缺水地區鳳梨粉介殼蟲防除改進試驗[1]

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摘要：數種粒狀殺蟲劑（Granular insecticides），如有機磷類之 Disyston5% G, Solvirex 5% G, Thimet 10% G, ，及氨基甲酸鹽類之 Sevin 5% G, Ortho-Bux 10% G, 撒施於鳳梨基部之葉基，防除鳳梨粉介殼蟲有優異之成效。惟有機磷之數種粒狀殺蟲劑較氨基甲酸鹽類者，有較快速之殺蟲效果。其施用量 Disystion 5% G, 和 Solvirex 5% G 每公頃40公斤，Thimet 10% G 每公頃20公斤，於鳳梨種植後約1～2個月施用，每隔2～3個月施用一次，連續三次，即可達成完全防除粉介殼蟲之目的。

一、前 言

鳳梨粉介殼蟲 *Dysmicoccus brevipes* (CKLL.) 之防除，自應用有機磷乳劑 (Organophosphorous emulsive insecticides) 作浸苗和種植後數次灌藥 (4,5)，施行以來，成效卓著。但在山坡地水源短缺，故在冬、春兩季灌藥時，往往難於推行。孫守恭等（6）曾經以甲基巴拉松 3% 粉劑 (Methyl parathion 3% dust)，在本省中南部及東部山坡地作粉介殼蟲防除試驗，效果甚優異。但因巴拉松粉劑甚毒，應用時稍有不慎，易於由呼吸器官或皮膚之接觸進入體內，而致中毒。復次，施用粉劑需在無風的晴天，若有微風，粉劑一經撒開，即隨風飛揚，不但撒下藥粉不能全部達到所欲施之部位，且易損及鄰近人畜，因此在應用上諸多不便，而難於推行。

Carter 氏（1）在夏威夷曾用有放射能的 (S^{35}) Bayer 19639 (di-syston) 20% EC 作鳳梨粉介殼蟲防除試驗，將該殺蟲劑稀釋500倍，每株鳳梨灌 125cc 於植株基部周圍土面。據氏試驗結果，該殺蟲劑可經由土壤進入鳳梨全株組織內，尤其在鳳梨根部聚集之藥量最多，僅微量進入幼果（Green half-developed fruit），而祇有在根部吸收之藥量，方足以使粉介殼蟲中毒致死。

近年來，粒狀殺蟲劑已廣泛用於害蟲防除，均獲良好殺蟲效果。粒狀殺蟲劑除可免於用水稀釋外，撒施時不致飛揚，其有效成份可藉微量雨露或土壤濕度逐漸溶化而發揮藥效，可維持較長之殺蟲時間。且貯藏和施用較安全而方便。防除害蟲外，不致損害益蟲，具有甚多優點。

目前政府正積極推展山坡地開發，而鳳梨在某些地區往往爲開發山坡地之先驅作物。但山坡地開發越多則水源之涵養越成問題，缺水問題必愈爲嚴重。因此，筆者爲求山坡地鳳梨粉介殼蟲之防治問題得以解決，在農業研究中心 68-A12-A-1877 (TARC)-(2)及69-A11-A-1941 (TARC)-K 兩計劃補助下，經兩年來應用數種粒狀有機磷劑 (Organic phosphates) 和氨基甲酸鹽類 (Carbamate compounds)，分別在室內和田間作鳳梨粉介殼蟲防除試驗。茲將試驗結果，整理報告於后，尙祈先進指教。

二、材料及方法

供試粒狀殺蟲劑，屬有機磷劑者，有 Disyston 5%G, Solvirex 5%G, Thimet 10% G；屬氨基甲酸鹽類者有 Sevin 5%G, Orthc-Bux 10% G 等。本試驗分別在室內和田間進行。茲將試驗方法分述如下：

