Field Trials in Thailand on the Efficacy of some Soil Termiticides to Prevent Subterranean Termites

by

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Abstract

A study on the efficacy of some soil termiticides available in Thailand market was made in order to evaluate their effectiveness in preventing invasion of subterranean termites foraging underneath buildings. The Modified Ground Board Test (MGB), a method representing slab-on-ground construction, a practice widely used for houses was used in the study. Five test sites were chosen as experiment plots to compare different climate and land use practices common around the country. The first test site was in the northeast followed by the second test site in the west, the third in the east, while the fourth and the fifth were in the south. Synthetic pyrethroids was the major group of termiticide used in the study (alpha-cypermethrin, cypermethrin, permethrin, bifenthrin and fenvalerlate). One organophosphate and carbamate termiticide was used in the study chlorpyrifos and fenobucarb, respectively. Four newly introduced products were also testing including; fipronil, imidacloprid, chlorfenapyr and chlorantraniliprole. Results from yearly observations reveal that the pyrethroids bifenthrin 3 EC effectively prevented termite attack for more than 8 years, alpha-cypermethrin 4 SC, 8 SC and cypermethrin 10 MC lasted 9 years, permethrin 30 EC lasted 5 years and fenvalerate 10 EC lasted 4 years. The organophosphate chlorpyrifos 40 EC lasted 7 years and the carbamate fenobucarb 20 EW lasted 5 years. The newly introduced products fipronil 2.5 EC, 5 SC, 5 SL and 80 WDG lasted more than 7 years, imidacloprid 5 SL, 10 SL and 17.8 SL lasted more than 7 years, chlorfenapyr 2 SC lasted between 5-7 years and chlorantraniliprole 17.8 SC lasted more than 8 years.

Key words: subterranean termite, termiticide, efficacy, prevention

Introduction

Soil treatment in Thailand can be dated back only until early 1960's (Vongkaluang, 1990). Before that time termite damage to buildings was considered as less important because of many reasons, the most obvious were type of buildings and the durability of timber used as construction materials. In those days, homes and buildings were one stories with high post and timber used were highly durable species such as teak, ebony, rose wood ects. Changing of construction design later to slab on ground and replacement of durable timber by non-durable timber resulted in higher degree of termite infestation in buildings and prevention of termite damage then started to gain more attention from all concerned. Soil treatment was the practice recommended to be used and chemicals used for treatment during those time were mostly insecticides used for agricultural crops such as aldrin, dieldrin and chlordane (Vongkaluang, 2004). The organophosphate group entered into practice about a decade later followed by synthetic-pyrethroids in late 1980's. By that time the chemicals used for soil treatment for termite management were switched from agricultural insecticides to termiticide which were readily available in the market. After the expiration of patented of many synthetic pyrethroids and the most popular termiticide (fipronil), various generic termiticides were introduced into the country. It was therefore necessary to evaluate the efficacy of these soil termiticides to be used as guideline for both home owners and pest control operators whenever they came to the point to select soil termiticides in their construction deals.

Materials and methods

1. Materials

1.1 Termiticide

The various concentrations of commercial soil termiticides tested in the 5 permanent plots designated by Royal Forest Department belong to 7 chemical classes. The chemical class, common name of the active ingredient and product formulations used were:

