SAVOV, P. (1969). Influence of gamma rays on the variability of different common wheat cultivars and their hybrids. *Genetics & Plant Breed.*, 2, 3 : 227-238.

SAVOV, P. (1973). [Results obtained after irradiation of some hybrid combinations], *Sci. Sess. Genetics. Sofia, 1971.*

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PHOTOSYNTHETIC RATE IN RICE AS INFLUENCED BY THE ROOT-KNOT NEMATODE, *MELOIDOGYNE GRAMINICOLA*, INFECTION

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The root-knot nematode, *Meloidogyne graminicola* Golden & Birchfield, 1968 is associated with loss in grain yields in rice and widely distributed in India (Prasad, Panwar & Rao, 1987). The symptoms of root damage by the nematode results in stunted and chlorotic plants (Rao, 1985). Reduction in chlorophyll a and b fractions (20 to 39.5 %) has been reported due to infection by this nematode (Rao, Jayaprakash & Mohanty, 1988; Swain & Prasad, 1988). In contrast a resistant variety, Udaya demonstrated a 43.5 and 24.3 % increase in a and b fractions of chlorophyll, respectively (Swain & Prasad, 1988). Reduction in photosynthetic rates of tomato and bean leaves due to root-knot nematode infection has been reported (Loveys & Bird, 1973; Melakeberhan, Webster & Brooke, 1984). Changes in photosynthetic rate in the resistant and susceptible rice varieties, following the root-knot nematode infection are reported in the present studies.

The seeds of five rice varieties (resistant : Annada, IR 36 and Udaya and susceptible : Annapurna and Parijat) isolated by Swain, Prasad and Rao (1986) were each sown in 30 polypots (one seed/pot) containing 200 g steam sterilised soil. When the seedlings were five days old, fifteen seedlings from each variety were inoculated with 100 infective juveniles of *M. graminicola* per pot. Thirty days after inoculation, the second leaf from top of the main tiller of each plant was excised under water, stabilised at 40 k-lux light for one hour and transferred to a photosynthetic chamber connected to an infra red gas analyser (Make ADC, Series 225, UK). Air containing 320-330 ppm carbon dioxide was drawn through the photosynthetic chamber at the rate of 0.25 l/min and depletion in carbon dioxide inside the chamber was recorded with infra red gas analyser. The initial and final readings were recorded and the photosynthetic rate per unit leaf area (Po) was calculated as mg CO_2 dm^{-2} h^{-1} with the following formula (Nayak, Padhi & Murty, 1983) :

$$Po = \frac{44\,000 \times \text{flow rate (l/h)} \times \text{difference in ppm of } CO_2 \text{ as recorded by IRGA}}{0.08205 \times \text{temperature in } ^oK\ (273^o + \text{ambient temp.}^o) \times \text{leaf area in } dm^2)}$$

The temperature of the photosynthetic chamber was 30°. The photosynthetic rate per unit leaf area of infected and non-infected plants was compared. The % reduction in photosynthetic rate in each rice variety was calculated basing on the means of fifteen replications of infected and non-infected treatments.

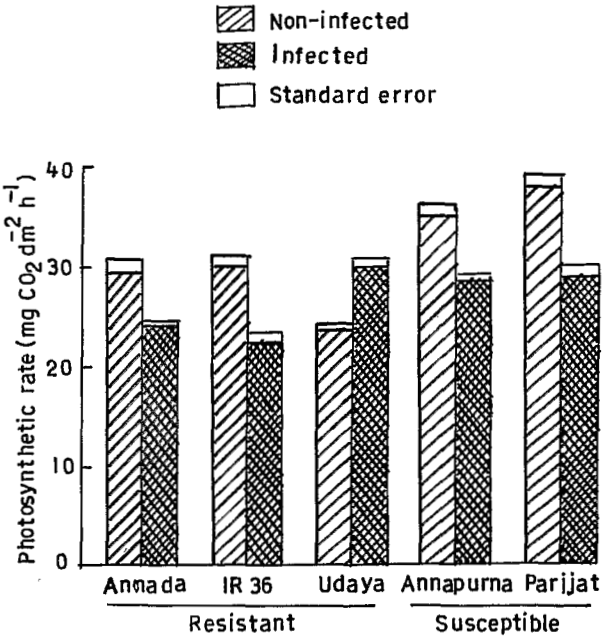

Fig. 1. Influence of root-knot nematode on the photosynthetic rate in five rice cultivars (mean of fifteen replication).

The photosynthetic rate in non-infected plants ranged from 23.6 mg in Udaya to 37.9 mg in Parijat (Fig. 1). The photosynthetic rate of var. Udaya was lowest followed by Annada and IR 36. Both the susceptible varieties, Annapurna and Parijat, produced highest photosynthetic rate which were similar to one another.

