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稻改良試驗及其他研究報告書

福州電氣公司農村電化部報告第二卷第一號

Report on Experiments for Improving Rice Cultivation and Other Studies.

Bulletin

of The

Department of the Rural Electrification, Foochow Electric Co., LTD.

本地稻作，尚無確實數字的統計，然自經營者人數，耕地面積，及生產價格等各點觀之，實占本地生產業最重要之位置。稻作之盛衰，影響于社會之文化及經濟殊大，此種現象，不僅本地如是，卽全省全國，亦莫不皆然。

斐列濱，伊大利，日本等產米諸國，政府或民間之有力者，設立農事試驗場，而行米種之改良及栽培學上之試驗，以謀優良品種之普及，並奬勵人民，利用試驗成績，或興水利，提高栽培能率，擴張耕地，始終一貫，力圖米穀之增收及品質之向上，是故劣質者變爲優良，不足者趨于富裕，一國之糧食政策，由是實現，故其加惠于民，誠非淺也。

本報告所記載之福州電氣公司農村電化部水稻改良事業，規模狹小，然本事業來日之興盛，深信無限，茲將農村電化部於民國十九年二十年間所行之水稻改良試驗及其他研究論文，合併發表之。若以此爲社會人士之參攷資料，則幸甚矣。

本報告分爲二篇，第一篇係水稻之試驗。第二篇登載其他研究。第一篇又分爲三章，第一章爲耕種概要，記述本試驗之水稻標準栽培法，及民國十九年二十年兩年間在

本部觀測之氣象記錄。第二章品種改良事業。第三章爲栽培法改良試驗。著者所採用之品種改良及栽培法試驗意見，已在『本地水稻改良之意見』篇內，述其概要，今附錄于末，藉作參照，至第二章及第三章內容，亦略加說明焉。

品種改良事業

(一)、本地品種之改良。　先調查本地水稻品種之特性，藉得確實認識本地之水稻，本研究係獨立論文。題曰 "An Investigation of Varieties of Rice in Foochow" 記載于第二篇。至純系淘汰方法，係由過去三年間品種比較試驗中之成績優良者，選擇早晚稻各二種，以求其純系，今將其過去二年之經過發表之。

(二)、外地優良品種之試驗及繁殖。　輸入外地良質多收之品種，而行栽培試驗，擇其成績優良者繁殖之，其試驗成績，述之此項。

栽培法改良試驗

(一)不混作法之研究　本項係不混作法之研究，卽以本地慣行之早晚混植之混作栽培法，代以早晚分植之不混作法是也。茲將不混作法之研究發表，並記載農家實地利用本法之成績。

(二)不混作栽培法栽培條件之研究　本項係記述不混作栽培法栽培條件之研究，又爲欲明瞭本地水稻品種與外地水稻品種性質之差異，故兼行兩者之比較，本研究包含下列三試驗。一、耐肥試驗。二、播種期及移植期試驗。三、播種期移植期及秧地日數試驗。

(三)混作栽培法之研究　本項專就本地慣行之混作栽培法之改良而行試驗。記載下列三試驗。一、栽植株數及肥料用量增加試驗。二、混作法外地品種之栽培試驗。三、一年一回耕作之試驗

(四)三要素及其他肥料試驗　本項專記以 Wagner 肥料試驗用植木鉢所行之肥料試驗。

第二篇記載獨立研究論文六篇，除最後柑橘肥料試驗一篇外，餘均以英文記之。

(1) **An Investigation of Varieties of Rice in Foochow**
福州水稻品種之調查報告

(2) **A Study of the Preservation of Rice**
米穀貯藏試驗

(3) **An Experiment in Using Potash as Added Fertilizer for the *Eleochxis Dulcis* or Water Chestnut**
荸薺(尾梨)鉀質肥料施用試驗

(4) **An Experiment in Catching Rice Moths by Light Traps**
誘蛾燈試驗

(5) **An Agricultural Survey of KeKung Village**
科貢鄉農事調查報告

(6) 柑橘肥料試驗
An Experiment of Fertilizing Orange Trees

上列水稻改良試驗及其他各研究，均得邱金枝，樓金寶，宗敦孝，章萬榮，余漢傑，羅估，諸君助力，英文論文之構成多得 *Charles L. Storrs* 先生之指教又，本報告之編輯多煩樓金寶君之勞，著者特此誌謝。

中華民國二十一年四月十二日

陳振鐸識

PREFACE

This report is on the agricultural experiments which were done in the Agricultural Experiment Station of the Department of Rural Electrification of the Foochow Electric Company in the years 1930 and 1931. It is divided into two parts. The first records experiments with rice. It contains the work of improving rice seed in Foochow and the experiments on the methods of cultivation in order to get better crops for the farmer. The second part contains six independent studies.