本著作之完成得國家科學委員會補助，謹此致謝

1. 試驗報告農試字第五一五號　2. 臺灣省農業試驗所鳳山熱帶園藝試驗分所技士

（一）室內試驗　爲明瞭該數種粒狀殺蟲劑之殺蟲作用，故在室內先以盆栽鳳梨，俟其成活後每株接種粉介殼蟲30～50隻，俟粉介殼蟲在鳳梨固定後施藥。施藥方法分爲施於鳳梨葉基部，以測定其接觸殺蟲作用；另一爲施於植株周圍土壤中，以測定其官能殺蟲作用。每一處理用盆栽鳳梨5株。每株施藥量分0.5克及1.0克，施藥後並以灌水及不灌水等處理而比較其對殺蟲效果之影響。處理後復分一週和兩週後調查，以明瞭其殺蟲效力之快慢。

（二）田間試驗　根據在室內盆栽鳳梨試驗結果，繼而作田間試驗。並爲觀察本省各主要鳳梨產地對於粒狀殺蟲劑防除粉介殼蟲之效果，和各地區粉介殼蟲發生密度之高低，特在南投頂新厝，嘉義大林和鳳山試驗所等地，作區域性試驗。

供試鳳梨係於民國57年9月種植，依各地試區之大小，每小區種鳳梨 100株左右。此次試驗目的，在求解決缺水地區之施藥問題，鳳梨苗均不浸藥，而在定植成活後施藥。施藥時間分別於民國57年11月，58年1月和3月將粒劑施於鳳梨葉基部，其用量爲 Thimet 10% G 和 Ortho-Bux 10% G 每株施0.5公克，以鳳梨每公頃 40,000株計，每公頃之用藥量爲20公斤。 Disyston 5% G, Solvirex 5% G和 Sevin 5% G 則每株各施 1.0公克，每公頃之施用量爲40公斤。 爲求施藥量準確， 在施藥前，先將粒劑秤量後分裝於小塑膠袋中，然後撒於鳳梨葉基部。此外另加巴拉松47%乳劑 2,000 倍稀釋液，依目前推廣方法灌於鳳梨芯部，作爲標準藥劑，另一不施藥之對照區等7處理，重複4次，採逢機完全區集設計 (Randomized complete block design) 。

三、結果及討論

由室內試驗結果，供試數種粒狀殺蟲劑防治鳳梨粉介殼蟲，在不同情形下所發揮之殺蟲效能，優劣互異。數種有機磷殺蟲劑如 Thimet, Disyston, Solvirex 之接觸殺蟲作用，在不灌水情形下經兩週，其殺蟲效果均達100%。如灌水則一週之殺蟲率即達100%。但兩種氨基甲酸鹽類殺蟲劑如Ortho-Bux 和 Sevin, 僅 Ortho-Bux 在灌水處理可達較高之殺蟲效果外，其他處理方法均不甚理想。至官能殺蟲作用，亦僅有機磷殺蟲劑在灌水處理區有輕微之效果外，其他均不足取。依據 Reynolds 等（3）試驗結果，謂粒狀殺蟲劑施用後，經灌水之土壤較不灌水者易爲植物根部所吸收。但在山坡地鳳梨園，除在雨季外，其他時期土壤很乾燥，故其藥效甚微。至其接觸殺蟲作用，一般均優於官能殺蟲作用，蓋粉介殼蟲都棲息於鳳梨葉基部，將粒劑施於葉基間，易於和粉介殼蟲接觸而發揮藥效。結果如表1及2。

表 1.　粒狀殺蟲劑用於防除鳳梨粉介殼蟲之接觸殺蟲作用

Table 1. Effectiveness of granular insecticides as contact action against pineapple mealybug *Dysmicoccus brevipes*

