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農業研究

第九卷　第一期

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東西橫貫公路沿綫蔬菜採種試驗（第一報）

李伯年　　謝靜吾

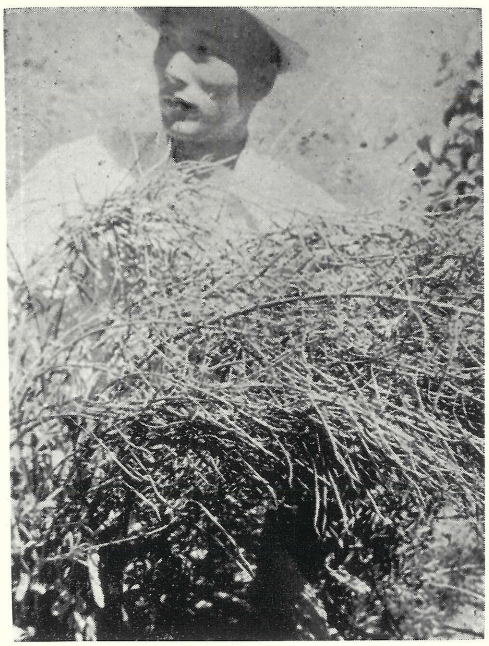
一、前　　言

東西橫貫公路，西部由臺中縣谷關入山，溯大甲溪流域而上穿越海拔2,800公尺之合歡埡口，順立霧溪流域而至東部花蓮縣太魯閣止，全長177公里；中途由梨山經海拔1,850公尺之鞍部，順濁水溪流域而至宜蘭縣獨立山支綫，全長82公里。當全綫公路興築之初，作者曾步行跋涉往沿綫各地考察過一次，一路山岳重叠，風景綺麗，雖可耕地不廣，但在海拔1,000公尺以上，2,000公尺以下沿綫之山麓及山腹地帶，終年氣候溫涼，爲溫涼性蔬菜採種之合適環境，經商得中國農村復興聯合委員會同意，將歷年補助計劃之剩餘經費，于1947年冬季，委託就地部落高山同胞，進行蔬菜種試驗工作，至1949年春季，前後費時三年，始獲得一套參考資料，茲經整理彙緝成冊，公諸社會，以供今後發展沿綫採種事業之參考。

爲獲得本資料之儘量完整，十餘種蔬菜在不同播種，開花，結實收穫期間，攝製其眞實照片，爭取時間性，不辭沿途艱險困難或豪雨爲害，振奮着萬分勇氣，步行跋涉上山數次，始能獲得本資料之適當齊全，附此數語，藉誌紀念。

二、臺中縣大甲溪流域沿綫

大甲溪流域，自谷關入口，萬山重叠，形勢險惡，沿綫自青山，小澤臺至達見，無一平坦之處；自達見經佳陽到梨山，漸見山勢開展；再由梨山經太保久，環山，有勝至鞍部，始見山勢開朗，肥沃之山腹及山麓地，觸目皆是，海拔約在1,700～1,850公尺之間，氣候與平地迥然有異，冬季嚴寒季節亦可見霜雪，故以耐寒性之蔬菜爲採種試驗對象，大部委託福壽山農場（海拔2,248公尺）試種，僅少數幾種委託環山（海拔1,750公尺）林清輝先生試種，在試驗期中，環山來往交通，困難重重，未能親自前往記載，僅憑林先生之通訊記錄，爲愼重計，此處略而不論，茲將福壽山農場之採種試驗結果，分述如下：

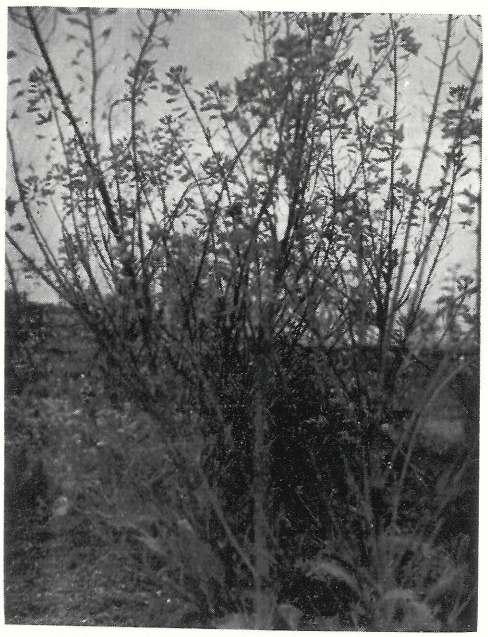


1. 三池中生甘藍結籽狀況
Cabbage—Miikechusei

1. 三池中生甘藍：三池中生甘藍用不切球採種法，在海拔2,000公尺左右之第四組試驗，8月20日播種翌年3月中旬開始抽苔，6月20日收穫種子，抽苔率100%，平均花苔高度129.05cm，分枝數15.12枚，每株有效莢數958.2莢，莢長7.86cm，每莢有效種子數12.52粒，千粒種子重量3.63g，每株種子收量43.18g，推算10公畝栽植2,000株，可收種子86.36kg。

2. 金澤晚生球莖甘藍：金澤晚生球莖甘藍用小球採種法，在海拔2,248公尺之第五組試驗，8月16日播種，因氣溫過低，球莖始終不能充分發育長大，翌年4月初旬開始抽苔，7月5日收穫種子，抽苔率100%，平均花苔高度114.13cm，分枝數14.20枚，每株有效莢數301.70莢，莢長6.88cm，每莢有效種子數11.60粒，千粒種子重量4.76g，每株種子收量16.65g，推算10公畝栽植2,400株，可收穫種子39.96kg。

3. 金門早生球莖甘藍：金門早生球莖甘藍由臺北農業試驗所培育完成之球莖，2月15日移往山上第五組進行採種試驗，4月中旬開始抽苔，7月10日收穫種子，抽苔率100%，平均花苔高81.34cm，分枝數14.4枚，每株有效莢數138.20莢，莢長5.37cm，每莢有效種子數11.83粒，千粒種子重量3.23g，每株種子收量5.28g，推算10公畝栽植2,400株，可收穫種子12.67kg。



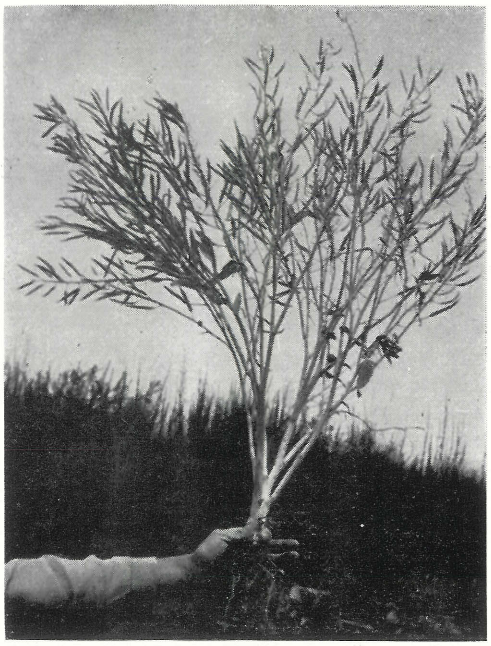
2. 金澤晚生球莖甘藍盛花情形
Kohlrabi—Kanazawa



3. 金門早生球莖甘藍盛花情形
Kohlrabi—Kinmen Early

4. 高脚白菜：高脚白菜用春播採種法，在海拔2,000公尺左右之第四組試驗，2月2日播種，4月初旬開始抽苔，7月初旬收穫種子，抽苔率100%，平均花苔高105.76cm，分枝數9.33枚，每株有效莢數727.00莢，莢長5.31cm，每莢有效種子數19.02粒，千粒種子重量2.90g，每株種子收量40.09g，推算10公畝栽植2,400株，可收穫種子96.21kg。

5. 青梗白菜：亦用春播採種法，同在第四組試驗，2月20日播種，4月初旬開始抽苔，7月初旬收穫種子，抽苔率100%，平均花苔高87.42cm，分枝數6.6枚，每株有效莢數205.9莢，莢長4.08cm，每莢有效種子數20.39粒，千粒種子重量2.36g，每株種子收量9.90g，推算10公畝栽植2,400株，可收穫種子39.60kg。



4. 高脚白菜結籽狀況
Pe-tsai—Kao-chio



5. 青梗白菜結籽狀況
Pe-tsai—Ching-keng

6. 京都三號包心白菜：京都三號用秋播採種法，在海拔2,100公尺第一組之山腰地試驗，9月15日播種，3月上旬開始抽苔，5月10日收穫種子，抽苔率100%，平均花苔高171.58cm，分枝數10.28枚，每株有效莢數1,157.33莢，莢長4.59cm，每莢有效種子數20.47粒，千粒種子重量2.66g，每株種子收量63.01g推算10公畝栽植1,800株，可收種子113.51kg。



6. 京都三號結籽狀況
Chinese Cabbage—Kyoto No. 3

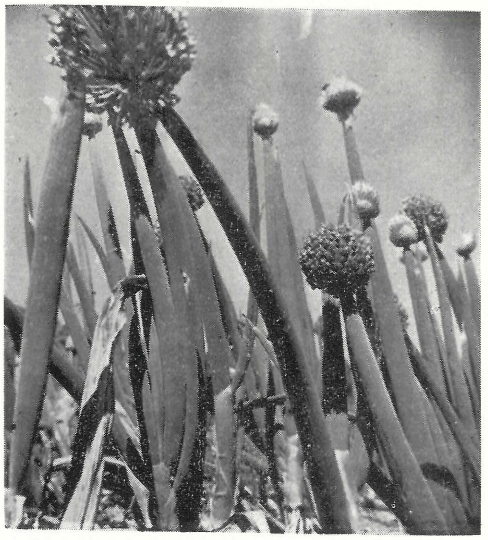


7. 烏塌菜結籽狀況
Wu-tu Tsai

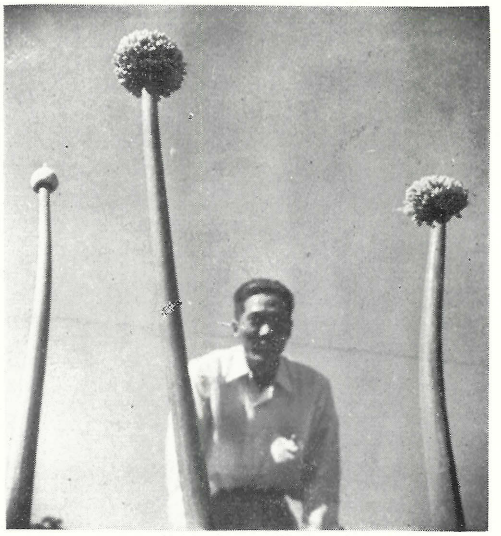
7. 烏塌菜：烏塌菜亦用秋播採種法，同在第一組之山腰地試驗，9月20日播種，3月上旬開始抽苔，5月10日收穫種子，抽苔率100%，平均花苔高94.44cm，分枝數11.10枚，每株有莢數1,002.20莢，莢長2.55cm，每莢有效種子數13.17粒，千粒種子重量2.70g，每株種子收量35.63kg，推算10公畝栽植4,000株，可收穫種子142.50kg。

8. 大葱：大葱在海拔2,000公尺左右第四組之土地試驗，7月20日播種，翌年3月中旬開始抽苔，6月10日收穫種子，抽苔率100%，平均花苔高70.70cm，分枝數2,3枝，每株平均小花數302.5朵，每株可收種子4.5g，千粒種子重量1.42g，推算10公畝可栽植3,000株，可收穫種子36.0kg。

9. 洋葱：洋葱所用品種爲 Early Grano，用大種子球9月10日種植，翌年4月中旬開始抽苔，7月15日收穫種子，試驗株數不多，抽苔率均達100%，平均花苔高94.00cm，分枝數3.2枚，每球平均小花數37.22朵，每株可收種子0.3g，千粒種子重量1.54g，開花情形甚佳，但結籽收量極少，爲美中不足之點。



8. 大葱盛花情形
Welsh Onion



9. 洋葱盛花情形
Onion—Early Grano

三、花蓮縣立霧溪流域沿綫

立霧溪流域，山勢陡峻，源短流急，沿綫自太魯閣入口，斷崖峭壁，觸目皆是，經天祥、西寶、洛韶、古白楊到碧祿關原止，極少坡度較緩之山麓及山腹地，在西寶附近設有西寶農場海拔1,020公尺，氣候溫涼，總面積亦僅5公頃左右，採種試驗委託該場進行，以金門早生球莖甘藍及四川榨菜爲試驗對象，二種蔬菜之抽苔開花，結籽情形，分述如下：

1. 金門早生球莖甘藍：9月16日播種，翌年2月下旬開始抽苔，4月28日收穫種子，抽苔率100%，平均花苔高105.90cm，分枝數24.8枚，每株有效莢數1,396.0莢，莢長6.17cm每莢有效種子數12.15粒，千粒種子重量2.50g，每株種子收量42.40g，推算10公畝栽植2,400株，可收穫種子101.76kg。

2. 四川榨菜：10月15日播種，翌年3月中旬開始抽苔，4月28日收穫種子，抽苔率100%，平均花苔高167.8cm，分枝數枚18.3枚，每株有效莢數4,276.0莢，莢長3.88cm，每莢有效種子數10.14粒，千粒種子重量1.68g，每株種子收量72.84g，推算10公畝栽植1,600株，可收穫種子116.54kg。



1. 金門早生球莖甘藍結籽狀況
Kohlrabi—Kinmen Early



2. 四川榨菜結籽狀況
Mustard—Szuchuan Cha-tsai

四、宜蘭縣濁水溪流域沿綫

濁水溪流域上流，自獨立山入口，地勢平坦，沿綫經留茂安、四季、俾仔南、米倉、馬當、溪流兩岸，空曠之處較多，可用之山腹地及高臺地，面積遼濶，冬春兩季雨量豐沛，空氣濕潤，故以耐濕之瑞典蕪菁（Yellow purple-top）及甜菜（Red hart beet）作測定性採種試驗，選擇海拔1,212公尺之俾仔南村及海拔900公尺之四季村二處同時進行；前者委託該村李木松先生負責，後者委託該村陳宜輝先生負責，在俾仔南村試驗地，設在公路旁側，初期及中期二種蔬菜生育極佳，因根部色澤鮮艷，路上行人視爲珍奇之物，不待抽苔，即陸續盜竊，無一留存，致乏成績爲憾事。在四季村試驗地，設在四季大橋（繼光橋）頂端之高臺地，二種蔬菜抽苔開花結籽情形，分述如下：



1. 瑞典蕪菁結籽情形
Rutabaga—Yellow Purple Top

1. 瑞典蕪菁：10月15日播種，翌年4月初旬開始抽苔，6月15日收穫種子，抽苔率100%，平均花苔高154cm，分枝數12.67枚，每株有效莢數1,472.75莢，莢長5.85cm，每莢有效種子數8.90粒，千粒種子重量2.08g，每株種子收量27.26g，推算10公畝栽植1,600株，可收穫種子43.61kg。

2. 甜菜：10月15日播種，翌年4月中旬開始抽苔，6月25日收穫種子，抽苔率僅68%，抽苔之植株結籽良好，平均花苔高111.14cm，分枝數7.45枚，

每株有效種子數 1,786.40粒，千粒種子重量12.30g，每株種子收量 21.97g，推算10公畝栽植 2,000株，60%抽苔結籽，可收穫種子 26.36kg。

五、展　　望

1. 臺灣年需：大量溫涼性蔬菜種子，必須仰外輸入，歷年農林機關爲謀種子自給，在平地曾進行各種試驗，但受高溫之限制，均乏良好結果。

2. 現在東西橫貫公路即將開通，沿綫 1,200～1,800公尺地段，不乏土地利用，終年氣候溫涼，排水灌溉亦便，實爲溫涼性蔬菜採種之合適環境。

3. 根據初步試驗結果，海拔超過 2,000公尺以上之地方，春夏溫度昇高極慢，初夏開花結籽時期，適值豪雨季節，影響種子品質及收量甚大，頗不理想。

4. 在海拔 2,000公尺以下1,600～1,800尺公之地段，春夏溫度昇高較快，一般溫涼性蔬菜，均可避免初夏豪雨季之影響，可安全收得種子。

5. 沿綫地區廣濶，雖可耕地面積不多，若能有計劃發展採種事業，則臺灣年需大量之中晚生甘藍，與中晚生白菜種子以及馬鈴薯種薯等，不難解決。



2. 甜菜抽苔開花情形
Beet—Red Hart

附表一　橫貫公路沿綫採種試驗品種記載項目參考資料

Table I. The experimental data of seed productions along the East-West Highway

試驗地點 Places	採種試驗品種 Varieties	調查株數 Plants observed	調查項目 Examination of items									
			花莖高度 Height of flowering stems (cm)	分枝數(枚) Number of branches	每株有效莢數(莢) Number of available pods per plant	莢長 Length of pods (cm)	每莢有效種子數(粒) Number of available seeds per pod	每株種子粒數(粒) Number of seeds per plant	千粒重量 Weight of 1000 seeds (g)	每株種子收量 Weight of seeds per plants (g)	10公畝栽植株數 Number of plants per 10 a.	折算10公畝收量 Yield of seeds per 10 a. (kg)
花蓮西寶 Hsi-Pao (Hwalien)	金門早生球莖甘藍 Kinmen Early Kohlrabi	10	105.90	24.80	1,396.00	6.17	12.15	16,961.40	2.50	42.40	24.00	101.76
	四川榨菜 Szuchuan Cha-tsai	10	167.80	18.30	4,276.00	3.88	10.14	43,358.64	1.68	72.84	16.00	116.54
宜蘭四季 Szu-chi (Yilan)	瑞典蕪菁 Rutabaga	10	154.00	12.67	1,472.75	5.85	8.90	13,107.47	2.08	27.26	1,600	43.61
	甜菜 Beet	10	111.14	7.49	—	—	—	1,786.40	12.30	21.97	60%抽苔 2,000	26.36
	三池中生甘藍 Miikechusei Cabbage	10	129.05	15.12	958.20	7.86	12.52	11,996.66	3.60	43.18	2,000	86.36

