[SHORT COMMUNICATION]

**Effects of Addition of Organic
Materials on Population
Density of *Meloidogyne javanica*
attacking Mungbean in Thailand**

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INTRODUCTION

Mungbean is an important crop in Thailand not only for consumption as a food containing a large amount of vegetable protein but also for exportation. In spite of the efforts made to improve the breeding and cultivation methods and to implement plant protection measures to increase the production of mungbean, yields have tended to remain stationary. Recently yield loss of mungbean caused by the root-knot nematode, *Meloidogyne javanica*, has been often observed. Therefore, it is important to develop an effective method of control of the nematode by minimizing chemical use to prevent the crop damage. Although the effects of organic materials including manure (5, 7, 8), oil cake (2, 11), sewage sludge (1), sawdust (12), chitin (6), and others (3, 4, 6) on the reduction of the population density of root-knot nematodes have been reported by a large number of authors, there are a few reports on *M. javanica* (11, 12, 13, 14) and no report on effect of silkworm feces on the control of nematodes. Accordingly, the authors examined the effects of the applica-

tion of organic materials including silkworm feces on the population densities of *M. javanica* attacking mungbean in Thailand.

MATERIALS AND METHODS

Experiment 1: Two kinds of treatments with organic materials and/or a chemical, as well as controls (no treatments) were prepared for the experiment. In the treatment with organic materials, 75 g of compost (urban waste compost), dried cow dung or dried silkworm feces was mixed with soils heavily infected with *M. javanica* in 5 plastic pots (1/2000 a, 25 cm in diameter and 30 cm deep) on February 5, 1990. For the plot with the chemical, 1g of carbofuran (20% a. i.) was also mixed with the soils in each 5 pots. Two weeks after the application, seeds of mungbean (Chainat 60) were sown in the soils and 15 plants were cultivated in each pot. Initial population densities of the nematode before the application of organic materials and the densities 3 months after cultivation of mungbean were examined. Five plants were selected from among the mungbean plants which survived in each pot and the growth and yield of the crop were also determined.

Experiment 2: In the treatment with organic materials, 1 kg (15,000 kg/ha by conversion) of compost, dried cow dung, dried fowl droppings or dried silkworm feces was mixed with soils contaminated with *M. javanica* in 80-cm-diameter and 50-cm-deep concrete pots, respectively on the same day as that when Experiment 1 was conducted. In the chemical treatment, 13 g of carbofuran (about 200 kg/ha) was applied with soil in the respective 5 pots. After 2 weeks, seeds of the same variety of mungbean were sown in these pots and 15 plants were grown for 3 months. The population densities of the nematode and yield of the crop were investigated in the same way as in Experiment 1.

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Table 1. Effects of application of organic materials on the population densities of *Meloidogyne javanica* infecting mungbean (Experiment 1).

Treatments	Rate/ha (kg)	No. of 2nd stage larvae/100g soil		Rate of increase of the nematode (%) ((B/A)×100)
		Initial population (A)	3 months after cultivation (B)	
Silkworm feces	15000	279± 65.8	168± 33.6	60
Compost	15000	344±106.6	147± 39.4	41
Cow dung	15000	241± 63.4	204± 49.1	85
Carbofuran	200	123± 22.1	740±176.8	602
No treatment	-	195± 41.0	1115±301.4	572

Note 1: Each value is a mean of 5 replications with a standard deviation.

Note 2: Plastic pots (1/2000 a, 25 cm in diameter and 30 cm deep) were used.

Table 2. Effects of application of organic materials on growth and yield of mungbean cultivated in potted soil infested with *Meloidogyne javanica* (Experiment 1).

Treatments	Rate/ha (kg)	No. of pods	No. of seeds	Weight of seeds (g)	Plant height (cm)	Percentage of dead plants
Silkworm feces	15000	11.4 a	65.0 a	4.0 a	34.9 a	20
Compost	15000	9.6 ab	41.4 b	2.6 ab	30.0 ab	40
Cow dung	15000	6.2 bc	37.4 b	2.3 b	32.1 ab	20
Carbofuran	200	5.0 c	24.2 b	1.4 b	26.1 b	60
No treatment	-	4.2 c	20.0 b	1.2 b	25.5 b	60

Note 1: Each value is a mean of 5 plants, Values followed by the same letter are not significantly different ($p=0.05$) according to Duncan's multiple range test.