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The percentage reduction in measured photosynthetic rates was higher in the susceptible varieties Annapurna (25 %) and Parijat (22.7 %) than in resistant varieties Annada (19.6 %) and IR 36 (18.9 %).

In contrast to the other varieties tested, a significant increase in photosynthetic rate was observed in infected plants of rice var. Udaya (27.9 %) over rates of non-infected plants. Swain and Prasad (1988) observed increase of 43.5 % and 24.3 % in a and b fractions of chlorophyll respectively under root-knot nematode infection in var. Udaya while all the other rice varieties showed a reduction. This behaviour may indicate compensating metabolic activity in this rice variety in response to root-knot nematode infection and contribute to its resistance or tolerance to damage caused by the nematode. Further, these results reveal that the stimulating effect of the nematode infection on the photosynthetic rate is not correlated with resistance.

REFERENCES

LOVEYS, R. R. & BIRD, A. F. (1973). The influence of nematodes on photosynthesis in tomato plants. *Physiol. Pl. Pathol.*, 3 : 525-529.

MELAKEBERHAN, H., WEBSTER, J. M. & BROOKE, R. C. (1984). Improved techniques for measuring the CO_2 exchange rate of *Meloidogyne* infected bean plants. *Nematologica*, 30 : 213-221.

NAYAK, S. K., PADHI, S. K. & MURTY, K. S. (1983). Screening for higher photosynthetic efficiency in rice. *Pl. Physiol. Biochem.*, 10 (Spec. Vol.) : 90-95.

PRASAD, J. S., PANWAR, M. S. & RAO, Y. S. (1987). Nematode problems of rice in India. *Trop. Pest Manag.*, 33 : 127-136.

RAO, Y. S. (1985). Research on rice nematodes. In : *Rice in India*, New Delhi, Indian Council Agric. Res. : 519-615.

RAO, Y. S., JAYAPRAKASH, A. & MOHANTY, J. K. (1988). Nutritional disorders in rice due to infestation by *Heterodera oryzicola* and *Meloidogyne graminicola*. *Revue Nématol.*, 11 : 375-380.

SWAIN, B. & PRASAD, J. S. (1988). Chlorophyll content in rice as influenced by the root-knot nematode, *Meloidogyne graminicola* infection. *Curr. Sci.*, 57 : 895-896.

SWAIN, B., PRASAD, J. S. & RAO, Y. S. (1986). Reaction of some rices to root-knot nematode. *IRRI Newsl.*, 11 : 25.

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HETERODERA CAROTAE, JONES, 1950.5. EFFET PHYTOSTIMULANT DU DD

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La lutte contre *Heterodera carotae* Jones consiste essentiellement en l'utilisation de traitements nématicides fumigants, que ce soit en zone méditerranéenne (Greco & Lamberti, 1976) ou océanique (Bossis, Cavelier & Mugniéry, 1989).

Quelques résultats publiés par ces derniers auteurs pourraient s'expliquer facilement par une activité phytostimulante du DD dont certains effets secondaires sont connus : ammonification de l'azote organique (Ritter, Simon Sylvestre & Bonnel, 1970), modification de la teneur en azote ammoniacal (Elliot, Marks & Tu, 1974), effet sur certains oligoéléments tels que le chlore (Goffart & Heiling, 1958), effet sur la microflore (Simon-Sylvestre & Fournier, 1980). Nous avons voulu, en utilisant la carotte comme résultante de ces effets divers, vérifier cette hypothèse de phytostimulation sur différents types de sols.

Matériel et méthode

Quatre sols dont les trois premiers proviennent de zones de culture de carotte sont utilisées : Plouhinec (sol sableux pauvre en matière organique et en éléments minéraux), Les Pieux (sol sablo-limoneux), Barfleur et Le Rheu (sols limon moyen sableux).

Chaque type de sol est stérilisé à la vapeur à 80° pendant 2 h pour détruire les nématodes susceptibles d'attaquer la carotte, et en particulier *H. carotae*, puis réparti dans huit bacs de 0,35 × 0,25 m et 0,22 m de hauteur. Un mois plus tard, un traitement au DD à 400 l/ha est effectué sur la moitié des bacs, par injection avec une seringue en quatre points, à 15 cm de profondeur. Un semis de carotte cv. Nandor est réalisé un mois plus tard. La culture est maintenue à l'extérieur. A la récolte, cinq mois plus tard, chaque carotte est pesée.

Résultats

Les données sont analysées par le test de Kullbach, rapporté par Arbonnier (1966). Les carottes sont réparties en classes de 10 g et cette répartition est soumise au test $2\hat{I}$. Pour chaque type de sol, les différences de structure entre traitement et témoin sont hautement significatives. Pour 6 ddl, $2\hat{I}$ = 44, 97, 42, 82, respectivement pour les sols de Le Rheu, Les Pieux, Plouhinec et Barfleur.