臺中福壽山 Fushoushan (Taichung)	金澤球莖甘藍 Kanazawa Kohlrabi	10	114.13	14.20	301.70	6.88	11.60	3,499.72	4.76	16.65	2,400	39.96
	金門早生球莖甘藍 Kinmen Early Kohlrabi	8	81.34	14.40	138.20	5.37	11.83	1,634.90	3.23	5.28	2,400	12.67
	高脚白菜 Kao-chio Pe-tsai	10	105.76	9.33	727.00	5.31	19.02	13,827.54	2.90	40.09	2,400	96.21
	青梗白菜 Ching-keng Pe-tsai	10	87.42	6.60	205.90	4.08	20.39	4,198.30	2.36	9.90	春插密植 4,000	39.60
	京都三號 Kyoto No. 3 Chinese Cabbage	5	171.58	10.28	1,157.33	4.59	20.47	23,690.54	2.66	63.01	秋插疎植 2,000	126.02
	烏塌菜 Wutu Tsai	10	94.44	11.10	1,002.20	2.55	23.17	13,198.97	2.70	35.63	秋插密植 4,000	142.52
	大蔥 (深根一本大蔥) Welsh Onion	10	70.70	2.30	—	—	—	—	1.42	4.50	8,000	36.00
	洋蔥(Early Grano) Orion	2	94.00	3.20	—	—	—	—	1.54	0.30	—	—
	胡蘿蔔 (Nantes) Carrot	5	69.20	10.00	花球 29.00	—	每花球 1,642.0	46,418.0	0.95	44.10	2,000	88.20
	胡蘿蔔(喜樹五寸) Carrot	5	45.35	5.00	花球 22.00	—	每花球 1,125.3	24,756.6	0.93	23.02	2,000	46.04
	美濃蘿蔔 Minou Radish	10	125.09	19.00	1,099.75	4.55	3.79	4,168.05	12.76	53.18	2,400	127.63

附表二　橫貫公路沿綫氣象及地理環境概要參考資料

Table 2. The meteorographic datas along the East-West Highway

地段 Areas	地名 Places	標高 Altitude (M)	年平均溫度 Annual mean temperature (°C)	年降雨總量 Annual rainfall (mm)	地理環境概述 Geographic conditions
宜蘭濁水溪流域 Yilan Choshui River Basin	留茂安 Liumaoan	590	19.8	2,045.0	地勢平坦空曠之處較多，可耕之山腹地及高臺地面積遼濶，多春兩季雨量豐沛，空氣濕潤，土壤鬆鬆，含腐植質較多，排水灌溉便利，爲耐濕性蔬菜採種之合適環境。
	四季 Szu-chi	900	17.5	2,175.5	
	俾仔南 Pitzunan	1,212	17.4	2,548.0	
花蓮立霧溪流域 Hwalien Liwu River Basin	梅園 Mei-yuan	787	—	1,275.0	山勢緊密，斷崖削壁，觸目皆是，可耕之山腹地及山麓地面積有限，多春兩季氣候乾燥，土壤大多含腐植質而豐富，排水灌溉稍加設備，可稍便利，如全綫發展，希望可能性不大。
	西寶 Hsi-pao	1,020	19.0	—	
	洛韶 Lo-shao	1,200	—	—	
	古白揚 Kupeyang	1,300	—	—	
	碧祿 Pi-lu	—	—	—	
臺中 Basin	佳陽 Chia-yang	1,540	16.50	2,908.9	山勢開展，可用之處爲肥沃之山腹及山麓地，面積較廣，氣候與平地迥異，多季嚴寒季節可見霜雪，氣候亦較乾燥，土壤大
	梨山 Lishan	1,697	16.20	4,277.5	

大甲溪 Tachia River 流域 Taichung	環山 Huanshan	1,750	16.50	3,090.1	多屬腐植質，排水易而灌溉則較難，發展耐寒性蔬菜採種，希望甚大。
	有勝 Yu-sheng	1,850	14.80	2,614.0	
	鞍部 An-pu	1,948	14.00	2,653.6	
	福壽山 Fushoushan	2,247	12.10	—	
	合歡山 Hohuanshan	3,070	5.70	2,495.0	

說明：(1) 上項資料來源摘錄農家便覽及橫貫公路沿線資源調查報告。
(2) 福壽山之記錄根據1958～59年度之記載。

REPORT ON EXPERIMENTS IN SELECTED VEGETABLE PLANTATIONS ALONG ROADSIDES OF THE EAST-WEST HIGHWAY (Part I)

by

PE-NIEN LEE and CHING-WU SHEN

SUMMARY

1. We are in need of large amount of cool season vegetable seeds, but it can only be imported from abroad. Various efforts of experiments had been made by several agricultural institutions and governmental organizations, none of them, however, has good result due to the limitation of high temperature in Taiwan.

2. There is certain land which can be cultivated along the roadsides of East-West Highway at the altitude from 1,200–1,800 meter. It is adaptable for the cool season vegetables, because the weather is cool and irrigation can be made.

3. Based on the preliminary experiments, we understand the temperature in summer rises very slowly at places 2,000 meter above sea level, it is the right time for flowering and fruiting, but it is also the season for heavy rain. The quality and quantity of harvest, therefore, are badly influenced.

4. At the altitude of 1,600–1,800, harvest of seeds can be expected because temperature rises faster and heavy rain comes later than the scheduled harvest time.

5. It is concluded here that despite there is not too much cultivatible land along the above said altitude, a well-planned vegetable development business is still very hopeful. The problem of the seed supply with great quantity annually of cabbage, pe-tsai, and potato can be solved.

FIELD EXPERIMENT ON FERTILIZER APPLICATION IN CITRUS ORCHARDS

(First Report)

by

T. F. CHIU, S. LIAN and C. S. HSU

Citrus industry in Taiwan has been developing gradually after the war, and the export of citrus fruits to Canada, Singapore, Korea and Philippine etc. in recent years has been increasing. This indicates the possibility for citrus to be a promissing crop. It is estimated that the annual production of citrus fruits in Taiwan at present is about 35,000 tons and the acreage of citrus orchard is about 5,800 ha.[1] which is expected to increase yearly.

Plentiful citrus harvest in an unit area hinges much on the technical management of the orchard, in which fertilizer practice plays an equally important role as pest and disease control and other cultivation techniques. We are frequently to find unreasonable fertilization at citrus orchards affecting its fruit yield and quality. However, the lack of experimental data on citrus fertilization caused by the difficulties involved in the experimentation of perennial crop make the farmers poorly provided with knowledge in using chemical fertilizers for its production, consequently the fertilizer allocation[2] for citrus conducted by the government seems not ideal.

To meet the demand mentioned above, this experiment has been undertaken since January, 1958, which will provide the optimum fertilizer ratio for soils with similar conditions to this experiment, and at the same time the effect of trace elements on citrus will also be clarified. Furthermore, by a long term experiment the effect of fertilizer upon fruit quality and storage will be acertained. Ponkan variety which is the most favourable one among citrus crops was selected as an object crop and field experiments were laid out at Shinpu and Yuanlin, representative of its production in Taiwan.

METHOD OF EXPERIMENT

1) **Experimental treatments:**

Fertilizer treatments are shown in Table 1, using ammonium sulphate, calcium superphosphate, potassium chloride as N, P, K sources respectively. As the treatments were designed to determine the deficiency of N, P, K in the soils as well as the effects of trace elements, the amount of fertilizers applied were actually more than sufficient. The amount of nitrogen was estimated on the basis of the fertilizer practice made by the local farmers as shown in Table 2.

Table 1. Experimental treatments

Name of plot	Treatment
a. PK	No N but P,K are applied
b. NK	No P but N,K are applied
c. NP	No K but N,P are applied
d. NPK	N, P, K are applied (check plot)
e. NPK & T. E.	N, P, K, Mg application and trace elements spraying

Note: 1. At Yuanlin experimental locality, 1.2kg of soybean cake per tree per year at all plots was applied in January in addition to the chemical fertilizers according to the local conventional practice.

2. In the treatment e, two kinds of trace elements, i. e. zinc and manganese were applied by foliage spray twice a year in May and September, using 0.5% solution of Zn SO_4 and $MnSO_4$. In addition, one pound of $MgSO_4$ per tree was applied in January every year.

Table 2. Amount of fertilizer applied

Locality	N	P_2O_5	K_2O
Shinpu orchard	300 kg/ha 600 g/tree	200 kg/ha 400 g/tree	250 kg/ha 500 g/tree
Yuanlin orchard	400 kg/ha 800 g/tree	250 kg/ha 500 g/trre	300 kg/ha 600 g/tree

Note: It was estimated on the basis of 500 trees per ha.

Fertilizers were applied in bands by hoeing ditchs up to a depth of 2 or 3 inches at both sides of tree trunk. Broadcasting is also an common practice in some orchards, but band placement were made all the time in this trial. The amount of fertilizers per tree were measured accurately by suitable vesseles.

2) **Experimental design and locality:**

Three localities for field trials were set out where the growth condition and tree age of citrus were uniform. One place is in Yuanlin town and two places in Hsinpu town as shown in Table 3.

Table 3. Localities of experiments

Chawmen, Hsinpu	(20 year old tree of citrus ponkan grove)
Taping, Hsinpu	(18 year old tree of citrus ponkan grove)
Yuanlin	(9 year old tree of citrus ponkan grove)

Randomized block was adopted with five replications in all experimental localities except in Taping where only four replications were permissible. Each plot consists of four experimental trees with one guard tree placed between two neighbouring plots.

It was reported by Pearce[3] that eight trees provide a more effective plot size for citrus experimentation owing to the fact that the more variation is involved in

the individual tree than in its position. However, as no adequate field is available to accommodate a large number of such plots, a compromise was made to give four trees for an unit plot.

3) **Time and proportion of ferilizer dessing:**

Most of the citrus growers applied chemical fertilizers twice per year in January and May and night soils several times according to their conventional practice. A proper fertilization is shown in Table 4 as recommended by Yakujitera[4] on which this experimental desighn was based.

Table 4. Time and proportion of fertilizer application

	N	P_2O_5	K_2O_5
January	50%	40%	30%
May	25%	40%	50%
August	25%	20%	20%

4) **Items invesigatted:**

A. Field records; Records were taken on fruit yields and their number

B. Leaf analysis;

Method of sampling: 20–30 matured leaves from every single tree which are at the position of 3rd and 4th leaves from the apex of twigs were taken, and the leaves from the same treatment in two blocks were combined to make a composite sample for chemical analysis. (I & II blocks, III & IV blocks, two replications) Times of leaf sampling were March, May, June, August and November.

Analytical method: Leaf sample was prepared according to Piper[5] and analysed on N, P, and K, i.e. Micro-Kjeldahl method for N, Molybdenum-blue method for P[6] and flame photometric method for K[7].

Soilt test: Soil samples were taken before fertilizer dressing and total N, available P and K, organic matter content, texture, and pH were determined.

RESULTS AND DISCUSSION

Soil Conditions

The soil conditions of Yuanlin experimental locality is quite different in comparison with that of Hsinpu. The former is slate alluvial soil with specific characters of paddy fields, such as high underground water level, (40–50cm in summer season and 70–80cm in winter season), fine texture, high fertility and neutral reaction, while the later is yellowish brown latosol which is developed on rolling hills and the parent materials are sandstone and shale. It is characterized by relatively dry condition, low fertility, coarse texture and acid in reaction. The description of the soils is shown as follows.

Table. 5. Chemical and physical properties of soils

Location	Depth	pH	N%	O.M.%	Ava. P kg/ha	Ava. K kg/ha	Texture	Clay%	Silt%	Sand%
Yuanlin	0-15cm	7.1	0.126	1.32	12	180	Si. L.	18	62	20
	15-40cm	7.2	0.083	0.96	12	160	C. L.	31	48	21
Chawmen, Hsinpu	0-15cm	5.3	0.092	0.51	7	70	S. L.	11	30	59
	15-40cm	5.3	0.052	0.31	5	70	S. L.	10	28	62
Taping, Hsinpu	0-15cm	5.5	0.075	0.57	7	70	S. L.	15	32	53
	13-40cm	5.2	0.048	0.49	7	50	S. L.	18	28	54

The soil analytical works were made by the routine methods at this laboratory, e. g. pH: glass electrode pH meter, Total N: Kjeldahl method, Organic matter content: Potassium dicromate titration, Available P & K: Peach and English's metod, Mechanical analysis: Hydrometer method etc.

Effects on Yields

The data of fruit yields in the first year trial at three localities are show in Table 6, 7 and 8. The plot which received complete fertilizer of three elements was taken as a check. According to the statistical analysis, the effects of treatments were found to be insignificant. However, the adverse effect induced from lacking either N or K could be perceived. In other words, the application of N and K in combination seemed to increase the fruit yields in all the experimental orchards. More time will be needed to detect if a significant trend is developing in those orchards. But judging from the result of the first year trial, nitrogen will be undoubtedly expected as the most essential element effecting fruit yield, and potash will come to the next. The effect of phosphate is still obscure.

Table 6. Fruit yields in Chawmen orchard kgs/plot (4 trees)

Treatment/Block	I	II	III	IV	V	Total	Index
a. PK	213.7	223.4	287.9	156.7	240.6	1,122.4	89
b. NK	296.7	278.3	326.0	217.6	271.3	1,389.9	111
c. NP	176.4	262.5	313.6	288.8	118.5	1,159.7	92
d. NPK	311.7	211.0	182.4	312.1	238.7	1,255.8	100
e. NPK with T. E.	300.0	190.7	282.7	262.5	240.8	1,276.7	102

L.S. D. among treatments, N. S.

Table 7. Fruit yields in Taping orchard kgs/plot (4 trees)

Treatment/Block	I	II	III	IV	Total	Index
a. PK	51.0	111.1	120.3	68.4	350.4	86
b. NK	135.6	73.9	128.9	119.2	457.6	112

c. NP	87.5	67.0	80.3	57.8	292.6	71
d. NPK	150.7	49.2	75.1	134.7	409.7	100
e. NPK with T. E.	160.7	140.2	55.1	85.1	441.1	108

L. S. D. among treatments, N. S.

Table 8. Fruit yields in Yuanlin orchard kgs/plot (4 trees)

Treatment/Block	I	II	III	IV	V	Total	Index
a. PK	141.5	220.2	174.4	13.7	28.4	578.2	66
b. NK	146.0	247.4	366.8	54.4	35.1	849.6	87
c. NP	218.1	283.1	37.9	56.6	55.8	671.5	77
d. NPK	257.3	276.9	244.2	41.2	53.2	872.7	100
e. NPK with T. E.	156.4	234.6	202.0	51.5	150.1	794.5	91

L. S. D. among treatments, N. S.

Table 9, 10 and 11 presented in below are the mean yields and number of fruits per tree and the mean weight of unit fruit. It also shows that nitrogen and potash are the evident factors effecting on yields and number of fruits. The effect of fertilizers upon the weight of unit fruit was not so apparent in those orchards except in Yuanlin where the weight of fruit was decreased considerably by the unfertilization of nitrogen. In general, the size of fruit was the largest in Yuanlin, the medium in Chawmen and the smallest in Taping. The water content of soil may be considered as a main factor for this difference, e. g. Yuanlin orchard producing the Largest fruit size had the highest water content due to its paddy field character, Chawmen orchard situated in a humid valley produced the medium size, and Taping orchard located in the most arid soil condition had the smallest size. It is expected that the experimental treatments may influence not only upon the yields but also the fruit size after a long term trial.

Table 9. Yields of fruits per tree (kgs)

Treatment/Location	Chawmen	Taping	Yuanlin	Mean	Index
a. PK	56.12	21.92	28.41	35.48	81
b. NK	69.49	28.58	42.48	46.85	106
c. NP	57.99	18.38	33.58	36.62	83
d. NPK	62.79	25.60	43.64	44.01	100
e. NPK with T. E.	63.83	27.57	39.73	43.71	99

Table 10. Number of fruits per tree

Treatment/Location	Chawmen	Taping	Yuanlin	Mean	Index
a. PK	308	138	141	196	85
b. NK	382	189	173	248	108

c. NP	308	103	142	184	80
d. NPK	335	170	184	229	100
e. NPK with T. E.	345	164	174	227	99

Table 11. Average weight per fruit (gs)

Treatment/Location	Chawmen	Taping	Yuanlin	Mean	Index
a. PK	182	159	201	180	94
b. NK	181	150	244	192	100
c. NP	188	177	235	200	104
d. NPK	187	150	237	191	100
e. NPK with T. E.	184	167	228	193	101

The use of chemical sources of nitrogen has increased postwar as compared with that of concentrated organic sources such as soybean cake, peanut cake, fish meal etc. which are used at present extensively as feed for livestock and their prices are accordingly much expensive. Nevertheless, the growers in yuanlin still use them more or less now owing to its high intensive cultivation. Due to this reason, 1.2 kg of soybean cake per tree per year in all plots were applied in Yuanlin experimental orchard, but none was applied in Hsinpu orchards where citrus trees are planted on hillsides in a comparatively extensive way. The amount of chemical nitrogen dressed in Yuanlin reached as much as 800 gs per tree excluding the organic nitrogen, whereas in Hsinpu it was merely 600 gs.

The problems of phosphate and potash fertilizations has been neglected by most of the citrus growers. However, the allocation of ammonium phosphate by the government in recent years that are welcomed by the growers are supply considerable amount of phosphate to orchards. The use of chemical potash fertilizer is still restricted to a few growers, consequently the supply of potash may mostly come from night soil and compost which are conventionally used.

The plot received trace elements, i. e. Zn, Mn, Mg in addition to N, P, K, had negligible effect in comparison with the check plot. The application of magnesium, calcium or trace elements in orchards are a common practice in foreign countries especially for Zn, Mn, and Mg (8). In some Taiwan orchards, the chrosis caused by nutrient deficiencies actually occur. Some symptoms had certain points of likeness to mottle leaves of zinc deficiency have been observed by the authors. Therefore the occurrence of trace element or secondary element deficiencies in Taiwan orchards seem to be possible. In spite of the fact, no these elements other than N, P, K are conventionally applied as fertilizers in local orchards. However, soil dressing that is made after harvesting biyearly or triyearly by some skilful growers acts an important role in citrus cultivation. The beneficial effect of soil dressing might have been partially due to the increase of some nutrients other than N, P, K. It may be attributed

to the soil dressing that traceelements are ineffective in those experimental orchards. The growers have conducted this practice in preceeding years in those orchards.

Effects on Nutrient Contents in Leaves

Extensive studies on the foliar diagnosis in estimating the fertility status of soils and nutritional requirements of crops have been made by many workers[9]. They have shown that the leaf analysis was a valuable aid for diagnosing deficiency or excess of the nutrient elements. These chemical studies have been directed more and more toward assigning a significance to the various levels of nutrient elements in plants as they relate to sick and healthy plants.

Some studies on pineapple[10,11], tea[12], rice[13] concering foliar diagmonsis were reported in Taiwan although leaf analysis was not yet used successfully in making more effective fertilizer recommendations. Leaf analysis of citrus[14] was also conducted in Taiwan but not for diagnosis purpose. In foreign countries the suceessful result of leaf analysis on citrus was obtained and its value was being recognized by growers not only as a means of identifying nutritional troubles in citrus, but as a means of knowing their nutritional status so that serious deficiencies can be prevented.

The present paper reports the results of preliminary studies on the citrus leaf diagnosis regarding the relation of the nutrients contents in leaves to the fertilizer treatments and times of sampling. All leaf analyses were made duplicate and all the percentage were reported in a moisture free basis. The data are shown in Table 12, in which the following observation were made.