Synthetic pyrethroid:	α-cypermethrin	(0.15 EC, 2 EC, 4 EC, 4 EW, 4 SC, 5 EC, 5 SC, 7 EC, 8 SC, 10 EC)
	cypermethrin	(4 EC, 4 SC, 5 EC, 7, 8 SC, 10 EW, 10 MC, 15 MC, 16 SC, 25 EC, 25 EW, 25 SC, 35 EC)
	permethrin	(25 EC, 30 EC)
	bifenthrin	(1 EW, 1 EC, 2 EW, 2.5 EC, 2.5 SC, 3 EC, 3 SC, 3 SP, 4 EC, 5 EC, 5 EW, 5 SC, 8 SC, 10 EC, 10 EW, 10 SC, 10 ME, 15 EC, 15 EW, 15 SC, 20 EC, 20 EW, 20 SC, 24 EC, 24 SC, 25 SC, 60 SC)
	fenvalerate	(10 EC, 10.5 SC)
Organophosphate:	chlorpyrifos	(40 EC)
Carbamate:	fenobucarb	(20 EC, 20 EW, 20 SC)
Phenyl pyrazole:	fipronil	(2.5 EC, 2.5 SC, 4 EC, 5 EC, 5 SC, 5 SL, 10 EC, 10 SC, 20 SC, 80 WDG, 80 WP)
Chloronicotinyl:	imidacloprid	(2.5 SL, 5 EC, 5 SC, 5 SL, 10 EC, 10 WP, 10 SC, 10 SL, 17.8 SL, 18.3 EC, 20 SC, 20 SL, 25 SL, 25 WP, 35 SC, 60 SC, 70 WDG)
Pyrroles:	chlorfenapyr	(2 SC, 24 SC)
Anthranitic diamide:	chlorantraniliprole	(17.8 SC)

1.2 Rubber wood block (*Hevea brasiliensis* Muell.Arg.) size was 5 x 5 x 2.5 cm^3 for treatments and control.

1.3 Construction tools.

2. Methods

Modified Ground Board Test (MGB)

This test representing field condition of building with slab on ground. Test methods are:-

2.1 Install 1 x1 x 0.2 m^3 cement block on designation plot.

2.2 Fill in the sand into the ditch and using construction tools to level the sand surface to the top of the plot height (20 cm).

2.3 Mix chemical to required concentration.

2.4 Evenly pour test chemical by the watering pot on the surface of the sand 5 liter to 1 square meter (1 plot).

2.5 Put the plastic sheet on the entire surface of the sand and the outer edge of the concrete blocks.

2.6 Put the PVC pipe in the middle of the ditch and pure concrete 8 cm thick on top of the plastic sheet (around the PVC pipe).

2.7 Cut out the plastic sheet inside the PVC pipe.

2.8 After the concrete hardened, put one block of rubber wood (5 x 5 x 2.5 cm^3) inside the hole of the PVC pipe and cover the pipe.

2.9 Comparatively evaluation the result on the rubber wood block in treated sand and untreated sand (Control) at 1 year and once every year thereafter.

3. Test Sites

The experiment was located at five locations

3.1 Khon Kaen Province (KK) in the northeast, at Extension & Development Utilization of Small Timber and Non-Wood Forest Products Station, Muang Distric.

3.2 Ratchaburi Province (RB) in the west, at Extension & Development Utilization of Small Timber and Non-Wood Forest Products Station, Muang Distric.

3.3 Chonburi Province (CB) in the east, at Nong Ta Yoo Forest Plantation, Sri Racha District.
3.4 Phuket Province (PK) in the south, at Bang Kanoon Plantation, Talang District.
3.5 Surat Thani Province (SR) in the south, at Surat Thani Silvicultural Research Station, Muang Distric.

