Journal of Plantation Crops 13 (1): 38-40 June, 1985

UPTAKE AND PERSISTENCE OF METALAXYL IN BLACK PEPPER (*PIPER NIGRUM* L.)*

N. RAMACHANDRAN and Y. R. SARMA
Central Plantation Crops Research Institute, Regional Station
Calicut 673 012, Kerala, India

ABSTRACT

A study was conducted to know the exposure time required for the uptake of metalaxyl and duration of its persistence in black pepper *(Piper nigrum* L.) plants, using a leaf lesion bioassay. Metalaxyl at 1000 ppm applied as soil drench was translocated acropetally in significant quantity even one hour after application. The infection on the leaves of metalaxyl treated plants was negligible on the 50th day after which the activity of the fungicide gradually reduced. Thus metalaxyl has an advantage over contact fungicides in controlling infections of *Phytophthora palmivora* especially under heavy rainfall conditions.

INTRODUCTION

The prophylactic fungicides used at present to control the quick-wilt disease of black pepper caused by *Phytophthora palmivora* MF_4 are subjected to severe leaching due to heavy rainfall, during June-September period, when the disease usually occurs. As a result even repeated application of contact fungicides does not give protection to pepper vines from infection. To overcome the leaching effect of rain, systemic fungicides are being tried.

Systemic fungicides namely, Metalaxyl (N-(2-6 Dimethylphenyl)-N-(methoxy acetyl) alanine methyl ester); Aliette (Aluminium tris (ethyl phosphonate) and Terrazole (5-Ethoxy-3-(Trichloromethyl)-1, 2, 4-thiadiazole) effective against the fungi belonging to Peronosporales were reported to be effective against *Phytophthora* infections in various crops (Mitchell, Kannwischer and Sanden, 1977; Knauss, 1978; Papavizas et al, 1979; Davis, 1982). Among these, Ridomil (metalaxyl) an acylalanine fungicide was found to be effective in controlling *Phytophthora* infections in black pepper (Ramachandran, Sarma and Nambiar, 1982). Studies on its uptake and persistence were conducted in pot-grown black pepper plants, employing a detached leaf bioassay.

* *Contribution No. 341, Central Plantation Crops Research Institute, Kasaragod*

MATERIALS AND METHODS

One year old plants of hybrid pepper Panniyur-I raised in 25 cm dia. earthen pots each containing about seven kilograms of nursery mixture (sieved field soil, river sand and cattle manure mixed in 4:2:1 ratio by volume) were used. Metalaxyl at 1000 ppm a.i. concentration was applied as soil drench @ one litre per pot. Black pepper isolate of *P. palmivora* was cultured on carrot agar medium and incubated at laboratory conditions (25 C) for three days. Three mm diameter culture discs cut out from the advancing margins of the colony with a cork borer, were used for inoculating the leaves.

Uptake of metalaxyl

The fungicide suspension was applied to the soil in the pots around the base of the vines. Ten leaves from the bottom of each vine were tagged. The treated plants were kept in bright sunlight until the leaves were sampled for bioassay. The tagged leaves were detached from six plants each at 1, 2, 3, 4, 5 and 24 hr after the treatment. Leaves from six untreated plants (0 hr) were maintained as control. The leaves were given a quick wash and blotted in between filter papers before inoculation. Each leaf was inoculated with culture discs of the fungus at two points one each on either side of the midrib following a small prick with a fine stainless steel needle. They were incubated in humid petriplates at 25 ± 1°C and lesion diameters were recorded after 72 hrs.

Persistent activity of the fungicide

Twenty four pepper plants were treated with the fungicide and maintained under green house conditions. In our earlier studies we found that metalaxyl treated leaves didn't take up infection even after 40 days. The leaves in the present study were assayed at 10 day intervals starting from the 40th day to the 90th day. At every interval ten leaves from each of four treated and four untreated plants were excised and inoculated. The lesion diameters were recorded 72 hr after incubating in humid petri plates at 25 ± 1°C.

RESULTS AND DISCUSSION

Diameter of the lesions were recorded and the percentage inhibition was calculated for treated plants (Tables I & II).

Table I. *Lesion dimensions on leaves inoculated at different intervals after treatment*

Duration of exposure to the fungicide in hours	Lesion diameter (Mean in mm)	Per cent inhibition
0 control	13.65	0.0
1	6.52	52.2
2	5.46	60.0
3	4.88	64.2
4	3.63	73.4
5	2.82	79.3
24	0.00	100.0

CD at 1% = 3.10 mm

The activity of the fungicide was noticed in the leaves even one hour after application as evidenced by the reduction in the lesion size to the extent of 52.2% compared to the control (Table I). The translocation based on the bioassay was found to be highly significant. Though the fungicide activity was found to increase with increase in the duration of exposure to the fungicide treatment, the rate of uptake between the treatments was not statistically significant after the

Table II. *Per cent inhibition of lesions in metalaxyl treated leaves inoculated at different periods after application*

Days after application	Lesion diameter (Mean) (mm)		Per cent inhibition
	Treated	control	
40	0.0	17.6	100
50	0.5	15.1	96.6
60	6.3	21.2	70.2
70	5.5	21.3	74.1
80	5.6	16.3	65.6
90	6.0	17.3	65.3

CD at 1% = 0.28 Cm

first treatment. Lesion development was not seen in leaves sampled 24 hrs after treatment. The high rate of uptake during the first hour might be due to the high concentration gradient between the soil drenched with the fungicide and the plant system, as the concentration gradient is thought to be a major factor governing the first phase of passive translocation in plants (Crowdy, 1977). This can also explain the slow rate of uptake in the subsequent intervals as the concentration gradient decreases with the gradual increase of fungicide concentration in plant.

The fungicide activity was found to persist in the foliage even 50 days after treatment. Though it almost completely inhibited lesion development at 50th day, the activity was found to decline gradually afterwards.

ACKNOWLEDGEMENT

The authors are thankful to Dr. M. K. Nair, Joint Director, Central Plantation Crops Research Institute, Regional Station Calicut, for the encouragement.

REFERENCES

CROWDY, S. H. 1977. Translocation. pp. 93-114, In *Systemic Fungicides* ed. Marsh, R. W. Longman group Ltd., London.

DAVIS, R. M. 1982. Control of *Phytophthora* root and foot rot of citrus with systemic fungicides, metalaxyl and phosethyl aluminum. *Plant Disease*. 66: 218-220.

KNAUSS, J. F. 1978. CGA 48988, a new systemic fungicide for control of *Phytophthora nicotianae*. var. *parasitica* on *Peperomia obtusifolia*. *Proc. Fla. State Hortic. Soc.* 90: 330-332.

MITCHELL, D. J., KANNWISCHER, M. E. and SANDEN, G. E. 1977. Control of black shank of tobacco with an acylalanine analogue. *Proc. Am. Phytopathol. Soc.* 4: 179-180 (Abstr. No. C 23).

PAPAVIZAS, G. C., SCHWENK, F. W., LOCKE, J. C. and LEWIS, J. A. 1979. Systemic fungicides for controlling *Phytophthora* root rot and damping-off of soybean. *Plant Dis. Reptr.* 63 708-712.

RAMACHANDRAN, N., SARMA, Y. R. and NAMBIAR, K. K. N. 1982. Effect of two systemic fungicides, Aliette and Ridomil on *Phytophthora palmivora* isolate of *Piper nigrum*. pp. 248-251. In *Phytophthora Diseases of Tropical Cultivated Plants*, ed. K. K. N. Nambiar, Central Plantation Crops Research Institute, Kasaragod and Calicut, Kerala, India.