaf 75 WP (Carbendazim 12% + Mancozeb 63%) and Antracol 75 WP (Propinels 70 WP) inhibited mycelial growth of the fungus by more than 80 percent at 200 ppm concentration as well as reduced the disease severity and increased grain yield under field condition. Among the bio-pesticides Achook (Azadirachtin 0.15% WP) and Tricure (Azadirachtin 0.03%) inhibited the mycelial growth up to 49 and 47 percent, respectively at 10% concentration. Spraying of bio-pesticides resulted in 12.9 to 21.4 percent disease control only.*

***Key word :*** *rice, sheath rot, fungicides, biopesticides*

Rice crop is affected by several diseases which cause heavy loss of yield. Sheath rot of rice incited by *Sarocladium oryzae* (Saw) Gams and Hawksworth is one of the serious and destructive diseases in Bihar (Ghufran *et al*. 1980, Singh 1987). Keeping in view of the increasing importance of the disease various new fungicides and bio-pesticides were evaluated *in vivo* and *in vitro* conditions for management of sheath rot disease.

## MATERIALS AND METHODS

Seven fungicides namely, Antracol 75 WP (Propinels), Armure 300 EC (Difenconazole+Propicnazole) of Syngenta, Dhanteam 75WP (Tricyclazole), Difenconazole+Propiconazole (Nagarjuna Agri Chem.), Saaf 75WP (Carbendazim+Mancozeb), Sheathmar 3L (Validamyan) and Sitara 5 EC (Hexaconazole), and four bio pesticides namely Achook (Azadirachtin 0.15% WP), Biotos (Plant extract of *Gauttheria* spp.) Ecomonas (*Pseudomonas fluoresens*), alongwith Bavistin 50 WP (Carbendazim) as standard check were evaluated against *Sarocladium oryzae* in vitro as well as in field.

For *in vitro* evaluation poison food technique using potato dextrose agar (PDA) as basal medium was followed. Fifty ml stock solution of 5000 ppm strength of each fungicide was prepared in sterilized distilled water. To obtain the desired concentration of fungicides in the medium, amount of stock solution to be added in potato dextrose agar was calculated by using the formula $C_1V_1=C_2V_2$ [$C_1$ = Concentration of stock solution (ppm), $C_2$=Required concentration (ppm) of the fungicide in the medium, $V_1$=Volume (ml) of the stock solution to be added and $V_2$=Final volume (ml) of PDA] Required amount of stock solution was poured in 80 ml of sterilized melted PDA to get final concentration of 50, 100, 200 ppm of fungicide in the medium. The bio pesticides were incorporated into potato dextrose agar medium at three different concentration i.e. 2, 5 and 10 percent.

PDA poisoned with each fungicides/bio-pesticide was poured into three sterilized petri-plates @ 20 ml plate$^{-1}$ and allowed to solidify. Plates containing PDA without fungicide served as check. After solidification, each petri-plate was inoculated with 5 mm mycelial disc aseptically. Plates were incubated at 28 + 1$^0$C and observation on radial growth of test fungus were recorded after 7 days. Percent growth inhibition (PGI) was calculated based on the radial growth by using formula PGI=C-T/C x 100, where C=colony diameter in check plate and T=colony diameter in treated plate.

Field trails with rice cv. Pankaj were conducted during wet seasons of 2006-2007, to observe the effect of foliar spray of fungicides and bio-pesticides on sheath rot of rice. Field trials were laid out in randomized block design with 3 replication. Recommended dose of

fertilizers and spacing was followed. In fungicidal trial as well as bio-pesticide trial two spraying at 10 days interval at 40 days after transplanting were given in all cases except Difenconazole+Propiconazole (Nagarjuna Agri Chem) where three sprays were given. Observations on disease severity were recorded at dough stage following 0-9 scale.

## RESULT AND DISCUSSION

All the fungicides tested were able to inhibit the growth of *S. oryzae* in vitro. Saaf 75 WP, which produced 85 percent inhibition of mycelial growth at 200 ppm, was most effective and statistically superior to others. Antracol 75 WP (200 ppm) which produced 80.8 percent inhibition of mycelial growth closely followed it. Rest of the treatments produced less than 60 percent inhibition of mycelial growth (Table 1).

Under field condition Antracol 75 WP (2.5 g $l^{-1}$) gave 47.8 percent disease control with 52 percent increase in yield. This was statistically at par with Saaf 75 WP (1.5 g $l^{-1}$) and Difenconazole. 150 g $l^{-1}$ + Propiconazole. 150 g $l^{-1}$ gave 47 and 46.5 percent disease control respectively. coupled with 51.4 and 49 percent increase in yield. Armure 300 EC (0.7 ml), Armure 300 EC (1.0 ml) and Sitara gave 39.6, 39.6 and 37.1 percent disease control, respectively and 44.7, 45.2 and 42.2 percent increase in yield were statistically at par with Antracol 75 WP and Saaf 75 WP in reducing the disease severity and increasing the yield. Armure 30 EC (0.5 ml), Sheathmar 3L and Dhanteam 75 WP were least effective in reducing the disease (Table 1).