The first part is divided into three chapters.

The first chapter describes the standard method of cultivation for the rice experiments in this report, and gives the record of meteological observations in the years 1930 and 1931, taken at this Experiment Station.

The second chapter is on the improvement of rice seed. It is divided into two sections.

(1) The Improvement of the Local Variety of Rice

In order to get accurate knowledge of the local varieties of rice, we made an investigation. The results of this study are in the paper: "An Investigation of the Varieties of Rice in Foochow." At one time I had all of the local varieties of rice cultivated, and selected those which are good in yield and quality, and used them for a pure line selection. This section states the work in pure line selection in the past two years.

(2) An Experiment in the Cultivation of Non-Local Varieties of Rice and in Crossing them with Local Varieties

In order to get improved rice seed, we collected several varieties of imported rice, and experimented in the effect on them of our climatic conditions, selecting those which were of good yield and quality for the work of crossing. This experiment is described in this section.

The third chapter is a study of the methods of rice cultivation. This is divided into four sections:

(1) A Study on the Method of Separate Planting of Early and Late Rice (A New Method)

The local method in cultivating rice is to plant the later rice in the intervals between the stands of the early rice. The early rice and the late rice are planted alternately in the same field from early in May to the end of July, when the early rice is harvested. So there is a forced and inequal absorption of the nourishment in the field and the sunlight between rows; the early rice and the late rice, in their vegetative period is impeded. This method is also inconvenient for working and very uneconomical from the viewpoint of using the natural resources of sunlight, water, and nourishment in the soil. In contrast with this method, we studied the method of planting separately. Early rice and late rice were planted separately, as is widely done in the south of China and in Formosa. Using this method, only an improved early rice was planted in early February, and after the harvest of it in July, the field was again plowed and fertilized, in order to plant the late rice. In this report are recorded the results of planting separately,—the new method,—and an experiment where the farmer followed this method by himself in his own field.

(2) A Study of the Conditions of Cultivation, Applying the Method of Planting Separately

To discover the best conditions for getting larger crops in the case of

applying the method of planting separately we made this experiment. At the same time, we made a study of the characteristics of local varieties of rice by cultivating them in the various conditions, and made comparison with the imported varieties. This section contains: (1) Fertilizer bearing experiment (2) An experiment to learn the time for sowing and for transplanting (3) An experiment on times of sowing, transplanting, and feeding

(3) A Study of the Usual Local Method of Culti vation by Alternate Planting

With this method, which is habitually used by farmers in this district, there is still great room for improvement. The object of this experiment is to learn methods to promote the yield and to raise efficiency in working the field. In this section there are (1) An experiment in the number of plants for transplanting and in the quantity of fertilizer to be used (2) An experiment in applying the local method of cultivation to the imported varieties of rice (3) An experiment in cultivation of rice once a year

The forth section is an experiment with fertilizer. Using the Wagner plots, we made an investigation of the fertility of different soils in the vicinity of Foochow, in order to know the quantity of fertilizer that should be used. At the same time, we made a study to determine the quantity of fertilizer to be used for the local and the foreign varieties of rice.

The second part contains the following six independent studies. These are written in English, except the last one, which is in Chinese.

(1) A Study of Varieties of Rice in Foochow.

(2) A Study of the Preservation of Rice.

(3) An Experiment in Using Potash as Added Fertilizer for the *Eleochxis Dulcis* or Water Chestnut.

(4) An Experiment in Catching Rice Moths by Light Traps

(5) An Agricultural Survey of KeKung Village.

(6) An Experiment in Fertilizing Orange Trees.

It is very rare that a private electric company is found doing agricultural improvement for the local place and people. The manager of the department of rural electrification, Mr. C. L. Liu, and the staff of company have great enthusiasm for this public work; and kindly guided and encouraged my work in the experiment station. In doing these experiments, I was assisted by Messrs K. C. Kiu, K. P. Low, S. T. Sung, W. J. Chang and I Lo. Here I express my hearty thanks to my seniors and coworkers. In editing of these papers I was helped by Mr. Charles L. Storrs. For his kindness I wish to express my sincere thanks.

