GROWTH INHIBITION OF *RHIZOCTONIA SOLINI* KUHN BY FIVE FUNGICIDES AND THEIR UPTAKE BY SOYBEAN SEEDLINGS[1]

J.E. CARDOSO[2], A.C. HILDEBRANDT[3] & C.R. GRAU[3]

[2] Centro de Pesquisa Agropecuária do Trópico Úmido – CPATU EMBRAPA, Cx. Postal 48, 66.000 – Belém-Pará; [3] Department of Plant Pathology University of Wisconsin Madison – Wisconsin, 53706 – U.S.A.

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ABSTRACT

The influence of five fungicides on growth inhibition of *Rhizoctonia solani* Kuhn and their uptake by soybean seedlings were studied. The fungicides were benomyl, pentachloronitrobenzene (PCNB), thiabendazole and the experimental fungicides EL-222 and EL-228 (Elli Lilly Co.). PCNB was the least fungal inhibiting fungicide, even though it significantly increased inhibition with each increase in concentration. EL-222 and EL-228 highly inhibited the growth of the fungus in the hypocotyl as well as in the cotyledons. Benomyl and thiabendazole inhibited significantly the fungal growth in the hypocotyls but not in the cotyledons. PCBN failed to inhibit in both hypocotyl and cotyledon.

(Fitopatologia Brasileira 4:11-15. 1979)

RESUMO

Sensibilidade, *in vitro*, do micélio de *Rhizoctonia solani* Kuhn a cinco fungicidas e absorção destes produtos por plantinhas de soja.

A eficiência de cinco fungicidas na inibição do crescimento de *Rhizoctonia solani* kuhn foi avaliada "in vitro". Os fungicidas utilizados foram benomyl, pentacloronitrobenzeno, tiabendazol e os produtos experimentais EL-222 e EL-228. Nas concentrações de 5 a 10mg/ml benomyl e tiabendazol revelaram-se como os mais eficientes dentre os cinco fungicidas testados. Pentacloronitrobenzeno foi o mesmo efetivo na inibição do fungo muito embora ele tenha elevado significativamente seu efeito inibitório sobre *R. solani* com o aumento de sua concentração.

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Os produtos experimentais EL-222 e EL-228 se mostraram altamente eficientes na inibição do crescimento do fungo no hipocótilo e cotiledones das plantinhas tratadas. Benomil e tiabendazol inibiram significativamente o crescimento do fungo apenas nos cotiledones enquanto que o pentacloronitrobenzeno não apresentou qualquer efeito inibitório.

(Fitopatologia Brasileira 4: 11-15. 1979)

INTRODUCTION

Rhizoctonia solani is able do induce many types of diseases, to a wide range of plants, over a large part of the world, and under diverse environmental conditions (Leach & Garber, 1970). Its isolates are extremely variable in specialized responses to host plants, symptom production, environmental, physiological and chemical responses. The control of *R. solani* diseases is, therefore, very difficult (Leach & Garber, 1970).

Many workers have reported the use of seed fungicide treatment in controlling seed and seedling diseases caused by *R. soloni* (Allan et al., Sinclair & Shilling, 1969; Borum & Sinclair, 1978; Gray & Sinclair, 1970; 1971; Kirkpatrick & Sinclair, 1973; Leach & Garber, 1970; Leach, Garber & Lange, 1959; Tachibana, 1969; Tachibana & Sinclair, 1970), as well as the uptake distribution of systemic fungicides in seedlings tissues (Borum & Sinclair, 1968; Gray & Sinclair, 1970, 1971; Kirkpatrick &Sinclair, 1973; Tachibana, 1969; Tachibana & Sinclair, 1970).

In the present work one aspect concerning control of *R. solani* diseases in soybeans was studied: the chemical control through the use of fungicides. Five fungicides were analyzed as to their ability to the fungal growth *in vitro* and their uptake and distribution within soybean seedlings.