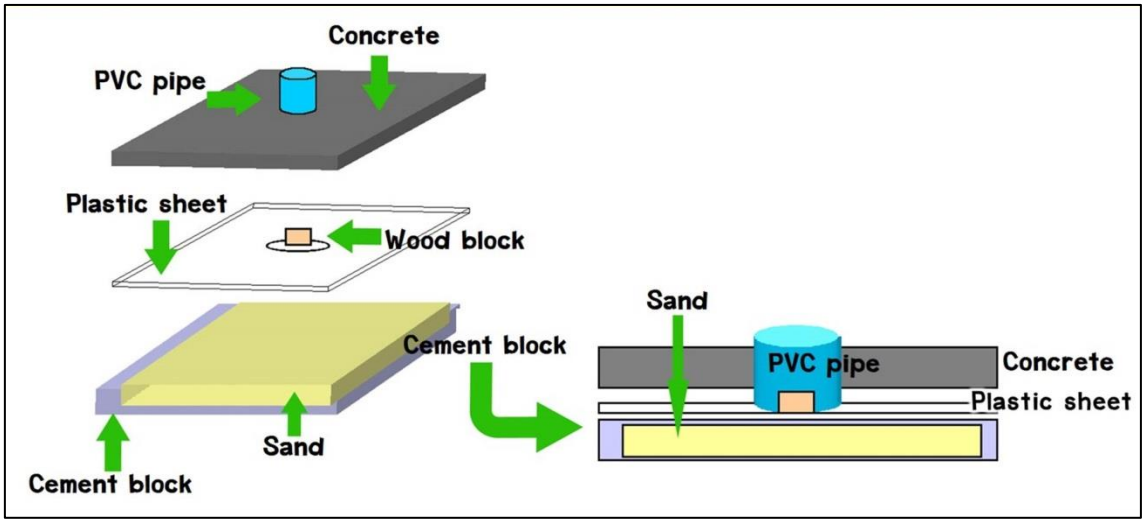

Figure 1 Modified Ground Board Test.

Figure 2 Plot of termiticides test by Modified Ground Board (MBG).

Result and discussion

Figure 3 - 6 show the results of the annual efficacy evaluation of the tested chemicals as soil termiticides using the Modified Ground Board Test (MGB). Number of years (Times on the Y axis) shown in the figures for each chemical indicate the longest period of time that chemical actively prevented the invasion of termites as demonstrated by the appearance of termites into at least one permanent plot.

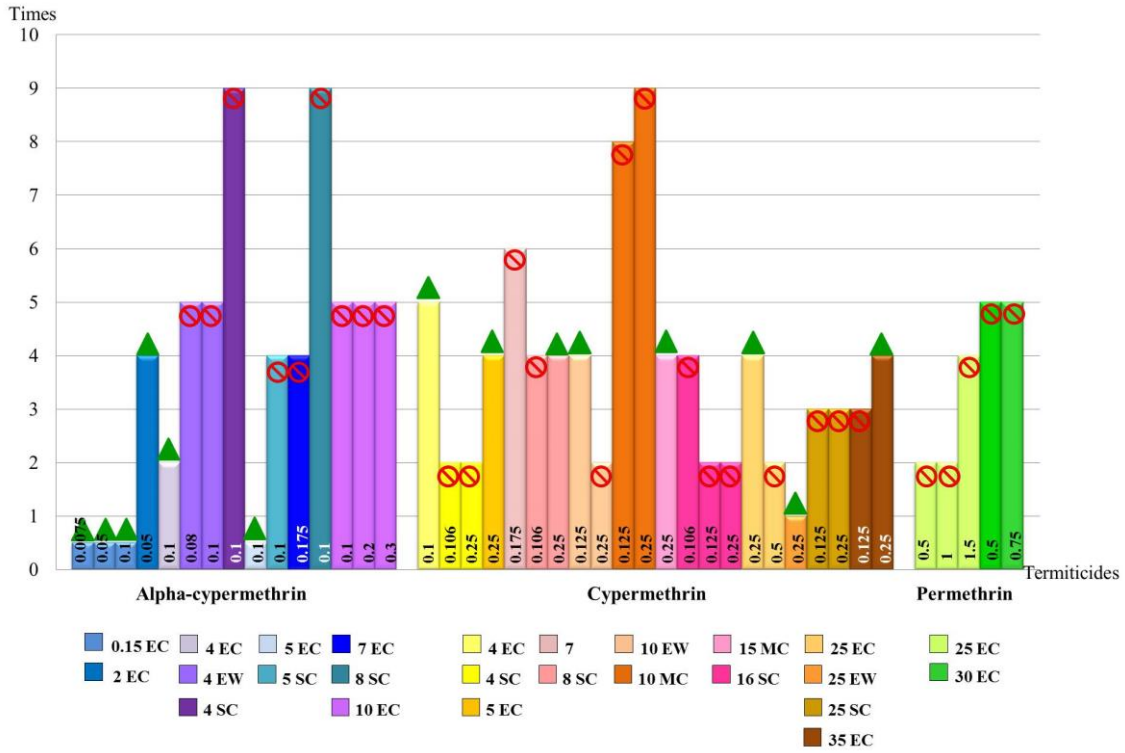

Figure 3 MGB efficacy results for the synthetic pyrethroid termiticides by formulation and concentration in time (years) when termites were first observed in at least one plot.