Agricultural Experiment Station, Foochow Electric Co., LTD.,

April, 1932.

C. T. CHEN

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第一篇

FIRST PART

FIRST PART

第一章　耕種概要

THE STANDARD METHOD OF CULTIVATION

本部採用之水稻耕作法有二，一爲混作法，即本地從來之法。一爲不混作法，即本部所改良研究之新式法也(報告第一號已有記載)。今將兩法之耕種概要一一述之。

(一)　不混作法(新式法)

第　一　期　作

秧　地。

(1)　防風設備。　秧地之西北首設高一丈五尺之防風牆。

(2)　整地。　十二月下旬，將準備之用地，耕耙數次(以深耕犁耕之)。一月下旬灌水後，以刈耙，手耙，蓋筒，均平地面。苗地之床幅爲四尺，溝幅一尺，作短册形之秧田。

(3)　浸種。　本地種二晝夜，外國種四晝夜，二月十七日起浸種，本地種遲二日。

(4)　萌芽。　第一日。　午後五時浸水完畢後，卽入米籠，僅以相當于種子半量之攝氏52° 溫湯，灌注攪拌，並將麻袋藁稈爲保溫裝置，安置於室隅。

第二日。　午前九時與第一日同，灌湯攪拌，午後五時亦如之。

第三日。　午前九時僅攪拌種穀，午後五時灌注攝氏18° 之冷水，並攪拌之，放置至翌晨。

第四日。　午前九時適經二晝夜半，其時根芽之子芽伸長二。三分，子根四。五分，卽可供播種之用矣。

（5）播種。　二月二十五日，每平方米播0,35立升，以土鎭壓之，使穀不見爲度，然後覆以木灰。

（6）肥料。　肥料施用之種類及分量如下。

每 Are 之量 (Kg.)

肥料名	基肥	追肥	計	N	P_2O_5	K_2O
廐肥	6o Kg.		60	0,348	0,180	0,300
豆餅	5	4	9	0,568	0,099	0,142
硫酸鈺	0,5	1	1,5	0,300		
過燐酸石灰	2,9				0,500	
藁灰	8,9				0,187	0,400
計				1,216 kg	0,966 kg	0,842kg

藁灰施于整地之時，其次施基肥。硫酸鈺應用于生育之際，而豆餅則在第一回追肥時施之。

（7）管理。　播種後三四日間，每次灌溉，床面常保飽水狀態，如在氣溫降低之夜間，宜灌溉深水。

本田。

（1）整地。　上年十一月間收獲後，犁起土塊，本年一月中旬，再反覆耕鋤之，至二月中旬灌溉後，以手耙，蓋筒，平均地面。

（2）移植。　每平方米十九株，一株五六本，於四月一號至五號間移植之

(3) 肥料。 肥料之施用量如次。

每 10 are 之量 (kg)

肥料名	基肥	追肥	計	N	P_2O_5	K_2O
堆 肥	600		600	3,480	1,800	3,000
豆 餅	30	15	45	2,840	0,495	0,071
硫酸鉀	5,5	10	15,5	3,100		
過燐酸石灰	21		21		3,600	
木 灰	80		80		1,680	7,471
計				9,420	7,575	10,542

(4) 除草。 插秧後經十五日，行第一次除草，以後每隔七日，續行第二，三，四次。

(5) 管理。 插秧後一週間內外，卽行補植，力保淺水。

(6) 收獲。 隨熟隨收。

(7) 乾燥。 收獲之谷，散于Cement之場上，連曬三日，卽可乾燥，然後以風扇選之，除去粃穀之屬。

第 二 期 作

秧 地。

(1) 浸種。 水浸一晝夜。

(2) 播種。 六月二十日，播種法與第一期同，惟不施木灰。

(3) 肥料。 施用第一期作之半量。

(4) 管理 插秧後一週間內外，注意下雨。降雨之時，床面常保深水狀態，以防穀之溢出。晴天時，床面常保飽水狀態。

本　田。

(1) 整地。　七月上旬第一期作收獲後，卽行灌溉，耡起土塊，施用刈耙，同月中旬，再耕鋤之，並用刈耙，手耙，蓋筒，平均地面。

(2) 移植。　七月二十五日至三十一日，每平方米植十七株，每株五本乃至十本。

(3) 肥料。　與第一期作同。

(4) 除草。　插秧後十日左右，行第一回除草，以後每隔五日，續行第二，三，四次。

(5) 管理。　與第一期作同。

(6) 收獲。　隨熟隨收。

(7) 乾燥。　與第一期作同。

(二) 混作法(本地法)