殺蟲劑 Insecticide	處理方法 Method of treatment		用量（克/株） Dosage (g/plant)	處理後調查期間 Duration after treatment	供試蟲數 No. of mealybug tested	死亡率 Mortality %
Thimet 10% G	葉基 Basal leaves	灌水 Watering	0.5	一週 One week	49	100.00
		不灌水 Non-watering	0.5	一週 One week	79	75.76
		灌水 Watering	0.5	二週 Two weeks	66	100.00
		不灌水 Non-watering	0.5	二週 Two weeks	34	100.00
		不灌水 Non-watering	1.0	二週 Two weeks	78	100.00

Ortho-Bux 10% G	葉基 Basal leaves	灌水 Watering	0.5	一週 One week	27	100.00
		不灌水 Non-watering	0.5	一週 One week	221	61.34
		灌水 Watering	0.5	二週 Two weeks	40	95.56
		不灌水 Non-watering	0.5	二週 Two weeks	48	25.83
		不灌水 Non-watering	1.0	二週 Two weeks	86	27.33
Disyston 5% G	葉基 Basal leaves	灌水 Watering	1.0	一週 One week	54	100.00
		不灌水 Non-watering	1.0	一週 One week	43	85.00
		灌水 Watering	1.0	二週 Two weeks	27	100.00
		不灌水 Non-watering	1.0	二週 Two weeks	41	100.00
		不灌水 Non-watering	2.0	二週 Two weeks	27	90.00
Sevin 5% G	葉基 Basal leaves	灌水 Watering	1.0	一週 One week	136	33.63
		不灌水 Non-watering	1.0	一週 One week	36	72.42
		灌水 Watering	1.0	二週 Two weeks	47	60.33
		不灌水 Non-watering	1.0	二週 Two weeks	49	49.50
		不灌水 Non-watering	2.0	二週 Two weeks	128	3.97
Solvirex 5% G	葉基 Basal leaves	灌水 Watering	1.0	一週 One week	31	100.00
		不灌水 Non-wateri ng	1.0	一週 One week	12	80.00
		灌水 Watering	1.0	二週 Two weeks	32	100.00
		不灌水 Non-watering	1.0	二週 Two weeks	78	100.00
		不灌水 Non-watering	2.0	二週 Two weeks	49	95.00
Check					680	3.05*

* 五次對照平均 Average of five checks

表 2. 供試粒狀殺蟲劑防除鳳梨紛介殼蟲之官能殺蟲作用

Table 2. Effectiveness of granular insecticides as systemic action against pineapple mealybug *Dysmicoccus brevipes*

殺蟲劑 Insecticide	處理方法 Method of treatment		用量（克/株） Dosage (g./plant)	處理後調查期間 Duration after treatment	供試蟲數 No. of mealybug tested	死亡率 Mortality %
Thimet 10% G	株旁土壤 Soil around plant	灌水 Watering	0.5	一週 One week	345	27.95
		不灌水 Non-watering	0.5	一週 One week	354	17.30
		灌水 Watering	0.5	二週 Two weeks	103	25.77
		不灌水 Non-watering	0.5	二週 Two weeks	328	16.77
		不灌水 Non-watering	1.0	二週 Two weeks	144	20.14

Ortho-Bux 10% G	株旁土壤 Soil around plant	灌　水 Watering	0.5	一週 One week	569	14.91
		不灌水 Non-watering	0.5	一週 One week	254	16.02
		灌　水 Watering	0.5	二週 Two weeks	301	13.89
		不灌水 Non-watering	0.5	二週 Two weeks	265	15.47
		不灌水 Non-watering	1.0	二週 Two weeks	113	16.78
Disyston 5% G	株旁土壤 Soil around plant	灌　水 Watering	1.0	一週 One week	118	28.82
		不灌水 Non-watering	1.0	一週 One week	202	26.87
		灌　水 Watering	1.0	二週 Two weeks	189	20.17
		不灌水 Non-watering	1.0	二週 Two weeks	929	15.71
		不灌水 Non-watering	2.0	二週 Two weeks	327	17.30
Sevin 5% G	株旁土壤 Soil around plant	灌　水 Watering	1.0	一週 One week	458	9.00
		不灌水 Non-watering	1.0	一週 One week	136	16.52
		灌　水 Watering	1.0	二週 Two weeks	410	1.91
		不灌水 Non-watering	1.0	二週 Two weeks	168	22.24
		不灌水 Non-watering	2.0	二週 Two weeks	43	13.10
Solvirex 5% G	株旁土壤 Soil around plant	灌　水 Watering	1.0	一週 One week	145	10.88
		不灌水 Non-watering	1.0	一週 One week	94	21.25
		灌　水 Watering	1.0	二週 Two weeks	50	57.62
		不灌水 Non-watering	1.0	二週 Two weeks	44	31.98
		不灌水 Non-watering	2.0	二週 Two weeks	210	13.14
Check					118	6.74