According to the statistical analysis, the effect of treatment on the nitrogen content of citrus leaves was found to be significant; the leaves of the no nitrogen plot were generally low in total nitrogen content as compared with that of the complete fertilizer plot or other treatment plots. It was also found that the leaves of the no phosphorus plot were also somewhat low in P content at Taping locality, but other

Table 12a. Effects of fertilizer treatments and time of sampling on the nitrogen contents in citrus leaves (mean N %)

Locality	Time of sampling / Treatment	PK	NK	NP	NPK	NPK + T. E.	Average	L. S. D.
Chawmen	March	2.78	2.98	2.74	2.88	2.86	2.85	Among times of sampling** 5% 0.10 1% 0.13 Interaction: time × treatment,* 5% 0.693
	May	2.97	3.43	3.33	3.41	3.39	3.30	
	June	2.51	3.14	3.30	3.23	3.32	3.10	
	August	2.72	3.23	3.16	3.11	3.24	3.09	
	November	2.77	3.10	3.07	3.09	3.16	3.03	
	Average	2.75	3.17	3.12	3.14	3.19	3.07	
	L. S. D. Among fertilizer treatments ** 5% 0.10 1% 0.13							

Taping	March	2.68	2.75	2.35	2.44	2.46	2.53	Among times of sampling** 5% 0.12 1% 0.17 Interaction: time ×treatment, N.S.
	May	2.80	3.00	2.88	3.01	2.76	2.89	
	June	2.84	3.17	3.05	3.10	2.92	3.01	
	August	2.81	3.29	3.15	3.40	2.86	3.10	
	November	2.98	3.02	3.16	3.13	2.94	3.04	
	Average	2.82	3.04	2.91	3.01	2.78	2.91	
	L. S. D. Among fertilizer treatment ** 5% 0.12 1% 0.17							
Yuanlin	March	2.88	2.85	2.75	2.88	2.90	2.85	Among times of sampling** 5% 0.09 1% 0.12 Interaction: time ×treatment, N.S.
	May	3.23	3.18	3.21	3.28	3.25	3.23	
	June	3.09	3.26	3.17	3.24	3.19	3.19	
	August	2.98	3.07	3.06	2.95	3.09	3.03	
	November	3.20	3.22	3.03	3.19	3.01	3.12	
	Average	3.07	3.11	3.04	3.11	3.08	3.08	
	L. S. D. Among fertilizer treatment N. S.							

experimental localities showed evidently no offect of fertilizer treatment on the P content in leaves. The effect of fertilizer treatment on the K content in leaves has not caused significant. It is expected that the significant effect of each fertilizer treatment on leaf composition may be brought about after a somewhat longer term of experiment.

Table 12b. Effects of tertilizer treatments and time of sampling on the phosphorus contents in citrus leaves (mean P %)

Locality	Time of sampling/Treatment	PK	NK	NP	NPK	NPK + T. E.	Average	L. S. D.
Chawmen	March	0.155	0.155	0.153	0.150	0.162	0.155	Among times,** 5% 0.011 1% 0.015 Interaction: time ×treatment, N.S.
	May	0.202	0.196	0.189	0.177	0.183	0.189	
	June	0.183	0.180	0.159	0.163	0.168	0.170	
	August	0.156	0.146	0.142	0.148	0.157	0.150	
	November	0.152	0.154	0.160	0.151	0.165	0.156	
	Average	0.169	0.166	0.160	0.158	0.167	0.164	
	L. S. D. Among treatments, N. S.							
Taping	March	0.146	0.146	0.151	0.141	0.153	0.148	Among times,** 5% 0.008 1% 0.011 Interaction: time ×treatment, N.S.
	May	0.208	0.198	0.207	0.204	0.210	0.205	
	June	0.171	0.161	0.159	0.158	0.155	0.161	
	August	0.152	0.136	0.152	0.147	0.149	0.147	
	November	0.176	0.150	0.167	0.155	0.165	0.162	
	Average	0.170	0.158	0.167	0.161	0.166	0.164	
	L. S. D. Among treatment,* 5% 0.008							

Yuanlin	March	0.154	0.148	0.144	0.154	0.148	0.149	Among times,** 5% 0.0063 1% 0.0085 Interaction: time ×treatmnet, N.S.
	May	0.176	0.173	0.185	0.177	0.174	0.177	
	June	0.143	0.144	0.142	0.144	0.143	0.143	
	August	0.136	0.136	0.137	0.136	0.143	0.137	
	November	0.182	0.165	0.173	0.162	0.166	0.169	
	Average	0.158	0.153	0.156	0.154	0.154	0.155	
	L. S. D. Among treatments, N. S.							

Table 12c. Effects of fertilizer treatments and time of sampling on the potassium contents in citrus leaves (mean K %)

Locality	Time of asmpling / Treatment	PN	NK	NP	NPK	NPK T. E. +	Average	L. S. D.
Chawmen	March	0.86	0.93	0.96	0.91	0.95	0.93	Among times.** 5% 0.067 1% 0.091 Interaction: texture × treatment, N. S.
	May	1.19	1.24	1.19	1.16	1.08	1.17	
	June	1.21	1.16	1.22	1.47	1.39	1.29	
	August	1.11	1.02	0.99	1.06	0.94	1.03	
	November	0.94	0.85	0.80	0.87	0.84	0.90	
	Average	1.06	1.04	1.03	1.09	1.04	1.05	
	L. S. D. Among treatments, N. S.							
Taping	March	0.60	0.64	0.56	0.70	0.68	0.64	Among times,** 5% 0.113 1% 0.152 Interaction: time ×treatment, N.S.
	May	0.86	0.86	0.80	0.81	0.92	0.84	
	June	0.95	0.81	0.89	0.84	0.88	0.87	
	August	0.91	0.79	0.88	0.92	0.94	0.89	
	November	0.74	0.69	0.69	0.60	0.58	0.66	
	Average	0.80	0.76	0.76	0.78	0.80	0.78	
	L. S. D. Among treatments, N. S.							
Yuanlin	March	1.04	0.99	0.94	1.01	0.93	0.98	Among times,* 5% 0.138 Interaction: time ×treatment, N.S.
	May	1.15	1.02	1.29	1.16	1.04	1.14	
	June	1.29	1.34	1.18	1.10	1.10	1.20	
	August	1.10	1.07	1.10	1.01	0.95	1.04	
	November	1.28	1.16	1.14	1.00	1.04	1.12	
	Average	1.17	1.12	1.13	1.05	1.01	1.10	
	L. S. D. Among treatments, N. S.							

In this study, leaf sampling were taken five times in the following months, March, May, June, August and November. The Table 12 reveals that the effects of sampling time on the nutrient contents in leaves are apparent at all the experimental localities. In general, the N, P, K contents in leaves were high in May and June, then

decreased gradually and became minimum in March though there were some exceptions. The samples taken in March were old leaves and those taken in May were newly-matured, so that the trend mentioned above would be responsible to the age of citrus leaves.

SUMMARY

Field experiments on the fertilizer application in citrus orchards have been conducted in Sinpu and Yuanlin, the ponkan producing centers, since January, 1958. Five treatments i.e., a) PK, b) NK, c) NP, d) NPK, e) NPK+Mg, Mn, Zn, were replicated four or five times in a randomized block layout to determine the effect of three elements as well as the trace elements upon fruit yields and the nutrient contents of leaves. The amounts of fertilizers dressed were based on the conventional application of the local farmers, and ammonium sulphate, calcium phosphate and potassium chloride were used as N, P, K sources respectively.

Fruit yields and their number were recorded. Leaves were sampled five times in a year. The results obtained in the first year trial are as follows:

1. Nitrogen would be expected as the most essential element affecting fruityields and potash came to the next. The effect of phosphate was still unapparent. The average fruit yields per tree in the three localities and their indices were calculated as follows; a) PK 35.5kgs (81), b) NK 46.8kgs (106), c) NP 36.6kgs (83), d) NPK 44kgs (100), e) NPK+T. E. 43,7kgs (99).

2. The effects of fertilizers upon the weight of unit fruit was not so apparent in those orchards except in Yuanlin where the fruit size was somewhat decreased by the unfertilization of nitrogen. However, the fruit size was differed greatly among these localities, e. g. the mean weight per fruit in Chawmen and Taping were 184 gs and 160 gs respectively, while that in Yuanlin reached 229 gs. The difference might be rather du to the water content in soils than the tree age.

3. The trace element plot had negligible effect in comparison with that of the check plot. It is expected that the detection of significant effects of trace elements may need a long term experiment. Some symptoms of trace element deficiciencies occuring in other orchards seems to justify the necessity of trace elements apart from this experimental result.

4. The N, P, K contents in the leaf samples taken from all the experimental plots at different seasons were analyzed and it was found that the leaves in the no nitrogen plot were generally low in total nitrogen content.

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柑桔園施肥試驗（第一報）

邱再發　連　深　徐水泉

摘　　要

本試驗始於民國47年1月，目的在探討肥料三要素與微量元素對於柑桔收量之影響，以明瞭肥料三要素之施用比率及微量元素之缺否。同時亦經分析各肥料處理之柑葉樣本以供將來葉部診斷法研究之參考。

田間設計採用逢機區集法 4～5 重覆，每小區由 4棵柑桔樹所成。試驗地點共設三處，其中兩處屬新埔鎮其樹齡爲18年及20年，另一處則屬員林鎮其樹齡爲 9年，其品種皆爲椪柑。第一年所得結果簡列如次。

（1） 三要素中以氮肥對柑桔收量之影響最大。鉀肥則次之，磷肥尚無明顯效果。各處理區平均每棵樹之果實收量及其指數如次：

每棵樹果實平均產量 （公斤）

處理＼地點	照　門	大　坪	員　林	平　均	指　數
a) 無 氮 區 (PK)	56.12	21.92	28.41	35.48	81
b) 無 磷 區 (NK)	69.49	28.58	42.48	46.85	106
c) 無 鉀 區 (NP)	57.97	18.28	33.58	36.62	83
d) 對 照 區 (NPK)	62.79	25.60	43.64	44.01	100
e) 微量元數區 (NPK+T.E.)	63.83	27.57	39.73	43.71	99

（2） 各種肥料處理對於單位果實重量之影響甚小，惟各地之平均果實重量則相差甚多，如新埔地區每粒重量爲照門 184g 大坪 160g 而員林則高達 229g。除柑樹年齡之外此必與土壤水分含量之多寡有關。

（3） 微量元素缺乏症狀曾見於新埔各地，惟本試驗所設微量元素區却尚無任何增收之效果。

（4） 由柑葉分析結果知無氮區柑葉所含全氮量顯然因不施氮肥而降低，於磷鉀含量則尚無處理間之明顯差異。因柑葉之新舊有別，故季節對於三要素含量之影響較大。

水稻硝酸鏮鈣追肥施用試驗報告*

林家棻　吳啓東

硝酸鏮鈣係本省花蓮氮肥廠製品，年產量約70,000公噸，含氮量爲20%，其中硝鏮各半。但據最近張[1]林[2,3]諸氏前後在全省十處舉行4種無機氮肥對于水稻效應試驗結果均認硝氮遠不如鏮氮，其原因一般認爲稻田施用硝氮，除部份爲植物吸收同化外，易因滲濾或還原作用而消失。

據1932年石塚氏[6]利用水耕試驗結果認爲水稻生育初期中吸收之氮素以鏮態爲主，後期則以硝態爲主。1934年印度學者 Dastur 與 Kalyani 氏[7]曾行試驗並解釋爲由于稻根細肥原形質等電點 (Isoelectric point) 在生育初期趨向于酸性，後期則轉向于鹼性所致，三井氏[5]研究全生育過程中稻根氧化還原電位之變異時亦示在開花期以前稻根具有氧化性，在開花期則爲還原性。

關於水稻施用氮素追肥之重要，木村及千葉兩氏(1943)[5]曾以氮素對于稻谷與藁稈產量之部份效力 (partial efficiency) 表示之，所謂部份效力乃指水稻在某一生長期內氮之吸收量除以同時期內各藁之增產量而獲得之，由此可以推知水稻生長期內每單位氮素所能增加谷藁收量何時爲最高，渠發現在水稻全生育過程中有兩次最高值之部份效力，換言之，氮素追肥對于水稻乃屬必要。三井及尾崎兩氏[5]利用同位素N15爲示跡物亦發現在出穗前20天施用之氮肥，經二週後多聚積于劍葉 (Boot blade) 及藁稈中，藉利用吸收之氮素促進此類生理作用旺壯部份之活動，足證後期追肥之重要。此外前作者(1952)[4]在臺北坋砂質粘壤土上進行水稻鏮素追肥試驗結果示硫酸鏮之追肥施用期在第一期作以水稻插秧後60日爲宜，以30日施用較妥。又硝酸鏮作追肥施用較基肥爲優。

基于以上諸點，試在本省8處舉行硝酸鏮鈣追肥施用試驗，其目的在探討硝酸鏮鈣對于水稻之肥效，以及其作基肥與追肥施用時對于水稻效應之差異，經三年來試驗結果，予以整理，尙祈先進指正幸甚！

試驗方法

本試驗係于民國44年開始，46年結束，計連續三年，各試驗地之土壤性質如表1。其中鳳山一地僅試驗一年，後二年則移在桃園舉行。

表1. 各試驗地之土壤性質

Table 1. Description of Soils

地點 Location	土壤種類 Kinds of Soil	質地 Texture	pH	有機炭 Organic Carbon	全氮 Total Nitrogen	有效性養分 Avdilable Natrients			
						P	K	Ca	Mg
				%	%	ppm	ppm	ppm	ppm
臺北公館	砂岩頁岩冲積土	粘壤土	5.0	0.76	0.14	30.5	173.2	764.7	159.8
臺北新莊	〃	砂壤土	5.1	0.85	0.12	52.2	52.6	634.3	136.6
羅東	粘板岩冲積土	粘壤土	5.6	0.87	0.19	37.8	82.4	484.3	87.6
桃園	洪積層紅壤	〃	5.3	1.28	0.19	11.5	100.4	824.2	141.8
新竹	砂岩頁岩冲積土	壤土	6.0	1.27	0.16	43.3	41.8	1,546.4	239.7
臺中	〃	砂壤土	4.4	0.49	0.08	30.8	120.6	679.4	144.4
嘉義	老冲積土(看天田)	粘壤土	5.2	0.49	0.11	15.7	138.0	807.2	123.7
鳳山	紅壤	〃	5.7	0.59	0.10	7.3	17.4	773.2	188.2

*pH: 玻璃電極法　全氮：Kjedahls法　有機炭：重鉻酸鉀滴定法　磷、鉀：Bray's法　鈣、鎂：EDTA法

* 本試驗經費承中國農村聯合委員會補助，並蒙該會朱海帆技正賜予指導，試驗進行中承各當地農林改良場及農業試驗分所鼎力協助，作者等謹此誌謝！

試驗中共設12處理，其項目如表2。每處理小區之面積爲 1/1,000公頃，4重覆，採用隨機區組排列，三要素施用量 $N:P_2O_5:K_2O$ 各爲80kg/ha，除氮外，磷用過磷酸鈣、鉀用氯化鉀、且均作基肥施用，其他則參照當地習慣法行之，各地所採用之品種及插秧期如表3。

表2. 試驗之處理

Table 2. Description of treatment

期作 Crop	處理 Treat ment					
第一期作 1st crop	$S^{0}_{1/3}N^{20}_{1/3}N^{40}_{1/3}$	$S^{0}_{1/3}N^{20}_{1/3}N^{50}_{1/3}$	$S^{0}_{1/3}N^{20}_{1/3}N^{60}_{1/3}$	$ON^{20}_{1/2}N^{40}_{1/2}$	$ON^{20}_{1/2}N^{50}_{1/2}$	$ON^{20}_{1/2}N^{60}_{1/2}$
第二期作 2nd crop	$S^{0}_{1/3}N^{15}_{1/3}N^{30}_{1/3}$	$S^{0}_{1/3}N^{15}_{1/3}N^{40}_{1/3}$	$S^{0}_{1/3}N^{15}_{1/3}N^{50}_{1/3}$	$ON^{15}_{1/2}N^{30}_{1/2}$	$ON^{15}_{1/2}N^{40}_{1/2}$	$ON^{15}_{1/2}N^{50}_{1/2}$
第一期作 1st crop	$S^{0}_{1/2}N^{20}_{1/2}$	$S^{0}_{1/2}N^{40}_{1/2}$	$S^{0}_{1/2}N^{60}_{1/2}$	$S^{0}_{1/2}S^{20}_{1/2}$	$N^{0}_{1/2}N^{20}_{1/2}$	0 0
第二期作 2nd crop	$S^{0}_{1/2}N^{15}_{1/2}$	$S^{0}_{1/2}N^{30}_{1/2}$	$S^{0}_{1/2}N^{50}_{1/2}$	$S^{0}_{1/2}S^{15}_{1/2}$	$N^{0}_{1/2}N^{15}_{1/2}$	0 0

*S=硫酸銨 (Ammonium Sulphate) N=硝酸銨鈣(Nitrocholk) O=無肥 (No fertilizer)
字母右上方數字指施肥期(插秧後日數) 右下方指施用量(以每公頃80公斤N素作爲1)
Figure on the upper right corner of the alphabets indicates the time of application (Number of days after transplantation). Figure on the lower right corner of the alphabets indecates the fractional amount of fortilizer applied (providing 80 kg/ha N as 1).