MATERIAL AND METHODS

The experiment was done with four systemic experimental fungicides, EL–222 (∝ – (2–chlorophenyl) – ∝ – (4–chlorophenyl–5–pyrimidinemethanol, of Eli Lilly Co.) and EL–228 (∝ – (2–chlorophenil– ∝ – (4–thirophenyl ∝) ∝ –5–(pyrimidine methanol, of Eli Lilly Co.) benomyl (methyl1–1–(butylcarbomonyl)–2–benzimidazole of Merck & Co., Inc.) and the monsystemic PCNB (pentachloronitrobenzena of Olin Co.).

An isolate of *R. solani* (R-5) isolated from soybean seedlings in Maryland State was used. The experiment was done by using a modification of the techniques used by Borum & Sinclair (1968) and Kirkpatrick & Sinclair (1973). Concentration of 5, 10, and 50 mg/ml (a.i.) of each fungicide were prepared in sterile distilled water and added to melted Potato Dextrose Agar (PDA) in plates. Agar discus containing the test fungus from a four-day old culture were placed in the center of each of the five plates per treatment, PDA plates without fungicide served as controls. The plates were incubated at 28ºC and the radial growth of colonies was measured 50 hours after transfer. The statistical analyses were done by using 5 x 3 factorial design.

In order to study the uptake of fungicides by soybean seedlings a modification of the methods used by Allan, et al. (1969) and Tachibana & Sinclair (1970) was used. Soyben seed of the cultivar Chippewa 64 was either nontreated or treated with 0.5g (a.i.) of benotreated or treated with 0.5g (a.i.) of benomyl, thiabendazole, El-222, El-228, or PCNB in closed saucers at room temperature (approximately 25º C). Four days after germination, cotyledon and hypocotyl tissues were homogenized by grinding in a sterile mortar and pestle with 10 mil of sterile distilled water, filtered through sterile cheesecloth and mixed with 50 ml of melted

sterile PDA. Five petri dishes containing 10 ml of PDA for each plant were used. Agar discs of 0.5cm diameter were transferred from a four-day old culture of R-5 isolate to the center of each petri plate. The experiment consisted of five replications for each seedling part/fungicide combination. The statistical analysis were made separately from each plant part in a completely randomized design and the data were presented as percentage of inhibition as compared to sseding partes from non-treated seeds.

RESULTS

There was a significantly greater inhibition of fungal growth with benomyl and thiabendazole than PCNB, EL-222 and EL-228 at 5 and 10Mg/ml concentration (Fig. 1). PCNB was the least fungal inhibiting fungicide, even though it significantly increased inhibition with each increase in concentration. EL-222 and EL-228 also significantly increased inhibition with increase in concentration.

The percentage of fungal growth inhibition of plates containing seed-treated seedling extracts from cotyledons and hypocotyls are presented in Fig. 2. All systemic fungicides significantly reduced the growth of the fungus in the extracts from the cotyledons when compared to seedlings from either non-treated or PCNB-treated seeds. EL-228 and thiabendazole *were similar* and *superior* to all other fungicides as to seedlings extracts from the cotyledons. EL-222 was superior to benomyl in concentration as determined by inhibition of fungal growth on PDA supplemented with cotyledon extracts.