None of the bio-pesticides could completely inhibit the growth of *S. oryzae* even at 10 percent concentration Achook was moderately effective as it inhibited fungus ranging between 27 to 49 depending upon the concentration. Bavistin used as a standard check was highly effective in inhibiting the growth of *S. oryzae* as it resulted in 56.7 percent growth inhibition of *S. oryzae* at 100 ppm concentration (Table 2). In the field, all the bio pesticides reduced the disease severity to some extent as compared to unsprayed check. 12.9 to 21.4 percent disease control was observed in plots sprayed with bio-pesticides. All the bio pesticides i.e. Achook, Biotos, Tricure and Ecomonas reduced the disease severity and increased the yield. Among them Achook @ 5 ml $l^{-1}$ showed minimum disease severity

**Table 1. Effect of fungicides on radial growth of *Sarocladium oryzae***

| Fungicides | Growth inhibition (%) over check after 7 days of incubation* | | | | Doses litre$^{-1}$ | Disease severity (%) | Disease control over check (%) | Yield (t ha$^{-1}$)* | Increase in yield (%) |
|---|---|---|---|---|---|---|---|---|---|
| | Concentration (ppm) | | | | | | | | |
| | 50 | 100 | 200 | Mean | | | | | |
| Antracol 75 WP | 54.8(47.73)$^{fg}$ | 74.0(59.32)$^{e}$ | 80.8(64.08)$^{b}$ | 69.86(57.04) | 2.5 g | 24.3$^{f}$ | 47.8$^{a}$ | 4.23$^{a}$ | 52.0$^{a}$ |
| Armure 300 EC | 30.0(33.23)$^{+n}$ | 43.1(41.05)$^{klm}$ | 55.7(48.30)$^{f}$ | 42.93(40.86) | 0.5 ml | 32.0$^{bc**}$ | 31.6$^{cd}$ | 3.13$^{fgh}$ | 33.8$^{de}$ |
| Armure 300 EC | | | | | 0.7 ml | 28.2$^{cdef}$ | 39.6$^{abc}$ | 3.68$^{cde}$ | 44.7$^{abc}$ |
| Armure 300 EC | | | | | 1.0 ml | 28.2$^{cdef}$ | 39.6$^{abc}$ | 3.72$^{cd}$ | 45.2$^{abc}$ |
| Dhanteam 75WP | 41.1(39.85)$^{lmn}$ | 45.0(42.13)$^{jklm}$ | 54.8(47.80)$^{f}$ | 46.96(43.26) | 0.6 g | 30.0$^{cd}$ | 35.9$^{bc}$ | 3.41$^{cdefg}$ | 40.3$^{cd}$ |
| Difenconazole 150 g $l^{-1}$ +Propiconazole. 150 g $l^{-1}$ (Nagarjuna) | 39.0(38.64)$^{n}$ | 47.8(43.75)$^{ijk}$ | 61.0(51.33)$^{de}$ | 49.26(44.57) | 1.0 ml | 25.0$^{def}$ | 46.5$^{ab}$ | 4.00$^{abc}$ | 49.0$^{ab}$ |
| Saaf 75 WP | 50.0(45.00)$^{hi}$ | 70.0(56.81)$^{e}$ | 85.0(67.29)$^{a}$ | 68.33(56.36) | 1.5 g | 24.8$^{f}$ | 47.0$^{a}$ | 4.21$^{ab}$ | 51.4$^{a}$ |
| Sheathmar 3L | 26.6(31.07)$^{o}$ | 40.4(39.44)$^{mn}$ | 45.9(42.68)$^{ijkl}$ | 37.63(37.73) | 3.0 ml | 36.0$^{d}$ | 23.0$^{d}$ | 2.86$^{hi}$ | 28.9$^{e}$ |
| Sitara | 48.4(44.06)$^{hij}$ | 56.7(48.83)$^{ef}$ | 64.1(53.19)$^{d}$ | 56.4(48.69) | 2.0 ml | 29.3$^{n}$ | 37.1$^{abc}$ | 3.54$^{cdef}$ | 42.2$^{bc}$ |
| S.Em. (+) | | | | 1.02 | | 1.57 | 3.37 | 0.16 | 2.60 |
| CD (P=0.05) | | | | 2.83 | | 4.72 | 10.10 | 0.48 | 7.82 |

* - Average of 3 replications. Figure in parenthesis are angular transformed values.
** - Values in a column followed by the same letter do not differ significantly at 5% level of significance