表3. 水稻品種與插秧期

Table 3. Varietry of Rice and Date of Transplantion on Rice Seedlings

	第一期作			第二期作			第一期作			第二期作		
	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957
	臺北公館						臺北新莊					
水稻品種 Variety	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65
插秧期日/月 Date of Transplantation	9/3	21/3	27/3	5/8	3/8	7/8	15/3	20/3	2/4	13/8	5/8	10/8
	羅東						桃園					
水稻品種 Variety	臺中65	中農4號	中農蓬117	臺中65	中農蓬376	中農蓬117		臺中65	臺中65		臺中65	臺中65
插秧期日/月 Date of Transplantation	3/3	23/2	29/7	29/7	17/7	28/7		19/3	28/3		28/7	28/7
	新竹						臺中					
水稻品種 Variety	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65
插秧期日/月 Date of Transplantation	31/3	22/3	20/3	13/8	7/8	3/8	20/2	20/2	25/7	25/7	25/7	25/8
	嘉義						鳳山					
水稻品種 Variety	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65	臺中65					
插秧期日/月 Date of Transplantation	5/3	22/2	23/2	25/7	26/7	25/7	22/1			24/7		

試驗結果

三年來各地試驗成績經變量分析並測定其差異顯著性需要值如下：

一、第一期作各地谷藁收量

處理 Treatment	臺北公館 Taipei (1)								臺北新莊 Taipei (2)							
	1955		1956		1957		平均 Mean		1955†		1956		1957		平均 Mean	
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
$S^{0}_{1/3}N^{20}_{1/3}N^{40}_{1/3}$	3,514	3,488	3,018	3,238	3,120	3,475	3,217	3,400	2,533	2,548	2,985	2,500	2,644	3,050	2,721	2,699
$S^{0}_{1/3}N^{20}_{1/3}N^{50}_{1/3}$	3421	3,363	3,075	3,125	2,978	2,938	3,158	3,142	2,420	2,223	3,078	2,510	2,813	2,975	2,770	2,569
$S^{0}_{1/3}N^{20}_{1/3}N^{60}_{1/3}$	3,516	3,450	3,105	3,350	2,870	2,825	3,164	3,208	2,255	2,098	3,000	2,490	2,788	2,875	2,681	2,488
$ON^{20}_{1/2}N^{40}_{1/2}$	3,175	3,213	3,358	3.150	3,210	3,375	3,248	3,246	2,465	2,370	3,135	2,480	2,663	3,375	2,754	2,742
$ON^{20}_{1/2}N^{50}_{1/2}$	2,958	3,088	3,120	2,975	3,230	3,125	3,103	3,063	2,378	2,270	2,980	2,630	2,663	3,125	2,674	2,675
$ON^{20}_{1/2}N^{60}_{1/2}$	3,356	3,025	3,192	2,950	3,020	2,865	3,189	2,947	2,463	2,388	3,128	2,580	2,813	2,950	2,801	2,639
$S^{0}_{1/2}N^{20}_{1/2}$	3,619	4,238	3,273	3,575	3,050	3,100	3,314	3,638	2,633	2,218	3,118	2,510	2,925	3,000	2,892	2,576
$S^{0}_{1/2}N^{40}_{1/2}$	3,719	3,700	3,173	3,350	3,260	3,350	3,384	3,467	2,500	2,180	3,038	2,460	3,013	3,250	2,850	2,630
$S^{0}_{1/2}N^{60}_{1/2}$	3,818	3,525	2,890	3,188	2,855	2,713	3,188	3,142	2,450	2,273	2,988	2,600	2,850	3,000	2,763	2,624
$S^{0}_{1/2}S^{20}_{1/2}$	3,923	4,450	3,318	3,550	3,190	3,300	3,477	3,767	2,413	2,283	3,148	2,410	3,038	3,300	2,866	2,664
$N^{0}_{1/2}N^{20}_{1/2}$	3,099	3,100	2,803	2,988	2,810	2,825	2,904	2,971	2,308	2,230	2,863	2,500	2,481	2,975	2,551	2,568
O O	2,221	2,050	2,425	2,188	2,338	2,275	2,328	2,178	2,273	2,253	2,453	2,120	2,025	2,150	2,550	2,174
L. S. D. 0.05	258,5	424.1	343.0	326.0	249.0	376.0			N. S.	N. S.	207.0	160.0	196.0	251.0		
L. S. D. 0.01	348.2	571.2	462.0	439.0	336.0	506.0			N. S.	N. S.	278.0	210.0	264.0	338.0		

†本年度所選用在地，滲漏甚速，肥效極低

處理 Treatment	羅東 Lotung Grain								桃園 Tour-yuam					
	1955		1956		1957		平均 Mean		1956		1957		平均 Mean	
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
$S^{0}_{1/3}N^{20}_{1/3}N^{40}_{1/3}$	3,304	4,095	3,906	5,324	3,139	3,428	3,450	4,282	4,390	3,163	4,170	2,760	4,280	2,962
$S^{0}_{1/3}N^{20}_{1/3}N^{50}_{1/3}$	3,802	3,978	3,968	5,355	3,227	3,575	3,666	4,303	4,358	2,980	4,203	2,778	4,281	2,879
$S^{0}_{1/3}N^{20}_{1/3}N^{60}_{1/3}$	3,727	3,336	3,765	5,210	3,408	3,658	3,700	4,068	4,080	2,983	4,193	2,725	4,137	2,854
$ON^{20}_{1/2}N^{40}_{1/3}$	3,354	3,409	3,375	4,440	2,933	3,268	3,221	3,706	4,015	2,890	3,998	2,863	4,007	2,877
$ON^{20}_{1/2}N^{50}_{1/2}$	3,459	2,843	3,383	4,530	2,997	3,345	3,280	3,573	4,040	2,983	4,095	2,790	4,068	2,887
$ON^{20}_{1/2}N^{60}_{1/2}$	3,249	2,646	3,677	3,904	3,206	3,379	3,377	3,310	3,993	2,470	3,793	2,555	3,893	2,513
$S^{0}_{1/2}N^{20}_{1/2}$	3,360	3,589	3,965	5,364	3,316	3,554	3,547	4,169	4,070	3,200	4,025	2,600	4,048	2,900
$S^{0}_{1/2}N^{40}_{1/2}$	3,449	3,834	4,011	5,403	3,301	3,675	3,587	4,304	4,635	3,343	4,348	2,865	4,492	3,104
$S^{0}_{1/2}N^{60}_{1/2}$	3,701	3,213	4,163	5,445	3,472	3,604	3,779	4,087	4,313	2,880	4,235	2,840	4,274	2,860
$S^{0}_{1/2}S^{20}_{1/2}$	3,580	4,158	3,964	5.734	3,513	4,225	3,686	4,706	4,143	3,473	4,483	3,145	4,313	3,309
$N^{0}_{1/2}N^{20}_{1/2}$	3,276	2,913	3,551	4,455	2,891	2,945	3,239	3,438	3,548	2,693	3,965	2,765	3,757	2,729
O O	2,486	1,904	2,806	2,708	2,394	1,965	2,562	2,192	2,825	1,940	3,163	2,130	2,994	2,035
L. S. D. 0.05	239.5	608.7	353.0	627.0	169.0	327.0			372.0	234.0	325.0	443.0		
L. S. D. 0.01	322.6	819.8	476.0	844.0	228.0	440.0			501.0	315.0	437.0	597.0		

處理 Treatment	新竹 Hsinchu								臺中 Taichung							
	1955†		1956		1957†		平均 Mean		1955		1956		1957‡		平均 Mean	
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ka	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	hg/ha	kg/ha
$S^{0}_{1/3}N^{20}_{1/3}N^{40}_{1/3}$	3,493	5,083	3,848	2,500	4,953	6,625	4,098	4,736	5,303	4,800	4,036	5,450	4,390		4,576	5,125
$S^{0}_{1/3}N^{20}_{1/3}N^{50}_{1/3}$	3,213	4,917	3,709	2,425	4,960	5,125	3,961	4,156	5,750	5,200	4,213	5,450	4,255		4,739	5,325
$S^{0}_{1/3}N^{20}_{1/3}N^{60}_{1/3}$	3,480	4,917	3,584	2,588	4,820	4,563	3,961	4,023	5,595	4,725	4,368	4,975	4,129		4,697	4,850
$ON^{20}_{1/2}N^{40}_{1/2}$	3,298	5,167	3,624	2,650	4,755	5,375	3,892	4,397	5,248	4,450	3,754	4,975	3,880		4,294	4,713
$ON^{20}_{1/2}N^{50}_{1/2}$	2,785	4,417	3,626	2,488	4,800	4,750	3,737	3,885	5,190	4,650	4,026	4,825	4,103		4,440	4,738
$ON^{20}_{1/2}N^{60}_{1/2}$	3,185	4,938	3,429	2,200	4,760	4,688	4,791	3,942	5,270	4,450	3,865	4,900	4,454		4,530	4,675
$S^{0}_{1/2}N^{20}_{1/2}$	3,368	5,063	3,510	2,550	4,893	5,250	3,924	4,288	5,545	4,950	3,985	6,125	4,153		4,561	5,538
$S^{0}_{1/2}N^{40}_{1/2}$	3,620	4,667	3,689	2,313	4,785	4,875	4,031	3,952	5,440	4,925	4,496	5,400	4,120		4,685	5,163
$S^{0}_{1/2}N^{60}_{1/2}$	3,585	4,938	3,418	2,550	4,755	5,125	3,919	4,204	5,808	4,750	4,596	5,325	4,153		4,852	5,038
$S^{0}_{1/2}S^{20}_{1/2}$	3,588	4,500	3,909	2,600	4,773	5,833	4,090	4,311	5,705	5,275	4,224	5,275	4,080		4,670	5,275
$N^{0}_{1/2}N^{20}_{1/2}$	2,785	4,625	3,156	2,450	4,478	5,750	3,486	4,275	5,270	4,575	3,530	4,475	3,880		4,227	4,525
O O	2,018	3,667	2,571	1,700	3,965	3,250	2,851	2,872	4,515	3,800	3,014	3,525	3,390		3,640	3,663
L. S. D. 0.05	313.0	N. S.	321.0	378.0	225.0	N. S.			389.8	496.8	291.0	758.0	255.0			
L. S. D. 0.01	421.6		432.0	509.0	303.0				524.9	669.1	392.0	1,020.0	344.0			

† 因曬乾時，部份小區藁稈遺失未行統計分析，‡ 因漏稱

處理 Treatment	嘉義 Charyi								鳳山 Fengshan					
	1955†		1956‡		1957		平均 Mean		1955					
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw				
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha				
$S^{0}_{1/3}N^{20}_{1/3}N^{40}_{1/3}$	2,255	4,150	6,200	5,900	4,800	6,000	4,418	5,350	5,000	4,700				
$S^{0}_{1/3}N^{20}_{1/3}N^{50}_{1/3}$	2,220	3,450	6,300	5,200	4,750	5,100	4,423	4,583	5,523	4,800				
$S^{0}_{1/3}N^{20}_{1/3}N^{60}_{1/3}$	2,065	3,850	5,900	4,900	4,750	5,000	4,238	4,583	8,500	4,600				
$ON^{20}_{1/2}N^{40}_{1/2}$	2,303	3,450	5,500	5,300	4,700	5,000	4,168	4,583	4,775	4,425				
$ON^{20}_{1/2}N^{50}_{1/2}$	2,258	3,050	5,500	4,800	4,700	4,800	4,153	4,217	5,300	4,800				
$ON^{20}_{1/2}N^{60}_{1/2}$	2,160	3,700	6,300	4,500	4,300	4,700	4,253	4,300	5,650	4,800				
$S^{0}_{1/2}N^{20}_{1/2}$	2,163	3,080	6,100	5,700	4,600	5,700	4,288	5,067	5,125	4,775				
$S^{0}_{1/2}N^{40}_{1/2}$	2,513	3,850	6,100	6,200	5,350	5,900	4,654	5,317	5,450	5,175				
$S^{0}_{1/2}N^{60}_{1/2}$	2,148	4,050	6,100	5,600	5,200	5,600	4,483	5,083	5,450	4,600				
$S^{0}_{1/2}S^{20}_{1/2}$	2,488	3,950	6,800	6,100	5,300	7,100	4,863	5,717	5,100	4,550				
$N^{0}_{1/2}N^{20}_{1/2}$	1,968	3,200	5,100	4,800	4,300	4,500	3,789	4,176	4,500	4,200				
O O	1,333	2,400	4,500	3,800	3,850	3,500	3,228	3,233	4,050	3,450				
L. S. D. 0.05	N. S.	N. S.	764.0	790.0	394.0	619.0			600.0	668.0				
L. S. D. 0.01			1,029.0	1,064.0	531.0	833.0			808.2	900.6				

† 因受螟害，‡ 本年豐收，產量特高

二、第二期作各地谷收藁量表

處理 Treatment	臺北公館 Taipei (1)								臺北新莊 Taipei (2)							
	1955		1956		1957		平均 Mean		1955		1956		1957		平均 Mean	
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
$S^{0}_{1/3}N^{15}_{1/3}N^{30}_{1/3}$	3,104	4,475	2,425	3,778	2,744	3,078	2,758	3,777	2,825	3,525	2,287	2,650	2,475	2.588	2,529	2,921
$S^{0}_{1/3}N^{15}_{1/3}N^{40}_{1/3}$	3.306	4,525	2,863	4,075	3,035	3,133	3,068	3,911	2,750	3'255	2,390	2,645	2,500	2,731	2,547	2,877
$S^{0}_{1/3}N^{15}_{1/3}N^{50}_{1/3}$	3,221	4,475	2,738	3,925	3,144	3,245	3,034	3,882	2,800	2,985	2,327	2,330	2,563	2,502	2,563	2,606
$ON^{15}_{1/2}N^{30}_{1/2}$	3,038	4,350	2,988	4,150	2,739	2,760	2,922	3,753	2,673	3,443	2,250	2,386	2,175	2,676	2,366	2,835
$ON^{15}_{1/2}N^{40}_{1/2}$	3,350	4,400	3.088	4,000	2,774	2,928	3,071	3,776	2,670	3,525	2,150	2,373	2,225	2,643	2,348	2,847
$ON^{15}_{1/2}N^{50}_{1/2}$	3,376	3,975	2,638	3,750	2,894	2,890	2,969	3,538	2,748	3,325	2,160	2,134	2,338	2,343	2,415	2,601
$S^{0}_{1/2}N^{15}_{1/2}$	3,336	4,475	2,438	4,025	2,930	3,375	2,901	3,958	2,685	3,005	2,250	2,499	2,500	2,834	2,478	2,799
$S^{0}_{1/2}N^{30}_{1/2}$	3,168	4,425	2,788	4,250	2,982	3,283	2,979	3,986	2,813	3,393	2,290	2,547	2,450	2,616	2,518	2,852
$S^{0}_{1/2}N^{50}_{1/2}$	3,121	3,950	2,488	3,875	2,981	3,135	2,863	3,653	2,785	3,233	2,330	2,218	2,425	2,345	2,513	2,599
$S^{0}_{1/2}S^{15}_{1/2}$	3,408	4,525	2,850	4,250	3,075	3,733	3,111	4,069	2,730	3,500	2,250	2,679	2,700	2,983	2,560	3,054
$N^{0}_{1/2}N^{15}_{1/2}$	3,033	4,500	2,575	4,350	2,901	3,143	2,836	3,998	2,710	3,168	2,300	2,285	2,275	2,541	2,428	2,665
O O	2,284	3,300	2,175	3,450	2,463	2,590	2,307	3,113	2,333	2,795	2,140	2,072	1,875	1,835	2,116	2,234
L. S. D. 0.05	314.1	435.0	N. S.	486.0	249.0	304.0			N. S.	N. S.	N. S.	N. S.	131	229		
L. S. D. 0.01	422.9	585.8	N. S.	654.0	336.0	410.0							176	308		

處理 Treatment	羅東 Lotung								桃園 Tour-yuam					
	1955		1956		1957		平均 Mean		1956†		1957		平均 Mean	
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
$S^{0}_{1/3}N^{15}_{1/3}N^{30}_{1/3}$	2,580	3,543	2,579	3,324	3,112	3,591	2,757	3,486	4,128		3,930	4,125	4,029	4,125
$S^{0}_{1/3}N^{15}_{1/3}N^{40}_{1/3}$	3,001	3,869	2,624	3,184	3,074	3,482	2,900	3,512	4,120		3,945	3,550	4,033	3,550
$S^{0}_{1/3}N^{15}_{1/3}N^{50}_{1/3}$	2,896	3,905	2,445	2,931	3,081	3,776	2,807	3,537	4,110		4,093	3,650	4,102	3,650
$ON^{15}_{1/3}N^{30}_{1/3}$	2,351	3,432	2,799	3,173	3,078	3,857	2,743	3,487	4,114		4,178	3,500	4,146	3,500
$ON^{15}_{1/3}N^{40}_{1/3}$	2,543	3,456	2,682	2,983	3,132	3,364	2,786	3,268	4,058		4,040	3,575	4,049	3,575
$ON^{15}_{1/3}N^{50}_{1/3}$	2,500	3,204	2,656	3,021	2,986	3,041	2,714	3,086	4,092		4,430	3,425	4,061	3,425
$S^{0}_{1/2}N^{15}_{1/2}$	2,713	3,803	2,369	3,029	3,175	3,545	2,752	3,459	3,900		3,893	3,750	3,897	3,750
$S^{0}_{1/2}N^{30}_{1/2}$	2,671	3,886	2,865	3,531	3,024	3,711	2,853	3,709	4,157		4,133	4,025	4,145	4,025
$S^{0}_{1/2}N^{50}_{1/2}$	2,862	3,602	2,828	3,149	3,247	3,235	2,979	3,329	4,300		4,083	3,525	4,192	3,525
$S^{0}_{1/2}S^{15}_{1/2}$	3,084	4,029	2,369	3,043	3,113	3,891	2,855	3,654	3,878		4,135	4,400	4,007	4,400
$N^{0}_{1/2}N^{15}_{1/2}$	2,484	3,358	2,213	3,258	2,929	3,647	2,542	3,421	3,978		3,990	3,825	3,984	3,825
O O	2,143	2,706	2,064	2,496	2,405	2,870	2,204	2,691	3,954		3,573	3,325	3,764	3,325
L. S. D. 0.05	367.3	362.9	288.0	310.0	194.0	547.0			N. S.		272.0	611.0		
L. S. D. 0.01	494.7	488.7	388.0	418.0	261.0	737.0					366.0	822.0		

†因漏稱

處理 Treatment	新竹 Hsinch								臺中 Taichung							
	1955		1956		1957		平均 Mean		1955		1956		1957		平均 Mean	
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
$S^{0}_{1/3}N^{15}_{1/3}N^{30}_{1/3}$	2,893	4,210	3,933	4,625	3,553	3,500	3,460	4,112	4,050	7,700	3,902	4,375	3,418	7,725	3,790	6,600
$S^{0}_{1/3}N^{15}_{1/3}N^{40}_{1/3}$	2,498	4,175	3,704	4,248	3,515	3,083	3,239	3,835	4,163	7,700	4,345	4,525	3,373	7,475	3,960	6,567
$S^{0}_{1/3}N^{15}_{1/3}N^{50}_{1/3}$	2,455	3,950	3,738	4,260	3,490	3,438	3,228	3,883	3,743	7,200	4,019	4,438	3,395	7,925	3,719	6,521
$ON^{15}_{1/2}N^{30}_{1/2}$	2,229	3,913	3,635	4,313	3,665	3,313	3,176	3,846	3,961	7,500	4,370	4,780	3,360	7,775	3,897	6,685
$ON^{15}_{1/2}N^{40}_{1/2}$	2,588	3,663	3,370	4,040	3,573	3,375	3,177	3,693	3,858	7,600	4,021	4,225	3,410	7,450	3,763	6,425
$ON^{15}_{1/2}N^{50}_{1/2}$	2,268	3,598	3,945	4,677	3,450	3,333	3,221	3,869	3,764	7,200	4,017	4,313	3,313	7,400	3,698	6,304
$S^{0}_{1/2}N^{15}_{1/2}$	2,568	3,978	3,595	4,348	3,446	3,375	3,203	3,900	3,857	7,300	4,014	4,413	3,365	7,875	3,745	6,529
$S^{0}_{1/2}N^{30}_{1/2}$	2,461	4,203	3,808	4,418	3,611	2,917	3,293	3,846	4,176	7,500	4,301	5,083	3,478	7,975	3,985	6,853
$S^{0}_{1/2}N^{50}_{1/2}$	2,454	3,173	3,753	4,400	3,304	3,625	3.170	3,733	3,765	6,900	4,305	4,518	3,365	8,100	3,812	6,506
$S^{0}_{1/2}S^{15}_{1/2}$	2,413	3,903	3,615	4,180	3,484	3,666	3,171	3,916	4,004	7,300	4,401	5,078	3,340	7,825	3,915	6,734
$N^{0}_{1/2}N^{15}_{1/2}$	2,371	3,935	3,518	4,215	3,285	3,375	3,057	3,842	3,629	6,800	4,090	4,773	3,318	7,650	3,679	6,408
O O	2,243	2,875	3,435	4,290	2,965	2,938	2,881	3,368	3,030	5,300	3,780	4,115	3,063	7,375	3,291	5,597
0.05 L. S. D.	N. S.	509.9	243.0	N. S.	245.0	N. S.			314.9	710.0	214.0	494.0	280.0	572.0		
0.01		686.7	327.0		330.0				424·1	950.0	288.0	666.0	377.0	770.0		