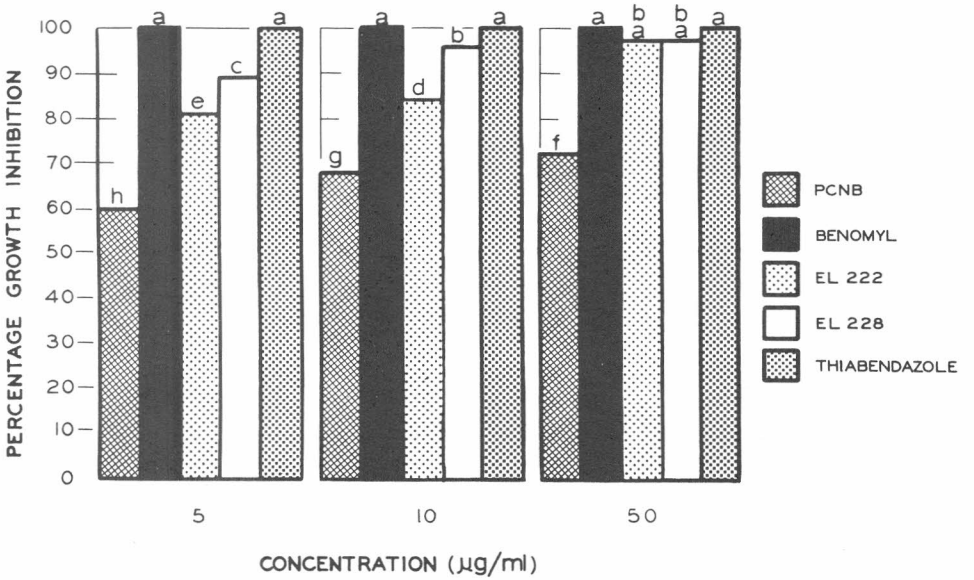

Figura 1 – Radial growth of *R. solani* grown on potato dextrose agar amended with five different fungicides at three concentrations. Bars not having similar letter are significantly different as determined by Duncan's multiple range test (P = 0.05).

DISCUSSION AND CONCLUSIONS

Since the systemic fungicide benomyl and the non systemic PCNB have been reported and recomended for controlling *R. solani* in soybeans Alann **et al.** (1969) and Tachibana (1969), the main goal of the present studies was to compare those two with thiabendazole and the experimental products El-222 and EL-229.

The data here presented shows clearly the potential capabilities of thiabendazole, EL-222, and EL-228 in controlling *R. solani* in soybean sedlings. In fact, from Fig 1, it can be concluded that these three fungicides showed better control than PCNB, and equal in some concentration to benomyl. As in earlier reports Gray & Sinclair (1970), Kirkpatrick & Sinclair, (1973), Tachibana (1969) and Tachibana & Sinclair (1970), benomyl did not move down to the hypocotyls as demonstrated by the lack of significant difference in inhibition from the control and PCNB which is not a systemic fungicide. Thiabendazole also was not present in the hypocotyls in a concentration high enough to reduce fungal growth. On the other hand, EL-222 and EL-228 highly inhibited growth of the fungus in the hypocotyls (Fig. 2).

The experimental fungicides, besides their high fungal inhibiting activity (Fig. 1), demonstrated one important characteristic in controlling soil borne fungi whereas they showed translocation downward (Fig. 2). This characteristic could be taken into consideration for further trials with these fungicides.

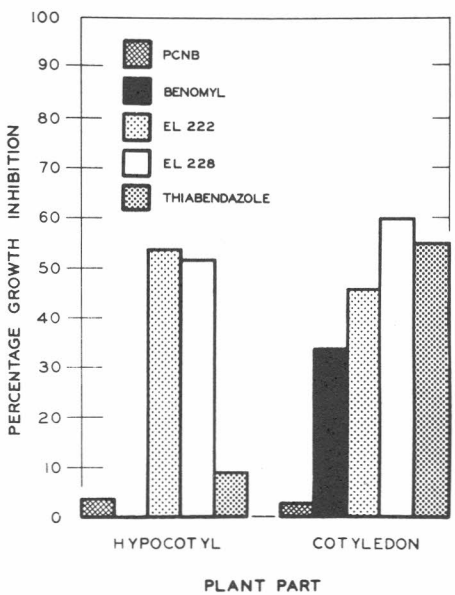

Figura 2 – Growth of *R. solani* on potato dextrose agar amended with hypocotyl and cotyledon extracts of soybean seedlings from previously treated seeds with five fungicides.

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