Note 2: Plastic pots (1/2000 a, 25 cm in diameter and 30 cm deep) were used.

RESULTS AND DISCUSSION

In Experiment 1, the application of organic materials was effective in reducing the mungbean damage caused by *M. javanica*. The population densities of the nematode decreased considerably in the pots amended with organic materials, whereas the densities remarkably increased in the pots with carbofuran or in the control pots (Table 1). Mungbean plants in the pots with silkworm feces, compost or cow dung were taller than those in the pots with carbofuran or in the control pots. A large number of pods and seeds were obtained in the pots amended with organic materials and the yield of mungbean was highest in the pots with silkworm feces. The percentage of dead mungbean plants was significantly lower in the pots treated with

organic materials (Table 2).

The results of Experiment 2 are shown in Tables 3 and 4. In contrast to Experiment 1, the nematode densities did not decrease even in the pots amended with organic materials. However the rate of population increase was relatively lower in those pots (Table 3). The population of free-living nematodes was low in the case of chemical application or in the controls (no treatments). On the other hand, the nematode population in the pots with organic materials, especially fowl droppings and compost, increased at a high rate (Table 4).

The effects of the application of organic materials on the reduction of *M. javanica* densities were significant in Experiment 1 but not clear in Experiment 2. It is considered that the difference in the results between two

Table 3. Effects of application of organic materials on the population densities of *Meloidogyne javanica* infecting mungbean (Experiment 2).

Treatments	Rate/ha (kg)	No. of 2nd stage larvae/100 g soil		Rate of increase of the nematodes (%) ((B/A) × 100)
		Initial population (A)	3 months after cultivation (B)	
Silkworm feces	15000	541 ± 151.2	752 ± 263.2	139
Compost	15000	252 ± 75.5	492 ± 137.7	195
Cow dung	15000	377 ± 87.5	497 ± 154.1	132
Fowl dropping	15000	503 ± 119.6	894 ± 281.8	178
Carbofuran	200	211 ± 60.9	455 ± 140.3	216
No treatment	-	123 ± 41.7	363 ± 94.4	295

Note 1: Each value is a mean of 5 replications with a standard deviation.

Note 2: Concrete pots (80 cm in diameter and 50 cm deep) were used.

Table 4. Effects of application of organic materials on the population densities of free-living nematodes (Experiment 2).

Treatments	Rate/ha (kg)	No. of nematodes /100 g soil		Rate of increase of the nematodes (%) ((B/A) × 100)
		Initial population (A)	3 months after cultivation (B)	
Silkworm feces	15000	110 ± 32.0	508 ± 136.5	462
Compost	15000	48 ± 15.5	324 ± 98.6	675
Cow dung	15000	37 ± 13.8	167 ± 49.3	451
Fowl dropping	15000	247 ± 76.2	2037 ± 682.2	825
Carbofuran	200	133 ± 38.2	39 ± 14.0	29
No treatment	-	70 ± 22.5	92 ± 32.8	131

Note 1: Each value is a mean of 5 replications with a standard deviation.

Note 2: Concrete pots (80 cm in diameter and 50 cm deep) were used.

experiments may be ascribed to the capacity of the pots used in the experiments or planting densities of mungbean plants in the pots with different sizes. As 15 plants each of the crop were grown in both small and large pots, the planting density of the crop in the small pots was much higher than that in the large ones. It is unlikely that the effects of these materials or chemical on *M. javanica* population and mungbean damage may have been different because the same amount of organic materials or carbofuran per ha (by conversion) was applied in both experiments. However, mungbean plants of a low planting density in large pots may be able to escape partially from the nematode attacking by extending roots to soil areas with lower

density of the nematodes or without the nematodes due to the large variations in the nematode distribution in soil in bigger pots. It is suggested that a relatively larger amount of organic materials was required to reduce the nematode density in the big pots in Experiment 2. Although free-living nematodes occurred at a higher density in the treatments with organic materials, their effect on the reduction of the density of *M. javanica* population was not appreciable because species of the nematode preying upon *M. javanica* was not clearly identified in this experiment. Significantly or relatively low population densities of *M. javanica* associated with the application of organic materials are considered to alter the physical and chemical prop-