田間試驗，乃依室內試驗結果，取其較優之處理方法，即藥劑之施用乃以接觸殺蟲作用而將粒劑施於葉基。至粉介殼蟲之爲害調查，分別於58年1，3及8月各調查一次。而鳳梨萎凋病則在58年12月，59年3及6月各調查一次。粉介殼蟲調查，第一、二次均在施藥後兩個月調查，第三次則在施藥後五個月調查。

第一次調查結果，各地區粉介殼蟲爲害率亦以有機磷之粒劑最低，而氨基甲酸鹽類之粉介殼蟲爲害率大致較高。第二次調查，除鳳山試驗區外，其餘兩區各處理之粉介殼蟲爲害率均降至零。由三試驗區三次調查平均，仍以有機磷粒劑效果較佳，與標準藥劑之巴拉松 47% EC2,000 倍之成效，均無顯著差異。而氨基甲酸鹽類粒劑，雖至第三次調查已無粉介殼蟲爲害，但因其藥效顯較緩慢，故其粉介殼蟲平均爲害率均較標準藥劑爲高。在三試驗區中，以頂新厝及鳳山兩區粉介殼蟲之爲害率較高，故處理間差異顯著，而大林之粉介殼蟲爲害率均甚低，各處理差異不顯著。詳如表3。

各地區之鳳梨萎凋病罹病率均甚低，此可能因果農年年對鳳梨粉介殼蟲施行防治，致粉介殼蟲之密度降低，因此萎凋病率亦低。在三試驗區中，對照區粉介殼蟲之爲害率以南投之頂新厝最高，次爲鳳山，再次爲嘉義之大林。但大林區萎凋病發生率却較高，其原因除粉介殼蟲外，排水之良否，往往亦和萎凋病有密切關係，因大林的鳳梨亦有種在平地者，其發育雖好，排水却較差，在雨期中，常因排水不良使根部發育受阻，致有萎凋現象，此並非因粉介殼蟲爲害而誘發萎凋者。故三地區各處理間

之萎凋率，經分析結果，其差異均不顯著。詳如表 4 。

表 3. 各地區用粒狀殺蟲劑防除鳳梨粉介殼蟲效果

Table 3. Effectiveness of the granular insecticides for control of mealybugs in several districts

	粉介殼蟲爲害百分率 * % of mealybug infestation			
	一月 January	三月 March	八月 August	平均 Average
	頂新厝 Ting-hsin-ts,o			
Disyston 5% G	7.50	0	0	2.50
Solvirex 5% G	2.50	0	0	0.83
Sevin 5% G	17.50	0	0	5.83
Thimet 10% G	2.50	0	0	0.83
Ortho-Bux 10% G	5.00	0	0	1.67
Parathion 47% EC	7.50	0	0	2.50
Check	40.00	20.00	7.50	22.50
				LSD 5% 3.16 1% 5.89
	大林 Ta-lin			
Disyston 5% G	0	0	0	0
Solvirex 5% G	0	0	2.50	0.83
Sevin 5% G	2.50	0	0	0.83
Thimet 10% G	0	0	2.50	0.83
Ortho-Bux 10% G	7.50	0	0	2.50
Parathion 47% EC	2.5	2.5	0	1.67
Check	10.00	0	2.50	4.17
				Non-significant
	鳳山 Feng-shan			
Disyston 5% G	5.00	0	0	1.67
Solvirex 5% G	0	0	0	0
Sevin 5% G	20.00	10.00	0	10.00
Thimet 10% G	0	0	0	0
Ortho-Bux 10% G	20.00	10.00	0	10.00
Parathion 47% EC	0	5.00	0	1.67
Check	25.00	20.00	0	15.00
				LSD 5% 3.57 1% 6.65