處理 Treatment	嘉義 Charyi								鳳山 Fengshan					
	1955†		1956		1957		平均 Mean		1655‡					
	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw	谷 Grain	藁 Straw				
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha				
$S_{1/3}^{0}N_{1/3}^{15}N_{1/3}^{30}$	2,820	5,410	3,250	4,350	3,050	4,450	3,040	4,737	3,270	6,450				
$S_{1/3}^{0}N_{1/3}^{15}N_{1/3}^{40}$	2,840	5,230	3,200	4,175	3,000	4,450	3,013	4,618	3,870	7,750				
$S_{1/3}^{0}N_{1/3}^{15}N_{1/3}^{50}$	2,190	5,310	3,000	4,000	2,650	3,900	2,613	4,403	3,350	6,250				
$ON_{1/2}^{15}N_{1/2}^{30}$	2,350	5,100	3,200	4,225	2,400	3,500	2,650	4,275	3,010	6,020				
$ON_{1/2}^{15}N_{1/2}^{40}$	2,610	5,090	2,900	3,925	2,900	4,150	2,803	4,388	3,320	7,900				
$ON_{1/2}^{15}N_{1/2}^{50}$	2,470	5,130	2,900	3,750	2,450	3,450	2,607	4,110	3,680	7,070				
$S_{1/2}^{0}N_{1/2}^{15}$	2,600	5,440	3,300	4,475	3,100	4,450	3,000	4,788	3,010	6,450				
$S_{1/2}^{0}N_{1/2}^{30}$	2,640	5,150	3,400	4,650	3,300	4,650	3,113	4,817	3,400	6,950				
$S_{1/2}^{0}N_{1/2}^{50}$	2,670	5,030	3,000	4,000	2,850	4,150	2,840	4,393	3,570	6,870				
$S_{1/2}^{0}S_{1/2}^{15}$	2,560	5,280	3,600	5,050	3,250	4,800	3,137	5,043	3,600	7,450				
$N_{1/2}^{0}N_{1/2}^{15}$	2,760	5,140	3,100	3,875	2,600	4,050	2,820	4,355	3,010	5,850				
O O	2,090	4,260	2,400	3,125	1,950	3,200	2,147	3,528	3,010	5,000				
L. S. D. 0.05	N. S.	N. S.	177.0	396.0	329.0	347.0			290.2	1,244.0				
L. S. D. 0.01			239.0	534.0	443.0	468.0			390.8	1,676.0				

†因螟害，‡該地區係採用在來種，在後論述中雖予列出但平均數則未包括在內

討論與結論

一、硝酸鏮鈣與硫酸鏮對于水稻肥效之比較：

在未探討硝酸鏮鈣追肥效果之前，關於硝酸鏮鈣比照硫酸鏮同樣施用法對于水稻效應之影響，有先加以檢討之必要。表4示各地第一期作水稻予以硝酸鏮鈣處理者，其谷實收量顯低於硫酸鏮區，僅第一年臺北之新莊嘉義及第三年之臺中三地爲例外，其中新莊因土質疏鬆，肥分滲失甚速，肥效均低第2,3年起則更換土地試驗嘉義則係螟害所致，此外藁稈收量亦以硫酸鏮區領先，其中新竹區之藁稈收量除1956年經變量分析差異不顯著外，其他兩年則因缺區所致。第二期作因施用硝酸鏮鈣而谷實減收者，不若第一期作之普遍，但在21次試驗中亦佔8次，藁稈則佔5次。

表4. 硝酸鏮鈣與硫酸鏮對于谷藁產量差異顯著性之比較

Table 4. Significant difference between the response of rice to nitrochalk and to Ammunium sulphate

期作 Crop	處理比較 Comparison beforeen	差異顯著性 difference	臺北公館 Taipei			臺北新莊 Taipei			羅東 Lo tung			桃園 Tour yuan			新竹 Hsin chu			臺中 Tai chung			嘉義 Charyi			鳳山 Feng shan		
			1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957
第一期作 1st crop	$N_{\frac{1}{2}}^{0}N_{\frac{1}{2}}^{20}$與$S_{\frac{1}{2}}^{0}S_{\frac{1}{2}}^{20}$	谷 Grain	‡	‡	‡		‡	‡	†	†	‡		‡	‡	‡	‡	†	†	‡			‡	‡	†		
		藁 Straw	‡	‡	†			†	‡	‡	‡		‡					‡	†			‡	‡			
第二期作 2nd Crop	$N_{\frac{1}{2}}^{0}N_{\frac{1}{2}}^{15}$與$S_{\frac{1}{2}}^{0}S_{\frac{1}{2}}^{15}$	谷 Grain	†					‡	‡									†	‡			‡	‡	‡		
		藁 Straw						‡	‡													‡	‡	†		

† = $N_{\frac{1}{2}}^{0}N_{\frac{1}{2}}^{20} < S_{\frac{1}{2}}^{0}S_{\frac{1}{2}}^{20}$ 差異顯著達5%平準 Significant at 5%

‡ = $N_{\frac{1}{2}}^{0}N_{\frac{1}{2}}^{20} < S_{\frac{1}{2}}^{0}S_{\frac{1}{2}}^{20}$ 差異顯著達1%平準 Significant at 1%

爲明瞭減收情形，乃以三年來各地硫酸鏮區之谷藁收量各作爲100，計算硝酸鏮鈣區之收量指數如表5，其中谷實收量指數在第一期作以嘉義區最低爲77.9，臺中區最高爲90.5，平均爲86.2，第二期作則以羅東區最低爲89.0，桃園區最高爲99.4，平均爲93.5，各較硫酸鏮區減收約14%～7%，至於藁稈收量之指數，在第一二兩期作中均以嘉義區最低爲72.9及86.4而以新竹區最高爲99.2及98.0平均第一期作爲85.1，第二期作則爲92.2，亦各較硫酸鏮區減收15%～8%左右。

至於硝酸鏮鈣與硫酸鏮中每公斤氮素對于谷藁之增產值如表6。其中各地硝酸鏮鈣區之增產值均不及硫酸鏮區，如就平均數而言，第一期作硝酸鏮鈣區對于谷藁之增產值各爲7.1及11.1公斤，第

表5. 硝酸鏮鈣對于水稻產量之影響（硫酸鏮區作100）

Table 5. Yield Index as influenud by application of nitrochalk (cummunion Sulphete being considened as 100)

期作 Crop	處理 Treatment	產量指數 Yield Index	臺北公館 Taipei	臺北新莊 Taipei	羅東 Lo tung	桃園 Tour yuan	新竹 Hsiu chn	臺中 Tai chung	嘉義 Charyi	鳳山 Feng shan	平均 Mean
第一期作 1st crop	$N_{\frac{1}{2}}^{0}N^{20}$†	谷 Grain	83.5	89.0	87.9	87.1	85.2	90.5	77.9	88.2	86.2
		藁 Straw	78.9	96.4	73.1	82.5	99.2	85.8	72.9	92.3	85.1
第二期作 2nd crop	$N_{\frac{1}{2}}^{0}N^{15}$†	谷 Grain	91.2	94.8	89.0	96.4	96.4	94.0	89.9	83.6	93.5
		藁 Straw	98.3	87.3	93.6	86.9	98.1	95.2	86.4	78.5	92.2

表6. 硝酸鏮鈣與硫酸鏮中每公斤氮素對于谷藁之增產值(公斤)

Table 6. Kilograms of grain and straw increased by 1 kilogram of nitrogen applied in the fertilizer (kg)

期作 Crop	肥料種類 Kinds of Feutilign	增產值 Inevenent	臺北公舘 Taipei (1)	臺北新莊 Taipei (2)	羅東 Lo tung	桃園 Tour yuan	新竹 Hsiu chn	臺中 Tai chung	嘉義 Charyi	鳳山 Feng shan	平均 Mean
第一期作 1st crop	$N_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{20}$	谷 Grain	7.2	3.8	8.5	9.5	7.9	7.3	7.0	5.6	7.1
		藁 Straw	9.9	4.9	15.6	8.7	17.5	10.8	11.7	9.4	11.1
	$S_{\frac{1}{2}}^{0}$ $S_{\frac{1}{2}}^{20}$	谷 Grain	14.4	7.7	14.1	16.5	15.5	12.9	20.4	13.8	14.4
		藁 Straw	19.9	6.1	31.4	15.9	18.0	20.2	31.1	13.8	19.6
第二期作 2nd crop	$N_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{15}$	谷 Grain	6.6	3.9	4.2	2.8	2.2	4.9	8.4	0.0	4.7
		藁 Straw	11.1	5.4	9.1	6.3	5.6	10.1	10.8	10.6	8.3
	$S_{\frac{1}{2}}^{0}$ $S_{\frac{1}{2}}^{15}$	谷 Grain	10.1	5.6	8.1	3.0	3.6	7.8	12.4	7.4	7.2
		藁 Straw	12.4	10.3	12.0	13.4	6.9	14.2	18.9	30.6	12.5

二期作各爲4.7及8.3公斤而硫酸鏮區在第一期作各爲14.4及19.6公斤，第二期作各爲7.2及12.5公斤。一般言之，每公斤氮素對于谷藁之增產值在第一期作時硝酸鏮鈣較硫酸鏮約減產7.3公斤，第二期作約減產2.5公斤。

綜上而言，同種氮肥對于水稻之效應均以第一期作大于第二期作，硝酸鏮鈣若比照硫酸鏮同樣施用方法，其肥效確遠遜於硫酸鏮。

二、硝酸鏮鈣追肥施用期對于水稻效應之影響：

若基肥不施任何氮素肥料，而將基肥應施之硝酸鏮鈣移在插秧後不同時期作追肥施用時，其所獲得之谷藁產量與基肥施用硝酸鏮鈣者分別比較其彼此間之差異顯著性時，各追肥時期中分佈之顯著性次數如表7，該表顯示在第一期作中所分佈硝酸鏮鈣追肥優于基肥之次數較第二期作爲多，第一期作中又以插秧後60日施用第二次追肥區所分佈之次數最多，40日者次之，50日者最少。而在第二期作中各追肥時期所分佈之谷實收量優于基肥者之次數，幾略相等，但對于藁稈收量之影響則不顯明，尤其第二期作追肥施用愈晚反較基肥區有顯著減產之虞。

表8乃以硝酸鏮鈣基肥區之谷藁產量作爲100，估計硝酸鏮鈣追肥區之增產百分比，該表顯示在第一期作情形之下，除羅東一處在插秧後40施用者外，其他各處追肥區之谷實收量均較基肥區爲高，就平均數而言，在40日施用者爲106.9，50者爲107.6，60者爲110.2，而藁稈收量則因追肥施用愈晚者，增產百分比愈少，其順序爲106.4，103.6及100.4。第二期作除新莊、嘉義兩處例外，其他各地追肥施用區之谷實收量亦較基肥區爲高，一般言之，插秧後30日施用者爲102.0，40日者爲103.1，50日者101.6，而藁稈則有減收之趨向，30者爲99.5，40日者爲98.2，50日者94.2。

由上敍述可知硝酸鏮鈣作追肥確較基肥爲優，但作追肥施用之後，每公斤氮素對于谷藁之增產值與硫酸鏮比較時相差若干仍得加以檢討，茲將各地各時期施用硫酸鏮鈣追肥之增產值計算如表9，若以該表中之增產值與表6中之增產值相互比較時，可知第一期硝酸鏮鈣第二次追肥在插秧後40，50及60日施用者對于谷實之增產值爲10.1，10.7，11.9公斤，對于藁稈之增產值爲13.9，2.6及11.5公斤與表6中硝酸鏮鈣基肥之谷實增產值7.1公斤及藁稈增產值11.1公斤者顯然提高，但與硫酸鏮區之谷實增產值及藁稈增產值19.6者14.4公斤者仍見遜色。在第二期作硝酸鏮鈣第二次追肥在插秧後30，40及50日施用者對于谷實之增產值爲5.7，5.9及5.3公斤，對于藁稈之增產值各爲8.1，7.4及5.5公斤。若以硝酸鏮鈣基肥區之谷藁增產值各爲4.7及8.3公斤相比較時，則硝酸鏮鈣在第二期作追肥施用時，谷實之增產仍較基肥施用者略高，藁稈之增產值則可因追肥施用遲晚而較基肥施用者

爲低。若與硫酸銨基肥區之谷藁增產值各爲7.2及12.5公斤者相比較時，則仍現減收。

表7. 硝酸銨鈣追肥施用期對于谷藁產量差異顯著性之比較(硝酸銨鈣基肥區作對照)

Table 7. Significant difference between the response of rice so Top-dressing of Nitrochalk (Yield from bose-dresing as chalk)

期作 Crop	追肥施用期 Time of Top-dressing	收量 Yield	臺北公館 Taipei (1)			臺北新莊 Taipei (2)			羅東 Lo tung			桃園 Tour yuan			新竹 Hsin chu			臺中 Tai chung			嘉義 Charyi			鳳山 Feng shan		
			1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955		
第一期作 1st crop	$ON^{20}_{½}N^{40}_{½}$	谷 Grain		*	*		*						*			*	*						*			
		藁 Straw			*			**							**											
	$ON^{20}_{½}N^{50}_{½}$	谷 Grain			*											*	**		**				*	*		
		藁 Straw																								
	$ON^{20}_{½}N^{60}_{½}$	谷 Grain	*	*			*	**							*		*		*	**	**		**			
		藁 Straw									*															
第二期作 2nd crop	$ON^{15}_{½}N^{30}_{½}$	谷 Grain								**							**	*	*							
		藁 Straw			†													*	†			‡				
	$ON^{15}_{½}N^{40}_{½}$	谷 Grain	*							**	*						*					†		*		
		藁 Straw																						**		
	$ON^{15}_{½}N^{50}_{½}$	谷 Grain	*							**						**						†		**		
		藁 Straw	†	†							†											‡				

* 示追肥優于基肥差異顯著性達5% **達1%平準 † 示追肥劣于基肥差異顯著性達5% ‡達1%

* Top-dressing supe to base-dressing, significant at 5% ** at 1%

† Top-dressing inferice to base dressing, significat at 5%, ‡at 1%

表8. 硝酸銨鈣追肥施用期對于谷藁產量指數之影響

Table 8. Yield Index as influenced by Time of Top-dressing of Nitrochalk. (Yielid from bose-dressing as 100)

期作 Crop	追肥時期 Time of Top-dressing	收量 Yield	臺北公館 Taipei (1)	臺北新莊 Taipei (2)	羅東 Lo tung	桃園 Tour yuan	新竹 Hsin chu	臺中 Tai chung	嘉義 Chanyi	鳳山 Feng shan	平均 Mean
第一期作 1st crop	$ON^{20}_{½}N^{40}_{½}$	谷 Grain	111.8	108.0	99.4	106.7	111.6	101.6	110.0	106.1	106.9
		藁 Straw	109.3	106.8	107.8	105.4	102.9	104.2	110.0	105.4	106.4
	$ON^{20}_{½}N^{50}_{½}$	谷 Grain	106.9	104.8	101.3	108.3	107.2	105.0	109.6	117.8	107.6
		藁 Straw	103.1	104.2	103.9	105.8	90.9	104.7	101.2	114.3	103.6
	$ON^{20}_{½}N^{60}_{½}$	谷 Grain	109.8	109.8	104.3	103.6	108.7	107.2	112.2	125.6	110.2
		藁 Straw	99.2	102.8	96.3	92.1	92.2	103.3	103.2	114.3	100.4
第二期作 2nd crop	$ON^{15}_{½}N^{30}_{½}$	谷 Grain	103.0	97.4	107.9	104.1	103.9	105.9	94.0	100.0	102.0
		藁 Straw	93.9	106.4	101.9	91.5	100.1	104.3	98.2	102.9	99.5
	$ON^{15}_{½}N^{40}_{½}$	谷 Grain	108.3	96.7	109.6	101.6	103.9	102.3	99.4	110.3	103.1
		藁 Straw	94.4	106.8	95.5	93.5	96.1	100.3	100.8	135.0	98.2
	$ON^{15}_{½}N^{50}_{½}$	谷 Grain	104.7	99.5	106.8	101.9	105.4	100.5	92.4	122.3	101.6
		藁 Straw	88.5	97.6	90.3	89.5	100.7	98.4	94.4	120.9	94.2

三、硫酸鎂作基肥，硝酸鎂鈣作追肥對于水稻效應之影響：

1. 以½氮素用硫酸鎂作基肥，其餘用硝酸鎂鈣作一次追肥施用。由上論述，可知硝酸鎂鈣若比照硫酸鎂之一般施用方法，其肥效確較硫酸鎂爲低，若將基肥應施之硝酸鎂鈣移在插秧後作追肥施用時，其肥效較原以基肥施用者顯然提高，但與硫酸鎂區比較時，仍略遜色，此外硝酸鎂鈣追肥之效應尙因施用時期而不同，故試以½之氮素用硫酸鎂作基肥，其餘用硝酸鎂鈣在插秧後不同時期作追肥施用、所得結果與單施硫酸鎂區比較時其差異顯著性如表10，其中在第一期作情形之下，若半數氮素之硝酸鎂鈣在插秧後20，40及60日施用時，對于谷實收量之影響，以40日施用者最佳，僅有羅東一次產量顯然較單施硫酸鎂區（$S_{\frac{1}{2}}^{0}S_{\frac{1}{2}}^{20}$）爲低，但在桃園亦有一次其產量却較硫酸鎂區爲高，其餘差異則均不顯著，此處務須提及者在前節基肥不施任何氮素時，第一期作中第二次硝酸鎂鈣似在插秧後60（$ON_{\frac{1}{2}}^{20}N_{\frac{1}{2}}^{60}$）日爲宜，而本節基肥施用40公斤氮素之硫酸鎂時，硝酸鎂鈣追肥期則以插秧後40日爲宜，前後相較提早約20天。似與木村及千葉氏(1943)[5]所謂水稻生長期中具有二次最高值之部份效力有關渠等並謂第一次最高值之出現日期受氮素施用量之影響，施用量愈高其出現愈早，施用量愈低，其出現愈晚。至於第二期作情形之下，若40公斤氮素之硝酸鎂鈣在插秧後15日施用時，在21次試驗中，其谷實收量顯較硫酸鎂爲低者有5次，而30或50日施用者則各有3次。因此在第一期作插秧後20日或第二期作插秧後15日施用硝酸鎂鈣均似歉過早，但對于藁稈收量而言，追肥施用愈晚者，其收量低於單施硫酸鎂區而達顯著平準之次數則愈多，第一期作插秧後60日與第二期作插秧後50日施用者在21次試驗中各佔有9次之多。