**Table 2.** Effect of bio-pesticides on radial growth of *Sarocladium oryzae*

| Biopesticides | Growth inhibition (%) over check after 7 days of incubation* Concentration (%) | | | | Doses per litre | Disease severity (%) | Disease control over check | Yield (t ha$^{-1}$) | Increase in yield (%) |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 5 | 10 | Mean | | | | | |
| Achook | 27.6(31.71)$^{+g}$ | 39.6(38.97)$^{de}$ | 49..1(44.46)$^{b}$ | 38.76(38.38) | 5.0 ml | 34.4$^{bcde}$ | 21.4$^{ab}$ | 30.4$^{b}$ | 26.9$^{b}$ |
| Biotos | 24.8(29.87)$^{h}$ | 26.6(31.02)$^{gh}$ | 35.7(36.70)$^{ef}$ | 29.03(32.53) | 2.5 ml | 37.6$^{abc}$ | 15.0$^{b}$ | 27.2$^{bcd}$ | 18.5$^{bc}$ |
| Ecomonas | 21.2(27.38)$^{i}$ | 24.3(29.50)$^{h}$ | 33.7(35.51)$^{f}$ | 26.4(30.79) | 10.0 g | 38.8$^{ab}$ | 12.9$^{b}$ | 26.0$^{cde}$ | 14.7$^{c}$ |
| Tricure | 26.4(30.91)$^{h}$ | 41.3(39.98)$^{d}$ | 47.1(43.35)$^{bc}$ | 38.26(38.08) | 5.0 ml | 36.5$^{bcd}$ | 16.0$^{b}$ | 28.2$^{bc}$ | 21.4$^{bc}$ |
| Bavistin (Check) | 43.1(41.03)$^{cd}$ | 43.7(41.36)$^{cd}$ | 56.7(48.87)$^{a}$ | 47.83(43.75) | 1.0 g | 28.4$^{e}$ | 36.0$^{a}$ | 37.6$^{a}$ | 41.1$^{a}$ |
| Check | | | | | | 2.35 | 5.82 | 1.29 | 3.67 |
| S.Em. (+) | | | | 0.94 | | 44.2$^{a}$ | - | 22.1$^{e}$ | - |
| CD (P=0.05) | | | | 2.72 | | 7.42 | 19.00 | 4.08 | 11.99 |

** Values in a column followed by the same letter do not differ significantly at 5% level of significance
+ Figures in parenthesis are Angular transformed values, ++ Bavistin tested at 50.75 and 100 ppm concentration

(34.4%) followed by Tricure. The yield also increased with respect to unsprayed plots (Table 2).

Saaf 75 WP and Antracol 75 WP produced more than 80 percent inhibition. Ragunathan and Vijayaragavan (1976) evaluated five chemicals *in-vitro* against A. *oryzae* Saw. All the chemicals suppressed the growth of A. *oryzae* at various concentrations. Purkayastha and Rooychodhuri (1977) studied the effect of six systemic fungicides and found that these formulations inhibited both mycelial growth and spore germination of the fungus. In field, out of seven fungicides Antracol 75 WP, Saaf 75 WP and Difenconazole 150 g l$^{-1}$ + Propiconazole. 150 g l$^{-1}$ were able to give 46 to 48 percent disease control with about 50 percent increase in yield. This is in accordance with the earlier findings of Reddy *et al*. (1985) who reported Bavistin (Carbendazin) as most effective fungicide for control of sheath rot followed by Antracol.

Present findings indicates that out of four biopesticides i.e. Achook, Biotos, Tricure and Ecomonas, none could completely inhibit the redial growth of fungus. Achook and Tricure were effective to some extent as they inhibited growth by 27 to 49 and 26 to 47 percent, respectively. Pramarick and Phookan (1998) showed that an aqueous extracts of *Ocimum sanctum* was the most effective in inhibiting mycelial growth of *S. oryzae* followed by *Eucalyptus citriodora* and *Azadirachta indica*. Narasimhan *et al*. (1998) have observed that all the formulations of neem oil and pungam oil effectively inhibited the mycelial growth of the *S. oryzae* under field conditons. Among the four biopesticides Achook @ 5 ml lit$^{-1}$ showed minimum disease severity (34.4%). The result are in accordance with Jagannathan and Sivaprakasan (1996), Narsimhan *et al*. (1998).

## REFERENCES

Ghufran MS, Ali A and Singh AP 1980. Wide spread occurrence of sheath rot in Bihar. Int. Rice Res. Newsl. 5 (5) : 14. Indian Economy 2007. Agriculture P. 72.

Jagannathan R and Sivaprakasan K 1996. Effect of botanicals on managing sheath rot of rice. Int. Rice Res. Notes 21 (1) : 49-50.

Nalimi *et al* 2003. Sheath rot of rice in Iran. Communications in Agricultural and Applied Biological Sciences 68 (4b) : 681-684.

Pramanick T C and Phookan A K 1998. Effect of plant extracts in the management of sheath rot of rice. J. of the Agricultural Science Society of North East India. 11 (1) : 85.

Ragunathan V and Vijayaragavan G 1976. Effect of certain fungicides on *in vitro* growth and enzymatic activities of *Acrocylindrium oryzae* Sawada. Malsas Agric. J. 63 (5/7) : 396-399.

Reddy C S and Ghosh A 1985. Sheath rot incidence and yield losses in rice due to the joint infection of rice fungro virus and sheath rot fungus. Indian Phytopath. 35 : 165-167.

Singh R S 1987. Investigations on sheath rot of rice. Ph.D. thesis, R.A.U. Bihar, Pusa, Samastipur.