* 粉介殼蟲爲害率經化爲轉角函數進行分析
Percentages were translated into angles for calculation

表 4. 各地試驗區鳳梨萎凋病發生情形

Table 4. Occurrence of pineapple wilt in the districts of mealybug control

殺蟲劑 Insecticide	各地區鳳梨萎凋病發生率 % of pineapple wilt in various districts									平均 Average
	頂新厝 Ting-hsin-tso			大林 Ta-lin			鳳山 Feng-shan			
	1969 十二月 Dec.	1970 三月 March	六月 June	1969 十二月 Dec.	1970 三月 March	六月 June	1969 十二月 Dec.	1970 三月 March	六月 June	
Disyston 5% G	0	0	0	1.00	1.50	1.00	0.60	0.75	1.00	0.65
Solvirex 5% G	1.61	1.93	2.00	2.00	2.15	2.50	0.63	0.83	1.15	1.64
Sevin 5% G	0.41	0.54	0.93	2.50	2.75	2.75	0.94	0.94	1.20	1.44
Thimet 10% G	0.77	0.83	1.00	0.50	0.50	0.50	1.25	1.25	1.25	0.87
Ortho-Bux 10% G	0.42	0.74	0.74	0.75	0.75	1.00	1.25	1.25	1.50	0.93
Parathion 47% EC	0.77	0.83	0.90	0.75	0.90	1.00	0.63	0.83	1.00	0.85
Check	1.12	1.50	1.68	2.00	3.00	3.25	1.88	2.74	2.50	2.19

差異不顯著 Non-significant

粒狀殺蟲劑在冬、春乾旱期施用，藉在鳳梨葉基間所集積之微量雨露，慢慢溶解而發揮其殺蟲作用，故於其施用後兩個月調查時，有些處理，仍可見其顆粒尚未完全溶化，尤以 Disyston 之顆粒較粗爲然。賽文則溶解較快，其顆粒均溶化而成粉泥狀。因此顆粒較粗的粒狀殺蟲劑，可能有較長的藥效，故其施藥之間隔時間，尚可予以拉長至三或四個月，而可減少其施藥次數

粒劑之撒施，應以施於鳳梨基部之葉基爲原則，不可撒落於芯部嫩葉，以免發生藥害。尤以有機磷類數種粒劑，若不小心而施於芯部，其藥害較氨基甲酸鹽類者尤爲嚴重。惟若藥害不甚嚴重時，由於鳳梨之新葉繼續從心部長出，對鳳梨的發育並無大碍。

參考文獻

1. Carter, W. and W. A. Gortner. 1958. The translocation of radioactive (S35) Bayer 19639 in pineapple plants. Jour. Econ. Entomol. 51 (6) 905–7.
2. Schread, John G. 1958. Thimet soil treatments for the control of leaf miners. Jour. Econ. Entomol. 51 (2) :245–46.
3. Reynolds, H. T. and R. L. Melcalf. 1962. Effect of water solubility and soil moisture upon plant uptake of granulated systemic insecticides. Jour. Econ. Entomol. 55 (1):2–5.
4. 李錫山、簡和順、1966.鳳梨粉介殼蟲 (*Dysmicoccus brevipes* (CKLL.)) 防治試驗，植物保護學會會刊 8 (4) : 143～156.
5. 孫守恭、李錫山、1952.富粒多防治鳳梨粉介殼蟲試驗，農林月刊 7 (10) : 1～5.
6. 孫守恭、李錫山、鄭咸和、簡和順、1963.巴拉松 (Methyl parathion) 粉劑防治鳳梨粉介殼蟲試驗，植物保護學會會刊 5 (3) : 295～303.
7. 杜金池、游江海、1964. Di-syston 防治田間棉蟲第一報、植物保護學會會刊 6 (2) : 87～92.