早　作

秧　地。

(1) 整地。　與不混作法同。

(2) 浸種。　三月十七日起浸水晝一夜。

(2) 萌芽。　與不混作法同。

(4) 播種。　三月二十二日，每平方米播0.3 立升，以土鎭壓之，使穀粒不見爲度，然後覆以木灰。

(5) 肥料。　與不混作法同。

（6） 管理。 與不混作法同。

本 田。

（1） 整地。 與不混作法同。

（2） 移植。 四月二十日至二十五日，每平方米植十四株，東西30 cm，南北22,7cm，一株五本乃至十本植。

（3） 肥料施用量。 與不混作法之量同。

（4） 除草。 插秧後七日，行第一回除草，再逾七日，則行第二回。

（5） 管理。 插秧後一週間內外，卽行補植，力保淺水。

（6） 收獲。 自七月中旬至八月上旬間行之。

（7） 乾燥。 與不混作法同。

晚 作

秧 地。

（1） 整地。 十二月下旬，將準備之秧地，耕鋤數次，三月上旬灌溉後，以刈耙，手耙，蓋筒，平均地面。

（2） 浸種。 四月五日起，水浸二晝夜。

（3） 萌芽。 與早作相同，萌芽期爲三日。

（4） 播種。 四月十日，每平方米之播種量爲0,3 立升，以土鎭壓之，使穀粒不見爲度，然後覆以木灰。

（5） 肥料。 與不混作法同。

（6） 管理。 與不混作法同。

本 田。

（1） 移植。 五月十二日前後，植于早稻之田內，混植於早稻間，每平方米植十四株，一株五本乃至十本與早稻成東西15cm之距離。

（2） 肥料。 七月下旬早稻收獲後，依下列之肥料，施用追肥，其成分及分量與早稻同，所異者，僅以硫酸鋅代用堆肥而已。

每10Are 之量 (kg.)

肥料名	基肥	追肥	計	N	P_2O_5	K_2O
豆 餅	30kg	15	45	2,840	0,495	0,071
硫酸鋅	18	15,5	33,5	6,700		
過燐酸石灰	24		24		4,100	
木 灰	134		134		2,820	7,400
計				9,540	7,415	7,471