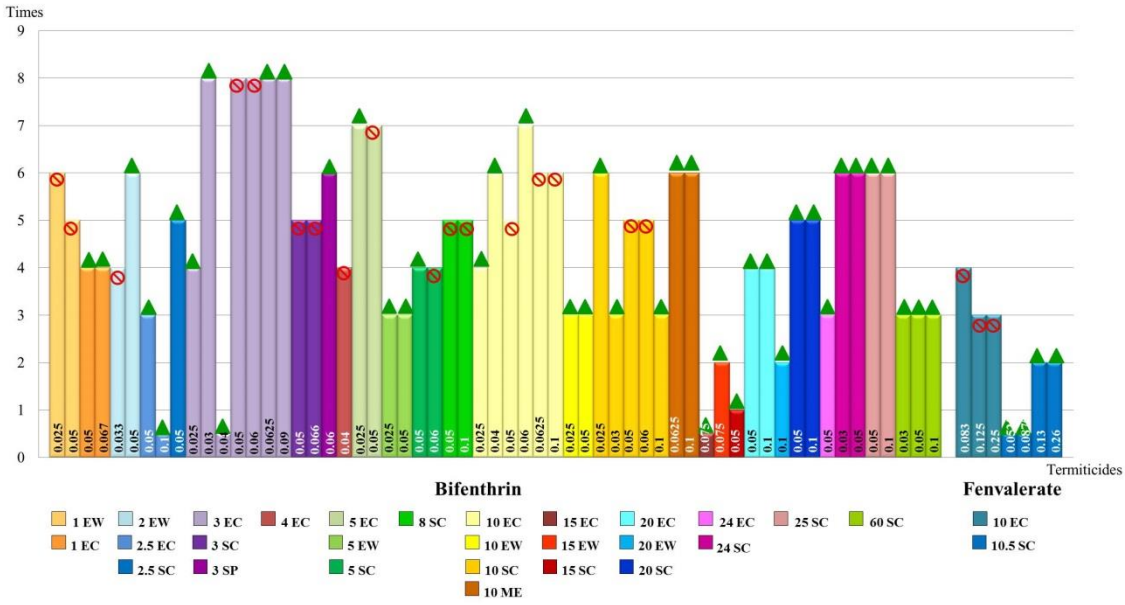

Figure 4 MGB efficacy results for the synthetic pyrethroid termiticides by formulation and concentration in time (years) when termites were first observed in at least one plot.