erties of soil. As a result, the soil environment becomes unsuitable for the growth of root-knot nematodes and the soil may also contain some substances that kill the nematodes (8, 9, 10). Accordingly, the application of organic materials is preferable to that of chemical nematicides whose overuse contaminates the environment or disturbs the ecosystems. Further studies on free-living nematodes and microorganisms which prey upon or parasitize pest nematodes in the soil applied with organic materials, as well as on practical use of the materials in fields seem to be important for the control of nematodes attacking crops and for the preservation of the soil fertility.

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LITERATURE CITED

- 1) HABICHT, W. A. (1975) Pl. Dis. Repr. **59**, 631-634.
- 2) HUSSAIN, M. S., ZAHID, M. I. & MAIN, I. H. (1992) Jpn. J. Nematol. **22**, 1-10.
- 3) JOHNSON, L. F. (1959) Pl. Dis. Repr. **43**, 1059-1062.
- 4) LINFORD, M. B., YAP, F. & OLIVEIRA, J. M. (1938) Soil Sci. **45**, 127-140.
- 5) MANKAU, R. (1968) Pl. Dis. Repr. **52**, 315-319.
- 6) MANKAU, R. & DAS, S. (1975) Indian J. Nematol. **4**, 138-151.
- 7) NAKASONO, K. (1989) Jpn. J. Nematol. **19**, 38-45. (in Japanese with English summary)
- 8) NOZU, R. (1940) Extra Bull. Shimane pref. Seric. Exp. Sta. 95pp. (in Japanese).
- 9) PATRICK, Z. A., SAYRE, R. M. & THORPE, H.

- J. (1965) Phytopathology **55**, 702-704.
  - 10) SAYRE, R. M., PATRICK, Z. A. & THORPE, H. J. (1965) Nematologica **11**, 263-268.
  - 11) SINGH, R. S. & SITARAMAIAH, K. (1966) Plant Dis. Repr. **50**, 663-672.
  - 12) SINGH, R. S. & SITARAMAIAH, K. (1967) Indian J. Phytopath. **20**, 349-355.
  - 13) SINGH, R. S., SINGH, B. & BENIWAL, S. P. S. (1967) Plant Dis. Repr. **51**, 861-863.
  - 14) SRIVASTAVA, A. S., PANDEY, R. C. & RAM, S. (1972) Labdev J. Sci. Tech. **9B**, 203-205. (indirect citation from Helm. Abstr.)
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和文摘要

有機質資材の施用がジャワネコブセン チュウの密度とリョクトウの生育 に及ぼす影響

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タイでリョクトウ(緑豆)を加害するジャワネコブセンチュウ(以下、ジャワネコブと略称)を防除しようとして、1/2000 a ワグネルポット(以下、小型ポットという)及び大型コンクリートポット(間口、奥行き各80cm、深さ50cm、以下、大型ポットという)各5個内のジャワネコブ生息土壤にコンポスト(都市ごみ)、乾燥蚕ふん、乾燥牛ふんなどをそれぞれ10 a 当り換算で1500kg混入した。対照として、Carbofuran(フラダン粒剤)20kg施用区と無処理区を設けた。処理7日後、緑豆の種子を播種し、ポット当り10個体を栽培した。播種前及び3か月後、各ポット内土壤のジャワネコブの密度を調べたところ、小型ポット試験では有機質資材施用区で線虫密度が明らかに低下し、緑豆の収量は増加、枯死率も低かった。一方、大型ポット試験ではいずれの処理区も線虫密度の低下は認められなかったが、有機質資材区の線虫増加率は他の区よりも低かった。大型ポットでは緑豆の栽植密度が小型ポットよりも小さかったため、緑豆が線虫密度の低い場所へ根を伸ばす余地があつて、線

虫の加害を部分的に回避できたものと推察された。有機質資材区では自活性線虫の密度が高

かったが、ジャワネコブに及ぼす影響は明らかでなかった。