爲檢討水稻基肥施用硫酸鎂，追肥施用硝酸鎂後對于谷藁增產之得失，仍以單施硫酸鎂區之谷藁收量作100，以求硝酸鎂鈣追肥區之增產百分比如表11，其中在第一期作插秧後20日施用硝酸鎂鈣者，谷實與藁稈之收量指數爲88.2～100.9及81.6～105.0平均各爲96.1及95.2，40日施用者爲95.7 106.9及91.498.7平均各爲99.9及92.1，60日施用者爲92.2～106.9及85.297.5平均各爲98.6及92.10。在第二期作插秧後15日施用硝酸鎂鈣者其各實與藁稈收量指數各爲93.2～101.0，及85.2～99.6，平均各爲96.6及94.2，30日施用者爲95.8～108.9及91.5～101.8，平均各爲101.7及97.1，50日施用者爲

表9. 硝酸鎂鈣追肥施用時每公斤氮素對于谷藁之增產值(公斤)

Table 9. Kilograms of grain and straw increared by 1 kilogram of Nitrlgen in Nitrochalk applied as Top-dressing (kg)

期作 Crop	追肥施用期 Time of Top-dressing	值增產 Increment	臺北公館 Taipei (1)	臺北新莊 Taipei (2)	羅東 Lo tung	桃園 Taer yuan	新竹 Hsin chu	臺中 Tai chung	嘉義 Chanyi	鳳山 Feng sha	平均 Mean
第一期作 1st crop	$ON_{\frac{1}{2}}^{20}N_{\frac{1}{2}}^{40}$	谷 Grain	11.5	6.3	8.2	12.7	13.0	8.2	11.8	9.1	10.1
		藁 Straw	13.4	7.1	18.9	10.5	19.1	13.1	16.9	12.2	13.9
	$ON_{\frac{1}{2}}^{20}N_{\frac{1}{2}}^{50}$	谷 Grain	9.7	5.3	9.0	13.4	11.1	10.0	11.6	15.6	10.7
		藁 Straw	11.1	6.3	17.3	10.7	12.7	13.4	12.3	16.9	12.6
	$ON_{\frac{1}{2}}^{20}N_{\frac{1}{2}}^{60}$	谷 Grain	10.8	6.9	10.2	11.2	11.8	11.1	12.8	20.0	11.9
		藁 Straw	9.6	5.8	14.0	6.0	13.4	12.7	13.3	16.9	11.5
第二期作 2nd crop	$ON_{\frac{1}{2}}^{15}N_{\frac{1}{2}}^{30}$	谷 Grain	7.7	3.1	6.7	4.8	3.7	7.6	6.3	0.0	5.7
		藁 Straw	8.0	7.5	10.0	2.2	6.0	13.6	9.3	12.8	8.1
	$ON_{\frac{1}{2}}^{15}N_{\frac{1}{2}}^{40}$	谷 Grain	9.6	2.9	7.3	3.6	3.7	5.9	8.2	3.9	5.9
		藁 Straw	8.3	7.7	7.2	3.1	4.1	10.4	10.8	36.3	7.4
	$ON_{\frac{1}{2}}^{15}N_{\frac{1}{2}}^{50}$	谷 Grain	8.3	3.7	6.4	3.7	4.3	5.1	5.8	8.4	5.3
		藁 Straw	5.3	4.6	5.0	1.3	6.3	8.8	7.3	25.9	5.5

表10. ½氮素用硫酸鏔作基肥其餘用硝酸鏔鈣作追肥時所得之谷藁產量與單施硫酸鏔區間差異顯著性之比較*

Table 10. Yield of Rice derived from the Combined Application of One-half of Nitrogen from Ammonium Sulphata as a base-dressing and the other from introchalk as a Top-dressing in Comparison with that from application of Ammonium Sulphate alme

期作 Crop	處理 Treatment	產量 Yield	臺北公舘 Taipei (1)			臺北新莊 Taipei (2)			羅東 Lo tung			桃園 Tour yuan			新竹 Hsin chu			臺中 Tai chung			嘉義 Chanyi			鳳山 Feng shan		
			1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1155	1956	1957	1955	1956	1957
第一期作 1st crop	$S_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{20}$	谷 Grain	†					†			†			‡		†			*			‡				
		藁 Straw						†			‡		†	†								‡				
	$S_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{40}$	谷 Grain									†		*													
		藁 Straw	‡								‡											‡				
	$S_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{60}$	谷 Grain		†	†											†			*							
		藁 Straw	‡	†		‡	*	†	‡		‡		†					‡				‡				
第二期作 2nd crop	$S_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{15}$	谷 Grain						‡	†										‡			‡		‡		
		藁 Straw									†								‡			‡	†			
	$S_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{30}$	谷 Grain						‡	†	†												†				
		藁 Straw						‡		**												†				
	$S_{\frac{1}{2}}^{0}$ $N_{\frac{1}{2}}^{50}$	谷 Grain						‡		*												‡	†			
		藁 Straw	†					‡	†		†			‡	†				†			‡	‡			

† 硝酸鏔鈣追肥區之產量低于單施硫酸鏔區達5%顯著平準

‡ 硝酸鏔鈣追肥區之產量低于單施硫酸鏔區達1%顯著平準

* 硝酸鏔鈣追肥區之產量高于單施硫酸鏔區達5%平準

** 硝酸鏔鈣追肥區之產量高于單施硫酸鏔區達1%平準

* See foatuote under table 7.

92.0～104.6及80.1～96.6平均各爲98.1及89.3，由上觀之，在本試驗情形之下，第一期作插秧後40日及第二期作插秧後30日施用硝酸鏔鈣，所得谷實收量尙可與單施硫酸鏔區相比擬，但其藁稈收量仍較硫酸鏔區相差約8%～3%。

2. 以⅓氮素用硫酸鏔作基肥，其餘用硝酸鏔鈣平分兩次作追肥施用：若以⅓氮素用硫酸鏔作基肥，其餘用硝酸鏔鈣作追肥其中在第一期作時第一次⅓N素之硝酸鏔鈣追肥均在插秧後20日施用，第二次⅓素之硝酸鏔鈣則分別在插秧後40，50及60日施用，在第二期作時，第一次⅓N素之硝酸鏔鈣均在插秧後15日施用，第二次硝酸鏔鈣追肥則分別在插秧後30，40及50施用，其結果仍與單施硫酸鏔區相比較時，其差異顯著次數分配情形如表12，其中第一期作第二次追肥在插秧後40日施用所得之谷實產量較硫酸鏔區顯著減收者有7次，藁稈有5次，50日施用者谷實亦有5次，藁稈則有6次，60日施用者谷實佔6次，藁稈則有9次。在第二期作第二次追肥在插秧後30日施用者，其谷實收量較硫酸鏔爲低而顯著平準者有5次，藁稈則有6次，而在40日施用者，谷實僅達2次，而藁稈仍爲5次。50日施用者谷實則爲4次，藁稈仍達5次。若以硫酸鏔區作100，比較其百分比時，其結果如表13，其中第一期作第二次硝酸鏔鈣追肥在插秧後40日施用者，其谷實與藁稈之增產百分比各爲90.8～100.2及89.5～109.9平均爲95.9及97.0，在50日施用者各爲90.8～108.3及80.2～105.5，

表11. ½氮素用硫酸銨作基肥其餘用硝酸銨鈣作追肥時對于谷藁產量指數之影響
Table 11. Yield of Rice as Influenced by the Combined Application of One-half of Nitrogen from Ammonium Sulphate as a Base-dressing and the other from Nitrochalk as a Top-dressing (Application of Ammonium Sulphate alone being considened as 100)

期作 Crop	處理 Treatment	產量 Yield	臺北公舘 Taipei (1)	臺北新莊 Taipei (2)	羅東 Lo tung	桃園 Tour yuan	新竹 Hsin chu	臺中 Tai chung	嘉義 Chenyi	鳳山 Feng shan	平均 Mean
第一期作 1st crop	$S_{\frac{1}{2}}^{0}\ N_{\frac{1}{2}}^{20}$	谷 Grain	95.3	100.9	96.2	93.9	95.9	97.7	88.2	100.5	96.1
		藁 Straw	96.6	96.7	88.6	81.6	99.5	105.0	88.6	104.9	95.2
	$S_{\frac{1}{2}}^{0}\ N_{\frac{1}{2}}^{40}$	谷 Grain	97.3	99.5	97.3	104.2	98.6	100.3	95.7	106.9	100.0
		藁 Straw	92.0	98.7	91.4	93.8	91.7	97.8	93.0	113.7	96.5
	$S_{\frac{1}{2}}^{0}\ N_{\frac{1}{2}}^{60}$	谷 Grain	91.7	96.4	102.6	99.4	95.8	103.9	92.2	106.9	98.6
		藁 Straw	83.4	98.5	86.8	75.2	97.5	95.5	88.9	101.1	92.1
第二期作 2nd crop	$S_{\frac{1}{2}}^{0}\ N_{\frac{1}{2}}^{15}$	谷 Grain	93.2	96.8	96.4	97.2	101.0	95.7	95.6	83.6	96.6
		藁 Straw	97.3	91.0	94.7	85.2	99.6	97.0	94.9	86.6	94.2
	$S_{\frac{1}{2}}^{0}\ N_{\frac{1}{2}}^{30}$	谷 Grain	95.8	108.0	99.9	103.4	103.8	101.8	99.2	94.4	101.7
		藁 Straw	98.0	93.4	101.5	91.5	98.2	101.8	95.5	93.3	97.1
	$S_{\frac{1}{2}}^{0}\ N_{\frac{1}{2}}^{50}$	谷 Grain	92.0	98.2	104.3	104.6	100.0	97.4	90.5	99.2	98.1
		藁 Straw	89.8	85.1	91.1	80.1	95.3	96.6	87.1	92.2	89.3

表12. ⅓氮素用硫酸銨作基肥其餘用硝酸銨鈣作追肥時所得谷藁產量與單施硫酸銨區間差異顯著性之比較*
Table 12. Yield of Rice Derived from the Combined Application of One-third of Nitrogen from Ammonium Sulphate as a Base-dressing and the other from Nitrochalk as a Top-dressing in Comparison with that from Application of Ammonium Sulphate alone

期作 Crop	處理 Treatment	產量 Yield	臺北公舘 Taipei (1)			臺北新莊 Taipei (2)			羅東 Lo tung			桃園 Tonr yuan			新竹 Hsin chu			臺中 Tai chung			嘉義 Chanyi			鳳山 Feng shan		
			1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957	1955	1956	1957
第一期作 1st crop	$S_{\frac{1}{3}}^{0}\ N_{\frac{1}{3}}^{20}\ N_{\frac{1}{3}}^{40}$	谷 Grain	‡					‡	†		‡							†		*			†	†		
		藁 Straw	‡					†			‡		†										‡			
	$S_{\frac{1}{3}}^{0}\ N_{\frac{1}{3}}^{20}\ N_{\frac{1}{3}}^{50}$	谷 Grain	‡					†			‡				†								‡			
		藁 Straw	‡	†				†			‡		‡										‡			
	$S_{\frac{1}{3}}^{0}\ N_{\frac{1}{3}}^{20}\ N_{\frac{1}{3}}^{60}$	谷 Grain	‡	†				†								†						†	‡			
		藁 Straw	‡	†				‡	‡		‡		‡					†				‡	‡			
第二期作 2nd crop	$S_{\frac{1}{3}}^{0}\ N_{\frac{1}{3}}^{15}\ N_{\frac{1}{3}}^{30}$	谷 Grain			†			‡	‡							*			‡			‡				
		藁 Straw			†			‡	†										‡			‡	†			
	$S_{\frac{1}{3}}^{0}\ N_{\frac{1}{3}}^{15}\ N_{\frac{1}{3}}^{40}$	谷 Grain						‡														‡				
		藁 Straw						†						‡					†			‡	†			
	$S_{\frac{1}{3}}^{0}\ N_{\frac{1}{3}}^{15}\ N_{\frac{1}{3}}^{50}$	谷 Grain						†											‡			‡	‡			
		藁 Straw						‡						†					†			‡	‡			

見表7脚註 See footnote under Table 7.

平均各爲98.0及92.7。在60日施用者各爲87.1～107.8及80.2～101.1平均各爲96.0及89.8。一般言之，爲提高谷實收量第一期作之第二次追肥以插秧後50日施用爲宜，但仍較單施硫酸銨區低約2%，在第二期作時，第二次硝酸銨鈣追肥在插秧後30日施用者，其谷實與藁稈之增產指數各爲88.7～100.1及92.8～105.0。平均各爲98.2及96.4，40日施用者各爲96.0～102.1及80.7～97.9，平均各爲99.9及93.4，50日施用者各爲83.3～102.4及83.0～99.2。平均各爲96.6及92.0。因此第二期作第二次硝酸銨鈣追肥似在插秧後40日爲宜。

表13. 1/3氮素用硫酸銨作基肥，其餘用硝酸銨鈣作追肥時對于谷藁產量指數之影響

Table 13. Yield of Rice as Influenced by the Combined Application of One-third of Nitrogen from Ammonium Sulphate as a Base-chessing and the other from Nitrochalk as a Top-dressing (Application of Ammonium Sulphate alone being considened as 100)

期作別 Crop	處理 Treatment	產量 Yield	臺北公舘 Taipei (1)	臺北新莊 Taipei (2)	羅東 Lo tung	桃園 Tour yuan	新竹 Hsin chu	臺中 Tai chung	嘉義 Chanyi	鳳山 Feng shan	平均 mean
第一期作 1st crop	$S_{1/3}^{0}N_{1/3}^{20}N_{1/3}^{40}$	谷 Grain	92.5	94.4	93.6	99.2	100.2	98.0	90.8	98.0	95.9
		藁 Straw	90.3	101.3	91.0	89.5	109.9	97.2	93.6	103.3	97.0
	$S_{1/3}^{0}N_{1/3}^{20}N_{1/2}^{50}$	谷 Grain	90.8	96.7	99.5	99.3	96.8	101.5	91.0	108.3	98.0
		藁 Straw	83.4	96.4	91.4	87.0	96.4	100.9	80.2	105.5	92.7
	$S_{1/3}^{0}N_{1/3}^{20}N_{1/3}^{60}$	谷 Grain	91.0	93.5	100.4	95.9	96.8	100.6	87.1	107.8	96.0
		藁 Straw	85.2	93.4	86.8	86.2	93.3	91.9	80.2	101.1	89.8
第二期作 2nd crop	$S_{1/3}^{0}N_{1/3}^{15}N_{1/3}^{30}$	谷 Grain	88.7	98.7	96.6	100.5	109.1	96.8	96.9	90.8	98.2
		藁 Straw	92.8	95.6	95.4	93.8	105.0	98.0	93.9	86.6	96.4
	$S_{1/3}^{0}N_{1/3}^{15}N_{1/3}^{40}$	谷 Grain	98.6	99.5	101.6	100.6	102.1	101.1	96.0	107.5	99.9
		藁 Straw	96.1	94.2	96.1	80.7	97.9	97.5	91.0	104.0	93.4
	$S_{1/3}^{0}N_{1/3}^{15}N_{1/3}^{50}$	谷 Grain	97.5	100.1	98.3	102.4	101.8	95.0	83.3	93.1	96.6
		藁 Straw	95.4	85.3	96.8	83.0	99.2	96.8	87.3	83.9	92.0

就上所述，若以1/3氮素用硫酸銨作基肥，其餘2/3用硝酸銨鈣作追肥時，其對于谷實減收之百分比以及發生差異顯著性之次數（以$S_{1/2}^{0}S_{1/2}^{20}$或$S_{15}^{0}S_{1/2}^{15}$爲準）均較上節以1/2氮素用硫酸銨作基肥與1/2氮素用硝酸銨作追肥者爲多，因此爲谷實增產安全計，硝酸銨鈣最多只可代用硫酸銨全用量之1/2而已。

摘　要

1.若硝酸銨鈣比照硫酸銨同樣施用，即以1/2氮素作基肥，其餘1/2在第一期作插秧後20日施用，或在第二期作插秧後15日施用時，其肥效確較硫酸銨者爲低，若以硫酸銨區之谷銨產量各作爲100，則硝酸鈣鈣區之谷藁產量指數，在第一期作各爲86.2及85.1，在第二期作各爲92.3及90.5。若以每公斤氮素對于谷藁增產之公斤數比較之，硫酸銨中每公斤氮素在第一期作可較硝酸銨鈣中者多增產谷實7.3公斤，藁稈8.5公斤，在第二期作多增產谷實2.5公斤，藁稈4.2公斤。

2. 若在第一期作將半數之硝酸銨鈣均在插秧後20日施用，其餘則分別在插秧後40，50及60日施用，而在第二期作時半數之硝酸銨均在插秧後15日施用，另半數則分別在插秧後30～40及50日施用，而基肥完全不施用任何氮素肥料時，其對于谷實之收量確較以硝酸銨鈣作基肥施用者提高。但其對于每公斤氮素所增產之谷藁公斤數與硫酸銨者比較時仍見遜色。

3. 就谷實收量而言，以½氮素用硫酸鎂作基肥，其餘用硝酸鎂鈣作一次追肥時，若施用時期適當可與完全硫酸鎂區相比擬，在本試驗情形之下，在第一期作以插秧後40日爲宜，第二期作以插秧後30日爲宜。若½氮素用硫酸鎂作基肥，其餘用硝酸鎂鈣平分兩次作追肥施用時，其效果不及前述以½氮素用硫酸鎂作基肥其餘用硝酸鎂鈣作追肥者。就藁稈收量而言，追肥施用遲者有減收之虞。

綜上而言，硝酸鎂鈣作追肥確較基肥爲優，但爲稻谷增產完全起見，仍不分配于稻農爲得策。

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AN EXPERIMENT ON THE TOP-DRESSING OF NITROCHALK TO RICE

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SUMMARY

The purpose of this experiment was to study the merit of nitrochalk to be applied as a base dressing or as a top dressing and to find out the proper time of applying nitrochalk. Since application of nitrochalk alone would cause a reduction in yield of grain and straw as found by previous investigators, comparisons of treatments with various amount of ammonium sulphate applied as a base dressing in combination with a portion of nitrochalk as a top dressing were also made. This experiment was conducted at 8 locations under a representative variety of soils and climate conditions in 1955-1957. Its result may be summarized as follows:

In most cases, the response of rice to nitrochalk applied as a base dressing was decidedly inferior to that to ammonium sulphate through statistically significant test. Providing both yields of grain and straw derived from ammonium sulphate as 100, those from nitrochalk were 86.2 and 85.1 for the first crop, and 92.3 and 90.5 for the second crop, respectively.

Significant differences were usually found between top dressing and base dressing of nitrochalk. Yields increased by one kilogram of nitrogen derived from nitrochalk applied at various times were given in the following table. Data from ammonium sulphate were also presented for reference.