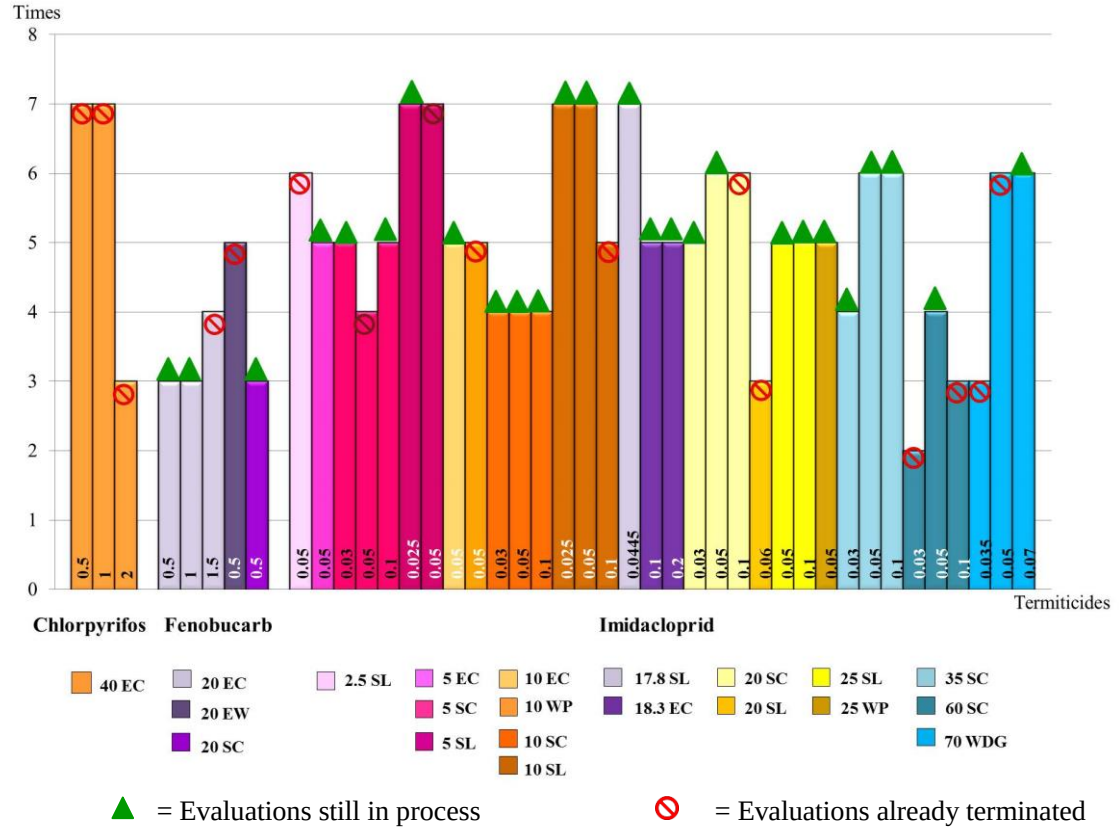

Figure 5 MGB efficacy results for the organophosphate, carbamate, chloronicitinyl termiticides by formulation and concentration in time (years) when termites were first observed in at least one plot.

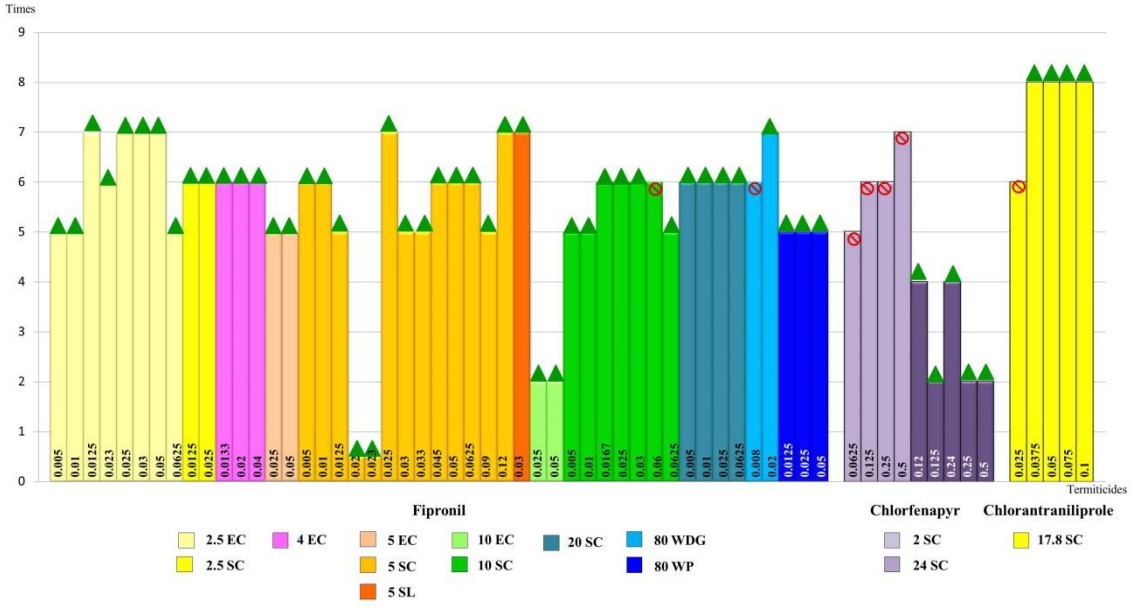

Figure 6 MGB efficacy results for the phenyl pyrazole, pyrroles, antranitic diamide termiticides by formulation and concentration in time (years) when termites were first observed in at least one plot.