（3） 除草。 插秧後，經十五日與早稻兼行除草，以後二十日，復行一回

（4） 管理。 插秧後，力保淺水，迨早稻收獲後，即將其葉根等，埋沒土中。

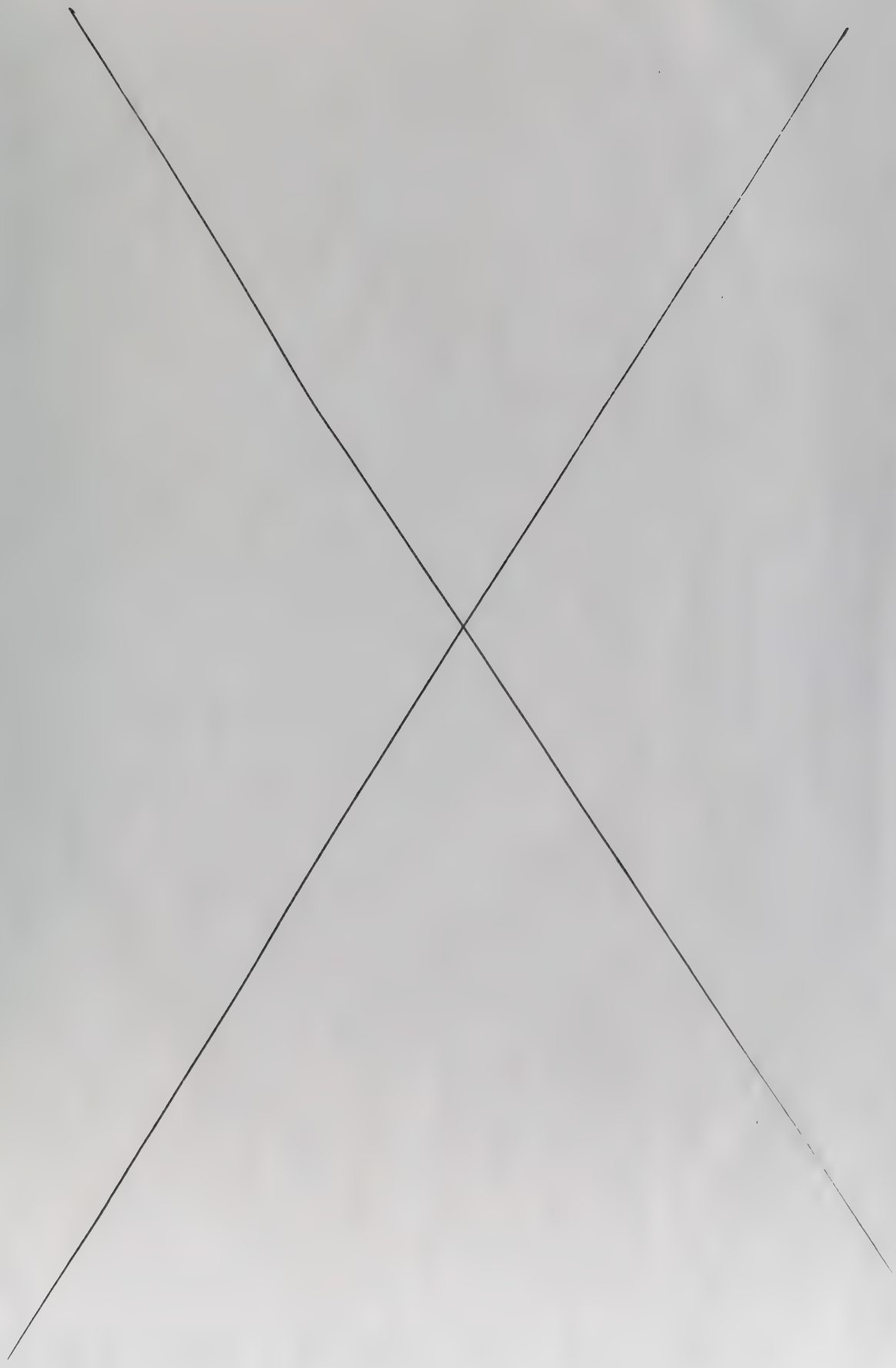
（5） 收獲。 十一月上旬，隨熟隨收。

（6） 乾燥。 與他法同樣。

氣 象 觀 測

THE RECORD OF METEOLOGICAL OBSERVATIONS

民國十九年二十年間本部在福州市新港福州電氣公司觀測之氣象記錄記於第一表



第二章　品種改良事業

AN EXPERIMENT FOR THE IMPROVEMENT OF RICE SEED

第一項　品種試驗

An Experiment in the Varieties of Rice

本試驗專以育成適應本地氣候，土宜，栽培方法及收量品質良好之品種爲目的。其耕種概要，全依不混作法，每區面積爲四十平方米，自民國十七年，從事試驗，迨本年度已閱五載矣。本期十九年第一期作之品種，計三十二種，內本地種十，台灣種七，日本種十五。第二期作計六十種，內本地種八江浙種十九，台灣種十二，日本種二十一。上列各種，皆行比較試驗，其成績請參閱第二表。

二十年第一期作之品種，計一百零七種，內本地種十七，江浙種十八，厦門種六，延平種三、台灣種七、日本種五十六。第二期作計五十二種，內本地種九，江浙種二十四，台灣種十一，日本種八。至其成績，請參閱第三表。

觀試驗結果，知本地種過去四年之成績，早稻以金早，白早最良，晚稻爲青種黃尖，快種黃尖，今更由此品種，選出純系而繁殖之，深信可得優良之成績也。台灣種之第一期作，出穗期概遲，收量品質不佳，惟第二期作之白殼格仔，尙爲適當之品種也。江浙種之早晚稻，在第二期作雖畧有適當品種，然第一期作出穗甚遲，不適於耕作法，且收量亦劣。日本品種中，有適于兩期作之良種，第一期作之稍早生者較良，第二期作之晚生者亦佳，但秧地期間之多少，卽苗齡之大小，影響于生育甚大，故栽培時，宜特別注意及之。

本地氣候，雖適於多種之稻種及各種之栽培法，然以利用最有利之栽培法及最優良之品種，始爲良策，故本試驗皆依不混作法行之。據過去之試驗，畧知本地栽培水稻之條件，苟異日選行品種比較試驗時，對於栽培之條件，實有攷慮之必要，俾使各品種發揮其特性甚爲必要也。又對本地品種之性質據本試驗及後篇An Investigation of Varietes of Rice in Foochow.已得相當之確信矣。