Time of Application	1st Crop				
	$N^{0}_{1/2}N^{20}_{1/2}$	$ON^{20}_{1/2}N^{40}_{1/2}$	$ON^{20}_{1/2}N^{50}_{1/2}$	$ON^{20}_{1/2}N^{60}_{1/2}$	$S^{0}_{1/2}S^{20}_{1/2}$
Grain kg.	7.1	10.1	10.7	11.9	14.4
Straw kg.	11.1	13.9	12.9	11.5	19.6
Time of Application	2nd Crop				
	$N^{0}_{1/2}N^{15}_{1/2}$	$ON^{15}_{1/2}N^{30}_{1/2}$	$ON^{15}_{1/2}N^{40}_{1/2}$	$ON^{15}_{1/2}N^{50}_{1/2}$	$S^{0}_{1/2}S^{15}_{1/2}$
Grian kg.	4.7	5.7	5.9	5.3	7.2
Straw kg.	8.3	8.1	7.4	5.5	12.5

Taking the yield from the plot treated with ammonium sulphate as 100, those treated with one-half of nitrogen from ammonium sulphate and the other from nitrochalk were as follows:

Time of Application	1st Crop				2nd Crop			
	$S^{0}_{1/2}S^{20}_{1/2}$	$S^{0}_{1/2}N^{20}_{1/2}$	$S^{0}_{1/2}N^{40}_{1/2}$	$S^{0}_{1/2}N^{60}_{1/2}$	$S^{0}_{1/2}S^{15}_{1/2}$	$S^{0}_{1/2}N^{15}_{1/2}$	$S^{0}_{1/2}N^{30}_{1/2}$	$S^{0}_{1/2}N^{50}_{1/2}$
Grain	100.0	96.1	100.0	98.6	100.0	96.6	101.7	98.1
Straw	100.0	95.2	96.5	92.1	100.0	94.2	97·1	89.3

It was found that yields of paddy rice produced by one third of nitrogen from ammonium sulphate and the other from nitrochalk were slightly lower than those given by one-half of nitrogen from ammonium sulphata and the other from nitrochalk.

It was concluded that nitrochalk should be allocated for the crops other than rice plant, otherwise, it should be applied properly as a top dressing in combination with ammonium sulphate as a base dressing.

CONTROL OF COTTON PESTS WITH SOME NEW INSECTICIDES AFTER TYPHOON

by

CHIA-HWA TAO

There are two important obstacles in cultivating cotton in Taiwan, namely, typhoons and insect pests. Though typhoons are a grave menace to cotton crops, they do not cause serious damage to cotton every year. During 1956 the typhoon Diana which occured on Sept. 15 was very strong. A heavy rain fell incessantly all day long. Where it entirely destroyed the squares and bolls at an early stage, the loss was estimated from 90 to 100 per cent. If the leaves, squares and bolls started growing again, the leafhopper (*Chlorita biguttula* Ishida) and spiny bollworm *Earias fabia* Stoll seemed more abundant than before. Meanwhile the control of these cotton pests was of great importance, since it would reduce further damage to the cotton. The results were obtained from these tests helped us to render better extension service to local farmers. In the experiments gusathion and diazinon were used and these were compared with endrin. The results are herein this paper.

MATERIALS AND METHODS

The field experiments were conducted at Tai-dou-kung, Chia-yi county in Taiwan in 1956. The field divided into three blocks of 18 plots each. The plots measured 35 sq. m. (5×7 m) including 70 plants, each plot had 5 rows making 14 plants per row. The plants were spaced 1 meter by 0.5 meter apart. The variety of cotton which was sowed on July 6 was Kuan-tung No. 119. Twelve different treatments and six checks were assigned at random to each block. Each insecticide was made up into a 0.02% and 0.04% dilution of active ingredient. The spray schedule was divided into five or seven applications. The five sprays were made at 14 day intervals. They were applied on Sept. 20, Oct. 3, 17 and Nov. 1 and 15. The seven sprays were applied at 10 day intervals, they were applied on Sept. 20, 30, Oct. 10, 20, 30, and Nov. 9 and 19. Sprays were made from emulsifiable concentrate and applied with a small type of automatic sprayer, each spray was applied at same of 1200 liters of insecticidal solution per hectare, respectively. The number of bolls on each plant was counted by examing 10 plants randomly selected from a central row of each plot and the percentage of infested bolls was also determined at same in all treatments.

RESULTS

All treated plots showed a significant greater yield than the check. There was also a significant difference between the number of sprays and the various concentrations

of sprays used. The high concentrations of sprays gave better results than low concentrated sprays. In the seven times of applications. The high concentration of endrin and gusathion gave about equal effectiveness against this pest. But seven sprays were superior to five sprays. Diazinon gave poor results for control of this pest whether in various concentrations or number of applications used. The reaults are given in Table 1.

Table 1. Effective control of cotton pests after Typhoon in 1956

Applied times	Chomical treatments	Bolls infested		No. of bolls per plant	Yield of seed cotton kg/ha	Index
		% (AV)	Angle			
5	0.04% Endrin emul.	25.40	30.25	24.70	1,044.00	1,104.60
7	0.04% Endrin emul.	18.80	25.57	26.00	1,380.00	1,460.30
5	0.02% Endrin emul.	33.77	37.80	13.30	732.00	765.10
7	0.02% Endrin emul.	21.72	27.72	24.40	1,119.00	1,184.13
5	0.04% Gusathion emul.	43.00	40.95	11.20	788.00	844.44
7	0.04% Gusathion emul.	18.20	25.31	25.10	1,356.00	1,434.90
5	0.02% Gusathion emul.	42.40	40.58	10.10	462.00	488.89
7	0.02% Gusathion emul.	26.40	30.94	17.90	794.00	840.21
5	0.04% Diazinon emul.	64.70	54.82	5.40	159.00	169.25
7	0.04% Diazinon emul.	40.30	39.35	9.50	248.00	262.43
5	0.02% Diazinon emul.	62.90	52.73	4.00	135.00	142.26
7	0.02% Diazinon emul.	59.40	50.59	5.00	159.00	168.25
	Check (Untreated)	69.15	57.56	2.32	94.50	100.00
	L. S. D. at level 5%		1.74	3.67	73.26	
	L. S. D. at level 1%		2.34	4.92	98.28	

DISCUSSION

The number of bolls on each plant receiving treatments was significantly higher than the check. It was 4.10 to 26.00 bolls per plant as compared with 2.32 in the check. There was also a significant difference between various treatments and number of sprays used. High concentrations with diazinon when applied seven times gave a difference over the check, but low concentrations gave no significant difference over the check. Percentage of infested bolls by spiny bollworm was lower than the check. It was 18.20% to 64.70% of infested bolls as compared 69.15% in the check. There was a significant difference between various treatments and number of sprays used. In various treatments of diazinon, the percentage of infested bolls was significantly greater than other chemical treatments. The treated plots gave significantly higher yield than the check. It was 135.00 to 1380.00 kgs of seed cotton per hectare as compared with 94.50 kgs in the check, but the treated plots with diazinon gave a lower yield than those treated with other chemicals.

SUMMARY

Endrin, gusathion and diazinon were tested for control of two important cotton insects, namely, leafhopper *Chlorita biguttula* Ishida and spiny bollworm *Earia fabia* Stoll infesting cotton crops after a typhoon at Tai-dou-kung, Chiayi county, in Taiwan in 1956. In all treatments. excellent results were obtained from high concentrated plots applied at intervals of 10 days. It was revealed that endrin and gusathion gave best results and also gave about equal effectiveness against this pest. The treated plots of endrin and gusathion in the yield of seed cotton were 1356 to 1380 kgs per hectare as the index of increased yield was at 143.49% to 146.03% and all plots treated with diazinon were less effective. According to this data, the control of cotton pests should be very important for reducing damage to cotton following typhoons.

颱風後田間藥劑防治棉蟲試驗

陶　家　驊

摘　　要

於民國45年9月15日棉田遭遇强力颱風黛納小姐襲擊後，損失不貲，乃以繼續進行藥劑防治兩種主要棉蟲爲棉浮塵子 *Chlorita biguttula* Ishida 與棉金鋼鑽蟲 *Earias fabia* Stoll 試驗，並在本分所臺斗坑農場舉行，參加殺蟲劑爲安特靈 (19.5% Endrin)，克殺聖 (20% Gusathion) 與大利農 (60% Diazinon) 三種乳劑。本試驗結果，其中以安特靈與克殺聖乳劑之高濃度處理，並間隔10天施藥1次者爲最優，每公頃籽棉產量達1,356—1,380公斤，增產指數143.49%—146.03% 唯獨大利農諸處理最差。茲據本試驗各處理中產量統計分析結果，顯示颱風後加强蟲害防治，殊爲重要，仍可挽救部份損失。

瓜實蠅防治試驗報告

陳　貴　華

前　言

瓜實蠅（*Dacus cucurbitae* Coq.）爲葫蘆科蔬菜之重要害蟲，在臺灣之被害作物有胡瓜、越瓜、絲瓜、甜瓜、西瓜、南瓜、冬瓜、苦瓜、扁蒲等，尤以胡瓜、越瓜、絲瓜、甜瓜、苦瓜爲害最重。瓜實蠅之成蟲形似蜂類，故一般瓜農稱之爲瓜蜂，該蟲之爲害均集中在花果期，果實漸次成熟被害漸輕，被害果實重則腐爛輕則成畸形或生長缺佳，減低商品價值，影響瓜類之增產至鉅，關于該蟲之防治在過去尙無有效方法，僅行果實套袋或以毒餌誘殺成蟲，但如胡瓜，越瓜等果實著生數多者，因掛袋所費勞力及紙費過高故多任其爲害，因此損失時常在20～80%之間，筆者爲欲研究該蟲之藥劑防治法乃於民國46年開始作三次防治試驗，茲將試驗結果報告如下。本試驗由前本系主任現住臺中農學院教授孫守恭先生指導下進行，文成後並蒙孫教授及臺灣省農業試驗所應用動物系陶主任家駒先生在百忙中校閱，本分所王所長炘不斷鼓勵謹誌謝意。

第一次防治試驗

第一次防治試驗於民國46年3月開始，地點選於南部胡瓜主要產地，仁武及楠梓，茲將試驗方法及試驗結果分述於後。

一、試驗方法：

1. 馬拉松對胡瓜之藥害測定：爲求試驗工作之安全計，於防治試驗開始前，以25%馬拉松(Malathion W.P.)可濕性，分1～400，1～600及1～800倍三種濃度，各加1～800倍水解性蛋白質 (Protein hydrolysate) 噴於胡瓜上，觀察其有無藥害發生，每處理供試胡瓜10株，施藥後三日調查生育情形，結果如表一。

表一：馬拉松對胡瓜藥害試驗結果

處理＼項目	調查株數	噴藥前平均株高	噴藥後平均株高	株高增加率	噴藥前平均葉數	噴藥後平均葉數	瓜葉增加率	噴藥前枯斑葉數	噴藥後枯斑葉數	藥害發生株數	備註
		cm	cm	%	枚	枚	%	枚	枚		
Pro.1/800加Ma1/400	10	53.8	67.7	25.84	9.6	11.2	16.67	15	17	1	株高在20cm者1株心梢瓜葉萎縮1枚變黃1枚
Pro.1/800加Ma1/600	10	51.5	66.0	28.15	8.9	10.5	17.93	18	20	1	株高在30cm者1株心部瓜葉梢萎縐
Pro.1/800加Ma1/800	10	57.4	76.2	32.75	9.8	11.8	20.40	27	27	0	
對照區	40	59.7	80.0	34.00	9.8	12.3	25.50	14	14	0	

備註：Pro. 爲 Protein hydrolysate. Ma.: 爲 Malathion

馬拉松對于開花前後胡瓜之藥害發生情形以1～800倍爲安全濃度，1～400及1～600倍者各發生一株藥害，藥害發生株之象徵爲心梢部瓜葉萎縮或變黃，植株停止發育等，株高已至50cm以上者，1～400倍濃度仍無藥害發生，本試驗之施藥期均在胡瓜開花以後，故對馬拉松之藥害均安全無慮。

2. 防治試驗之設計：供試藥劑爲25%可濕性馬拉松粉劑（25% Malathion W.P.）及 Dipterex 並加用食餌水解性蛋白質 (Protein hydrolysate) 及引誘劑甲基丁香油 (Methyl eugenol) 測驗對瓜實蠅之誘殺效果。

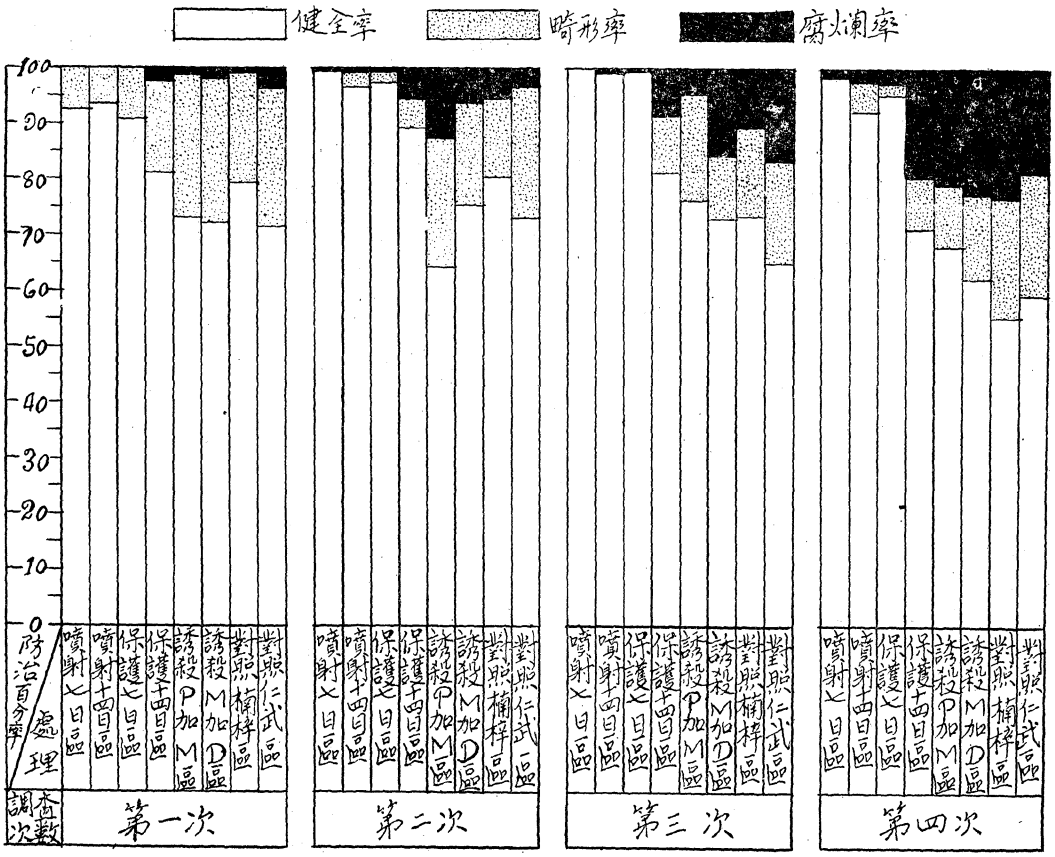
（1） 誘殺瓶(箱)誘殺法——誘殺箱爲60×25×25^{3}大小之容器五面裝鐵紗網，一面裝玻璃，於裝鐵紗之三面各開一直徑7cm 之圓孔，圓孔距離箱之頂邊10cm 其他部份均貼以白紙，箱底則除去鐵紗，換一紗布袋，以便調查時將蟲取出，誘殺箱內懸一浸藥液之紗布，其高度適於洞孔同高，以便瓜實蠅聞香味而入，每10公畝用誘殺箱二個及釜屋式誘殺瓶一個，每七日調查誘殺蟲數及胡瓜被害情形各一次，供試驗藥劑有水解性蛋白質1～400倍加馬拉松1～400倍及甲基丁香油加 Dipterex 二種。

（2） 保護行撒佈法——供試藥劑爲水解性蛋白質1～800倍加馬拉松1～400倍，以胡瓜開花時開始噴藥，每 7 日或14日撒佈一次，藥劑均噴射於瓜園四周之邊行及附近之雜草及其他作物上，以防瓜實蠅之侵入爲害。

（3） 隨機撒佈法——藥劑爲水解性蛋白質加馬拉松，濃度同前，惟採用隨機撒佈法，即將藥劑點點撒佈於瓜園內（每行均每隔二公尺施藥一公尺），施藥日期亦分七日一次及十四日一次。

（4） 試驗園之選澤——因瓜實蠅爲善飛，其活動範圍極大之昆蟲，尤以應用引誘劑或食餌時，若各處理相距甚近，必影響彼此之效果，故以上各法及各處理，均在仁武及楠梓二地，選澤孤立園作爲每一處理，故全園爲一處理是重複。

3. 調查方法：各處理均每隔七日調查防治效果一次，因每次調查均有各種生育程度不同之瓜果，故將果實分爲花果（果實生育至10cm內外果花已枯凋者），幼果（果花枯凋後至果刺生者尙密而尖者），及成熟果（果刺生着已疏且不尖而已近收穫者）三種，分別記載各種果實之健全，產卵畸形果）及被害腐爛果數等，每次調查均步及全區隨機取樣50株。



圖一：第一次防治試驗歷次調查結果

二、試驗結果：

1. 歷次調查結果：自噴藥後每隔七日調查各處理間藥效一次，茲將每次調查結果列如圖一。

由每次調查藥效結果可知，均爲隨機噴藥法之效果最佳，在第一次調查時其被產卵畸形率雖有6～7%，但自第二次調查以後產卵及腐爛率均減至0～1%，保護區位於第二，誘殺區最差。對照區自胡瓜結果後被害率逐日增高，第一次調查時之二區平均健全果百分率尙爲75.15%，被產卵畸形果有22.65%，腐爛果爲2.3%，但至最後一次調查時健全果減至57.78%，畸形果（產卵果）21.50%，腐爛果增至20.82%。

噴藥期間之不同與防治效果亦有顯著的差異，每七日施藥一次區較十四日區爲優，尤以保護法區之差異更甚，效果相差有10～12%之譜。

2. 果集結果：茲將調查四次之累集結果列如表二。

表二：第一次防治試驗結果統計

處理＼項目	調查次數	調查株數	瓜果總數	健全果數	百分率	產卵畸形果數	百分率	腐爛果數	百分率
隨機噴射七日區	4	200	447	438	97.99	7	1.57	2	0.45
隨機噴射十四日區	4	200	428	410	95.79	14	3.27	4	0.93
保護法七日區	4	200	489	471	96.32	13	2.67	5	1.02
保護法十四日區	4	200	349	285	81.66	38	10.89	26	7.45
誘殺法 P 加 M	4	200	477	335	70.23	103	21.59	39	8.18
誘殺法 M 加 D	4	200	518	369	71.24	92	17.76	57	11.00
對照區(楠梓)	4	200	459	332	72.23	84	18.30	43	9.47
對照區(仁武)	4	200	433	293	67.67	97	22.40	43	9.93

備註：誘殺法之 P 加 M 爲 Protein hydrolysate 加 Malathion. M 加 D 係 Methyl eugenol 加 Dipterex 之代號。