IMPROVEMENT OF CONTROL METHODS AGAINST PINEAPPLE MEALYBUGS IN DRY AREAS

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Summary

Parathion 47% EC has been used for the control of pineapple mealybugs very satisfactorily by dipping the plant materials and following by three times filling with the same material in field with an intervals of three months. However, this successful measure was untenable for overall extension, because, during the dry seasons in Winter and Spring in central and south Taiwan, water inaccessible on those upland plantations where pineapples are grown mostly. Meanwhile, mealybugs multiply rapidly in the dry and temperate seasons and so it is the proper time to control the pest.

Although 3% parathion dust was used for controlling pineapple mealybugs in 1957, but the chemical was found very toxic to human beings, and up to now, there is no adequate instrument available for safe handling of the application.

The purpose of this paper is to report the results of tests with some granular insecticides, such as (1) Disyston; (2) Solvirex; G; 5% 0-0 diethyl-S-2-ethylthioethyl-phosphorodithioate. (3) Thimet, G, 10% 0,0-diethyl S-(ethylthio) methyl phosphorodithioate. (4) Ortho-Bux G; 10% m-(1-methyl butyl) phenyl methyl carbamate and m-(1-ethyl propyl) phenyl methyl carbamate. (5) Sevin, G; 5% 1-naphthyl N-methylcarbamate., for control of mealybugs on pineapples, so as to improve the current application methods.

The granular insecticides as mentioned above were evaluated in the laboratory for studying both effectiveness and mehods of application before they were put to the field experiment. Pineapples were planted in pots, and mealybugs were then inoculated to the pot pineapples. Granular insecticides were applied as soon as the mealybugs had established.

As showing in Table 1 and 2, the results of the organo-phosphorous granular insecticides are better than that of the carbamate compounds in both contact and systemic actions. The function of the granular insecticides is that the contact treatments, as in general, are better than the systemic treatments since the soil was so dry that influenced the uptake of the active ingredient by the pineapple roots. The effectiveness is excellent in both contact and systemic treatments if 200cc of water per plant was poured onto the position where the insecticides applied.

After laboratory evaluation, the field experiment was then carried out in Fengshan, Ta-lin and Ting-hsin-tso where are somewhat the district representative of the pineapple plantation. Insecticides were principally applied to the base of leaves where mealybugs mostly infested. Three applications were made in November 1968, January and March 1969 respectively, dosage was at the rate of 0.5g for 10% G while 1.0g for 5% G of the chemicals per plant.

Disyston, Solvirex and Thimet showed better effectiveness than that of Sevin and Ortho-Bux as examined the infestation of mealybug two months after the first application, but there was almost not different effectivess in controlling the mealybugs among the insecticides two months after the third application.

Different degree of Phytotoxicity was observed in the central leaves as the granulates occassionally dropped on, but there was no evidence of bad result of pineapple growing in the serious phytotoxicities as observed laterly. Some of the granulars, such as Disyston, still remained a certain amount in the base of the leaves as observed two months after application. For economic sake, the intervals of application could be extended to as long as three months.

From the results of trial, granular insecticides are promisingly to be used in controlling the mealybugs on the upland areas instead of parathion emulsion A suitable applicator must also be designed for the purpose of safe and precise of applying the granular insecticides.