From the results as shown in Figures 3, 4, 5 and 6, it is quite obvious that some of the soil termiticide formulations and concentrations used in the "Modified Ground Board Test" performed for over 5 years especially the termiticides in synthetic pyrethroid, organophosphate, phenyl pyrazole and nicotinoid groups. The result revealed that bifenthrin is the most popular synthetic pyrethroid used by Thailand's pest control business. Bifenthrin 3 EC showed longer a preventive role (more than 8 years), while some formulations and concentrations revealed 4-6 years protection. Other termiticides in this group such as alpha-cypermethrin 4 SC, 8 SC and cypermethrin 10 MC lasted for 9 years, while fenvalerate 10 EC and permethrin 30 EC lasted 4 and 5 years respectively.

The organophosphate chlorpyrifos formulation 40 EC at the 0.5% and 1% concentration prevented termite attack for 7 years while the 2% concentration failed at 3 years, the carbamate fenobucarb 20 EW at 0.5% lasted 5 years while the 20 EC at 1.5% failed in three years.

The newly introduced termiticides such as the pyrroles and anthranitic diamide came into the Thailand market but still not very well recognized. Chlorfenapyr 2 SC lasted between 5-7 years and showed a concentration-dependent response with the lowest rate (0.0625) failing at 5 years and the high rate (0.5) at 7 years. Chlorantraniliprole 17.8 SC is still providing protection after 8 years at concentrations higher than 0.25%.

The concentration of termiticide and formulation played a role in the performance of the products in the MGB field trials. Termiticide such as fipronil (phenyl pyrazole) 2.5 EC, 5 SC, 5 SL and 80 WDG prevented attack for more than 7 years at various concentrations. Imidacloprid 5 SL, 10 SL and 17.8 SL lasted more than 7 years, while some formulations and concentrations lasted between 2-6 years, so it should be taken into consideration that the formulations and concentrations of termiticide may probably effect the degradation of termiticide when applied in field condition.

The record of observations as shown in Figures 3, 4, 5 and 6 revealed that results from different test site varied. Factors such as soil type, annual rainfall, pH of soil and land utilization can account for the variation of results from place to place.

Taking into consideration the discussion given above, it is recommended that factors involved in the selection of a termiticide for soil treatment should include the chemical group of the product, as well as the formulation, concentration and location.

Conclusions

Field trials in Thailand on the efficacy of selected soil termiticides to prevent subterranean termite infestations using the Modified Ground Board Test (MGB), which are modified from the USDA forest service guidelines fit with construction practice in Thailand were conducted at five sites in Thailand. The MGB can provide recommendations for soil treatments for houses with slab on ground. The study compared termiticide groups available to the termiticide industry in Thailand. Results revealed that bifenthrin 3 EC effectively prevented attack of termite for more than 8 years, alpha-cypermethrin 4 SC, 8 SC and cypermethrin 10 MC lasted 9 years, permethrin 30 EC lasted 5 years and fenvalerate 10 EC lasted 4 years. chlorpyrifos 40 EC lasted 7 years, fenobucarb 20 EW lasted 5 years. fipronil 2.5 EC, 5 SC, 5 SL and 80 WDG lasted more than 7 years, imidacloprid 5 SL, 10 SL and 17.8 SL lasted more than 7 years. chlorfenapyr 2 SC lasted between 5-7 years and chlorantraniliprole 17.8 SC lasted more than 8 years.

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