由表知三種處理中以隨機噴藥法防治效果最優，七日施藥一次區之健全果竟達 97.99%，十四日一次區爲 95.79%，較對照區之 67.67%相差30%之鉅，次爲保護法，七日施藥一次區之防治效果仍高至 96.32%，但至十四日區則爲 81.66%，至於誘殺法因水解性蛋白質對瓜實蠅之誘引力較差，故每次誘殺蟲數極少，Methyl eugenol 對瓜實蠅無引誘效果，故誘殺法之防治效果最差，其健全果百分率殆與對照區同。

3. 誘殺蟲數：茲將誘殺區每七日調查一次之誘殺蟲數列如下表。

表三：誘殺蟲數記錄

處理	調查日期	蟲類別	一號箱		二號箱		三號箱		誘殺瓶		合計		其他蟲類
			雌蟲	雄蟲	雌蟲	雄蟲	雌蟲	雄蟲	雌蟲	雄蟲	雌蟲	雄蟲	
水解性蛋白質加馬拉松粉劑	3月22日	瓜實蠅	1	0	0	0	1	0	0	0	3	0	蒼蠅 1
	〃	果實蠅	0	0	0	0	0	0	0	0	0	0	瓢蟲及小蜚蠊各 1
	3月29日	瓜實蠅	0	0	0	0	0	0	2	1	2	1	
	〃	果實蠅	0	0	0	0	0	0	0	0	0	0	
	4月5日	瓜實蠅	1	0	0	0	1	0	1	1	3	1	瓢蟲 2 蜜蜂 1
	〃	果實蠅	0	0	0	0	0	0	0	0	0	0	
	4月12日	瓜實蠅	0	0	0	0	0	0	7	3	7	3	蒼蠅 1 蛛蜘 1
	〃	果實蠅	0	0	0	0	0	0	0	0	0	0	

甲基丁香油加 Dipterex	3月22日	瓜實蠅	0	0	0	0			0	0	0	0	蒼蠅、虻及蜘蛛各1
	〃	果實蠅	0	2	0	20			0	1	0	23	
	3月29日	瓜實蠅	0	0	0	0			0	0	0	0	
	〃	果實蠅	0	5	0	4			0	1	0	10	蒼蠅、金龍、蜜蜂及鹿蛾各1
	4月5日	瓜實蠅	0	0	0	0			0	0	0	0	夜蛾1
	〃	果實蠅	0	5	0	4			0	0	0	9	蜜蜂1
	4月12日	瓜實蠅	0	0	0	0			0	0	0	0	蜘蛛、蜚蠊、蜜蜂各1
	〃	果實蠅	0	3	0	14			0	6	0	23	

水解性蛋白質用於誘殺器中，以誘殺瓜實蠅成蟲，雖有引誘之效能但效果不理想，每次調查誘殺蟲數結果，最多僅有10蟲，通常爲2～3蟲，但噴射區每次噴藥後檢查一行中之成蟲死亡數，第一次有14蟲，第二次21蟲，第三次有8蟲之多，由此可知應用水解性蛋白質防治瓜實蠅不宜用以誘殺，應以噴射法施用才能發揮其效能。

甲基丁香油對瓜實蠅完全無引誘效力，每次調查均無瓜實蠅，但對果實蠅 (Dacus ferrugineus dorsalisHendel) 則有極强之誘引力，每次調查時有9至23隻成蟲（雄蟲）之多。

4. 果實生育程度與被害關係：果實生育程度之不同與瓜實蠅爲害有密切的關係，茲將在本次試驗之三種生育不同果實間之被害情形列如下表。

表四：果實生育程度與瓜實蠅被害關係

瓜果產育程度 \ 被害程度	產卵畸形果數 個	百分率 %	腐爛果數 個	百分率 %
花果期	279	62.14	103	43.28
幼果期	150	33.41	71	29.83
熟果期	20	4.45	64	26.89
合計	449	100.00	238	100.00

瓜果生育程度之不同與瓜實蠅之爲害有密切的關係，即瓜果組織最嫩之花瓜被害本最高，被產卵或成畸形者竟有62.14%，腐爛率占腐爛全果數之43.28%，次爲幼果，熟果期之被害率最低，產卵率僅有4.45%，且被產卵者均係受外傷而後複被產卵者，由此可知瓜皮之軟硬及薄厚有直接或間接的抑制瓜實蠅之產卵。

第二次防治試驗

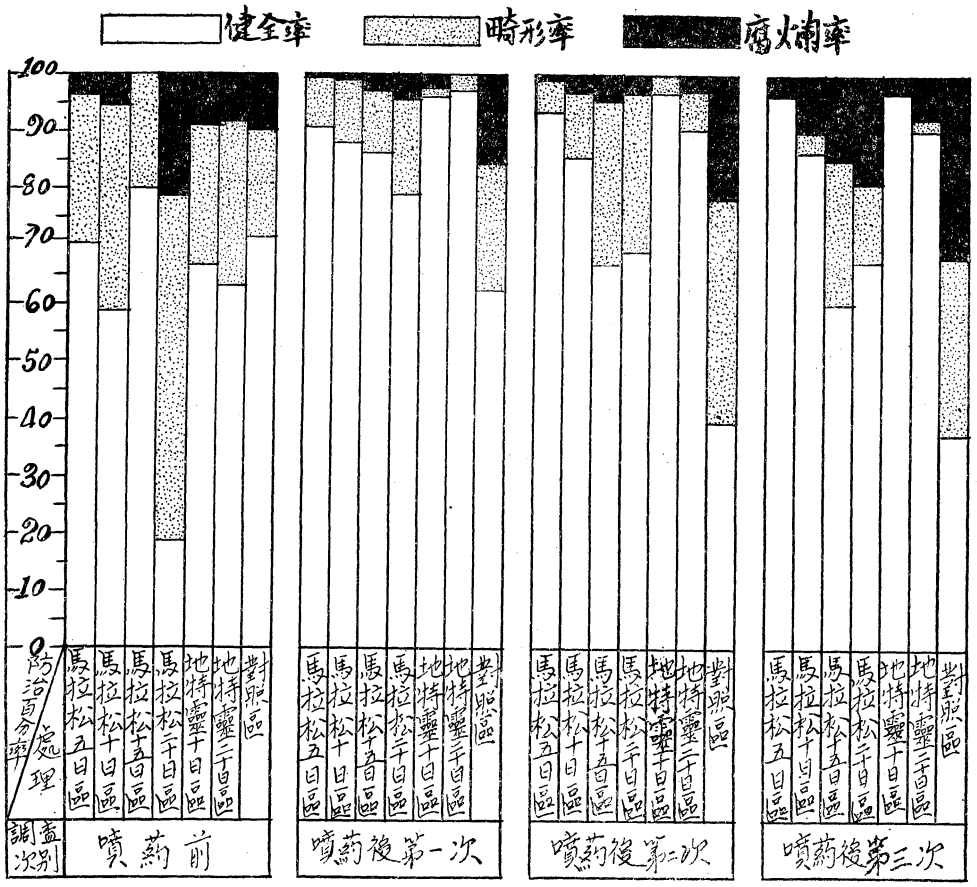
第二次防治試驗舉行於46年6月間，鑒於第一次防治試驗水解性蛋白質之效果優越，本次仍增强引誘劑之濃度測定有效之施藥日期。

一、試驗方法：

所用藥劑爲水解性蛋白質（1～400）加25%馬拉松可濕性粉（1～400）及水解性蛋白質（1～400）加50%地特靈可濕性（50% Dieldrin W.P.）（1～800）兩種，噴藥日期馬拉松區分5, 10, 15, 20日之四噴藥期及對照，地特靈區分10及20日二噴藥期。噴藥方法，均採用隨機噴藥法，於施藥前先調查被害情形一次，施藥開始後，每隔10日調查防治效果一次，調查方法同前。

二、試驗結果：

1. 各處理間藥效調查結果：茲將各處理在噴藥前之被害情形及噴藥後之歷次防治效果列如下圖。



圖二：第二次防治試驗歷次調查結果

第二次試驗恰逢南部之雨期，因此各處理均因雨未能如期開始，由圖知在噴藥前各處理均已發生相當高之被害率，尤其馬拉松20日區竟有80%以上之被害果，但自第一次噴藥後各處理被害率均驟然減少，六種處理中，地特靈10日區防治效果最優，每次調查之健全果數均在96%以上，被害腐爛僅有3%左右，馬抱松5日區與地特靈20日區防治效果稍爲相近，平均健全果數92%，而被害果爲7至8%。馬抱松10日區於第三，15及20日區之防治效果較差，對照區之被害率逐日增加，健全果數逐漸減少，噴藥前之健全果爲71.79%，第二次調查爲62.30%，至第三次減至34.20%，第四次則37.11%，被害果竟增至63%。

2. 累集結果：自噴藥後每次調查防治效果之累集結果如表五。

表五：第二次防治試驗結果統計

處理	調查次數	株數合計	果數總個	健全果百分率%	畸形果百分率%	腐爛果百分率%	健全果指數	備註
馬拉松五日區	3	150	317	92.43	5.68	1.89	211	因排水缺佳，第四次調查時瓜園積水致瓜株萎凋枯死。
馬拉松十日區	4	200	431	87.78	7.74	4.48	201	
馬拉松十五日區	3	150	270	72.96	20.74	6.30	167	患毒素病最重，至第二次施藥時已廢耕。
馬拉松二十日區	3	150	302	72.52	20.20	7.28	166	

地特靈十日區	4	200	464	96.34	1.94	1.72	220
地特靈二十日區	4	200	388	92.53	4.38	3.09	211
對照區	4	200	441	43.77	29.71	26.52	100

由表知地特靈與馬拉松之防治效果有極明顯的差異，即地特靈十日區共噴藥三次調查四次之平均防治效果竟至96.34%，二十日區共噴藥二次調查四次之結果仍有92.53%，尙不遜於馬拉松五日區，至於馬拉松之十，十五，二十日等區隨噴藥時間延長而防治效果遞減。由此可知防治瓜實蠅仍以殘毒期間長久之效果爲優。

據本次試驗調查六處理中僅地特靈十及二十日區有採收成熟果(大瓜)，其每10公畝產量，十日區竟有1,920公斤，二十日區有1,500公斤，馬拉松各區均採收花瓜，其五日區爲900公斤，十日區爲720公斤，對照區爲570公斤，且對照區570公斤中，據調查健全果百分率爲43.77%，而據瓜農自己之收穫出賣實績言僅有40%，故收益不够肥料費之支出，又該區留有300個採種瓜果，自花果期以套袋法防止被害（產卵），但至紙袋不能容納，而瓜果露出後仍有多數被害而腐爛者，300個果實中僅採成50個，由此可知防治瓜實蠅具有極大經濟價值。

第三次防治試驗

1. 試驗方法及結果：

第三次防治試驗在46年9月開始，於本分所舉行，以產量測定藥效以求更確實之防治效果及經濟價值，應用藥劑及濃度同於第二次試驗，噴藥期則自胡瓜開花後每隔10日施藥一次，並在幼苗期以50%好速殺（Orthocide）可濕性粉液400倍防治露菌病，至開始防蟲時（開花期）則殺蟲劑及殺菌劑混合噴射，在胡瓜生育期間共噴藥五次（殺菌劑噴射四次）每次噴藥前日及噴藥後五日各採集瓜果一次，均採收大瓜爲主，同時分稱各處理間之健全，被害畸形及被害腐爛果產量，每處理相距間隔200公尺以上，每區面積爲0.6公畝，栽培品種爲黑刺晚生種，栽培管理法同於一般農家，茲將試驗結果列如表六。

表六第　三次防治試驗結果

處理	試驗面積(公畝)	產量(公斤)	每10公畝平均產量(公斤)	健全果		被害畸形果		被害腐爛果		噴藥次數	噴藥量公升	每10公畝每次平均噴藥量公升
				產量(公斤)	百分率(%)	產量(公斤)	百分率(%)	產量(公斤)	百分率(%)			
水解性蛋白質400倍加地特靈800倍	0.6	241.46	4,024	229.94	95.23	8.56	3.55	2.96	1.22	5	10.8	36
水解性蛋白質400倍加馬拉松400倍	0.6	207.83	3,464	185.82	89.41	9.56	4.60	12.45	5.99	5	10.8	36
對照區	0.6	79.60	1,319	21.44	27.08	40.45	51.10	17.27	21.82	0	0	0

由表六可知水解性蛋白質加殺蟲劑地特靈或馬拉松防治瓜實蠅效果極優，尤以地特靈爲佳，即以產量比較地特靈區共收241.46公斤，較對照區之79.60公斤相差3倍之多，而馬拉松爲207.83公斤，較對照區亦相差2.6倍，至於各處理間之防治效果仍爲地特靈較馬拉松爲優，即地特靈健全果有95.23%，被害畸形果爲3.55%，被害腐爛果僅有1.22%，馬拉松之健全果爲89.41%，畸形果4.6%，腐爛果5.99%，對照區健全果僅有27.08%，被害畸形果51.10%，被害腐爛果有21.82%之多。

惟地特靈因殘毒期長，而胡瓜多以生食爲主，尤其花瓜均不除皮故地特靈之應用對于人體有缺安全之嫌。

2. 防治瓜實蠅之經濟價值：爲明瞭防治瓜實蠅之經濟價值計特將防治區與對照區之收支情形列如表七。

表七：處理間收支比較

處理	每10公畝平均產量(公斤)	健全果		被害畸形果		被害腐爛果		健全果每公斤一元計算所得收益(元)	畸形果每公斤一元計算所得收益(元)	每10公畝收入總計	每10公畝防治費用(元)	淨利(元)
		產量(公斤)	百分率(%)	產量(公斤)	百分率(%)	產量(公斤)	百分率(%)					
水解性蛋白質 400 倍加地特靈 800 倍	4,024	3,832	95.23	142.8	3.55	49.2	1.22	3,832.00	71.4	3,903.4	110	3,793.4
水解性蛋白質 400 倍加馬拉松 400 倍	3,464	3,097.2	89.41	159.3	4.60	207.5	5.99	3,097,2	79.6	3,176.8	110	3,066.8
對照區	1,319	357.2	27.08	674	51.10	287.8	21.8	357.2	337	694.2	0	694.2

由表可知防治區與對照區之收益差異極大，即地特靈每分地收入有3,903.4元，馬拉松爲3,176.8元，除去防治費用尙有3,793.4元至3,066.8元之淨利，較對照區之 694.2之相差有 5.6 至 4.6 倍之多，防治費用以藥劑90元（即水解性蛋白質及馬拉松各一磅按市價計算之）噴藥工資20元計算之。

摘　　要

1. 瓜實蠅爲胡蘆科蔬菜之重要害蟲，在臺灣之被害作物有胡瓜、越瓜、絲瓜、甜瓜、西瓜、南瓜、冬瓜、苦瓜、扁蒲等，尤以胡瓜越瓜及絲瓜之被害嚴重，本文乃應用數種新藥劑所作之防治試驗結果。

2. 馬拉松25%可濕性粉劑 400 倍及 600 倍液對幼小胡瓜有輕微藥害，800 倍液則甚爲安全，但 400 倍液對大株無藥害。

3. 第一次試驗以誘引劑水解性蛋白質 (Protein hydrolysate) 800 倍加殺蟲劑25%馬拉松粉 (25% Malathion W.P.) 400 倍及甲基丁香油 (Methyl eugenol) 加 Dipterex 二種藥劑，分誘殺，保護法及隨機噴射之三種不同處理比較防治效果，結果以水解性蛋白質加馬拉松隨機噴藥法防治效果最優，保護法及誘殺法均不理想，噴藥期則爲 7 日一次者爲優。

4. 甲基丁香油對瓜實蠅無誘引效果，但對果實蠅之雄蟲誘引力極强。

5. 防治瓜實蠅50%地特靈可濕性 (50% Dieldrin W.P.) 較馬拉松爲優，馬拉松具有速效性，但效力持久性極短，地特靈之效力稍遲，但可維持較久之期間，馬拉松各處理中，以五日噴藥一次區最優，但地特靈20日區尙有過之，惟因其殘效力長，故不宜用於蔬菜上，但可施用於土中，以防治瓜實蠅幼蟲之化蛹及羽化。

6. 瓜實蠅之發生與氣溫之關係至大，冬季栽培胡瓜時瓜實蠅較少，爲用馬拉松防治可以 7 至 10日施藥一次，若於夏季可以 5 日一次均可圓滿防治瓜實蠅之爲害。

7. 以產量測定防治效果具有莫大之差異，馬拉松區每10公畝有 3,464公斤，對照區僅有 1,319公斤，故防治區產量較對照區相差有 2.6倍之多。又馬拉松區健果爲89.14%，對照區僅有27.08%，故防治區較對照區相差高達 3.2倍。

8. 防治瓜實蠅仍有極大之經濟價值，即防治區每10公畝收益（淨利）有3,066.8元，而對照區僅有 694.2元，相差 4.6倍之多。

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STUDIES ON MELON FLY CONTROL

by

K. H. CHEN

SUMMARY

1. Melon fly, Dacus cucurbitae Coq. is a serious vegetable insect of the family Cucurbitae. Its hosts contains cucumber, oriental pickling melon, ray gourd, melon, water melon, pumpkin, wax gourd, balsam pear. Among them, the infestetion of cucumber, oriental pickling melon and ray gourd are the most favourable. The following results are the report of using some chemicals against this pest.

2. 400 and 600 dilution of malathion 20% w. p. had been tested on young cucumber foliage it showed some scorch but 800 dilution was the safest to the young foliage and 400 dilution being very safe to the old one.

3. In the first experiment 800 dilution of protein hydrolysate plus 400 dilution of malathion 25% w. p. and methyl eugenol plus dipterex used as attractant, guard spray and randomized spray separately. The results showed that guard spray was much better than remaining two treatments and 7 day intervals was the best of getting sound fruits and high yield.

4. Methyl eugenol showed as not an attractant for melon fly but it was an outstanding attractant of fruit fly, Dacus dorsalis Hendel.

5. For controlling melon fly dieldrin 50% w. p. seemed to be better than malathion 50% w. p. but malathion had a quick killing activity but lacked of long residue effect. Killing action treatments 5 day intervals application was the best but 20 day intervals of dieldrin application seemed not so inferior. However, its residue was too long therefore it could not be used on vegetable, but it could be used as soil treatment to prevention of maggot pupation and emergence.

6. Seasonal infestation of melon fly and temperature showed having much interrelation. Melon fly infestation of winter crop of cucumber was not so heavy, 7 or 10 day intervals application was enough but in summer crop it had to be shortened to 5 day intervals application both of them getting the complete control.

7. According to the yield test had a significant differences among different treatments. Malathion 10 day intervals application had 3464 kg, but in check 1,319 kg only. So far as the control treatment was 2.6 times of yield increased than the check. The sound fruit of malathion treatment was 89.14% and 27.08% only in the check, in other words, 3.2 times of sound fruits increased as compared with the check.

8. It had a tremendous economic value of melon fly control, the profit of one tenth hectare had N. T. $ 3,066.8 in treatments and 694.2 in the check as well as in differences 4.6 times of profit in controls.

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