第二項　純系淘汰

An Experiment in the Pure Line Selection

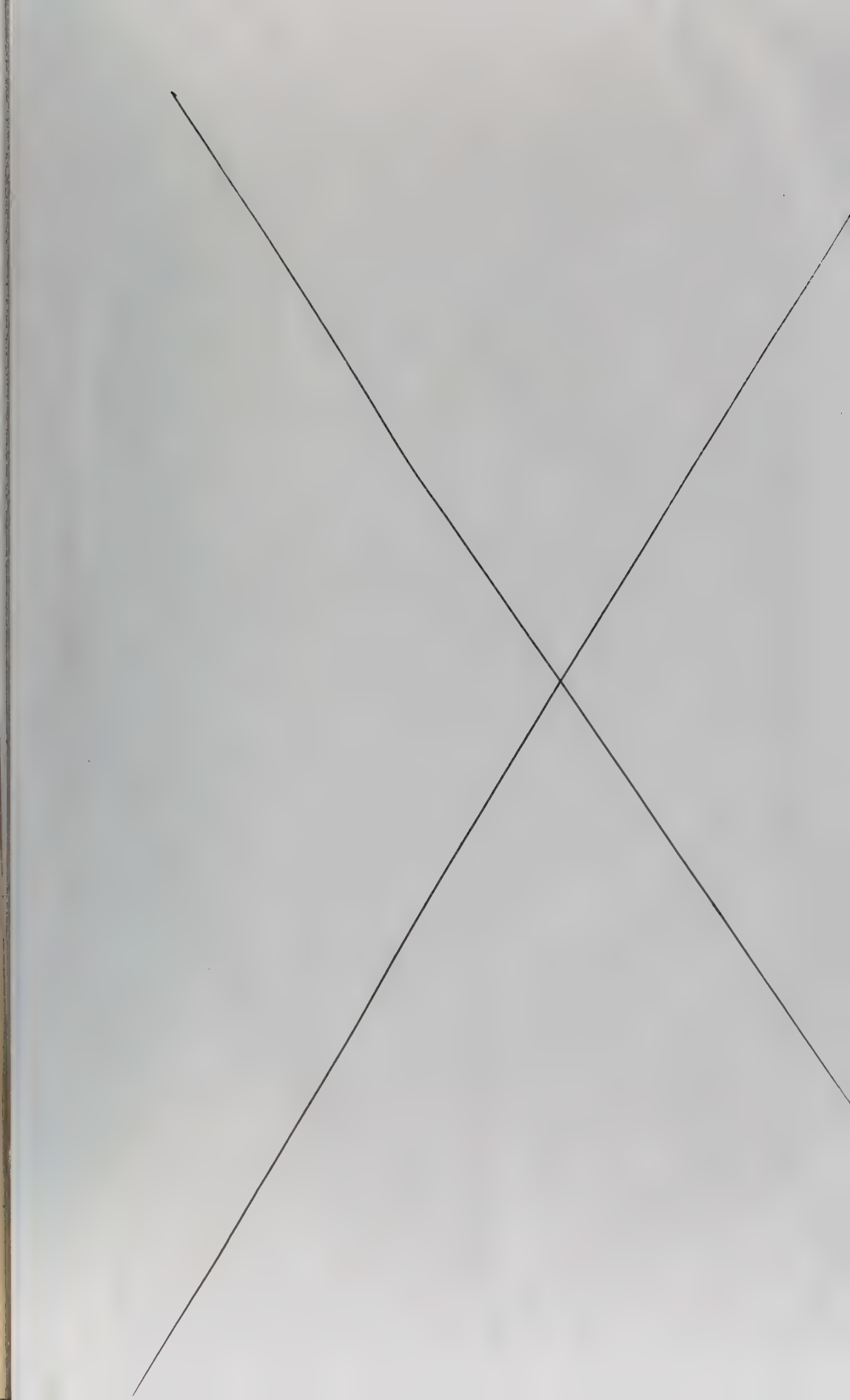
本試驗之目的，係欲由優良水稻品種中，更求優良之系統也。本地種之早稻選金早，白早，晚稻爲青種黃尖，快種黃尖，外地種之早稻選龜尾，早58號，早生大野，晚稻爲白殼格仔。

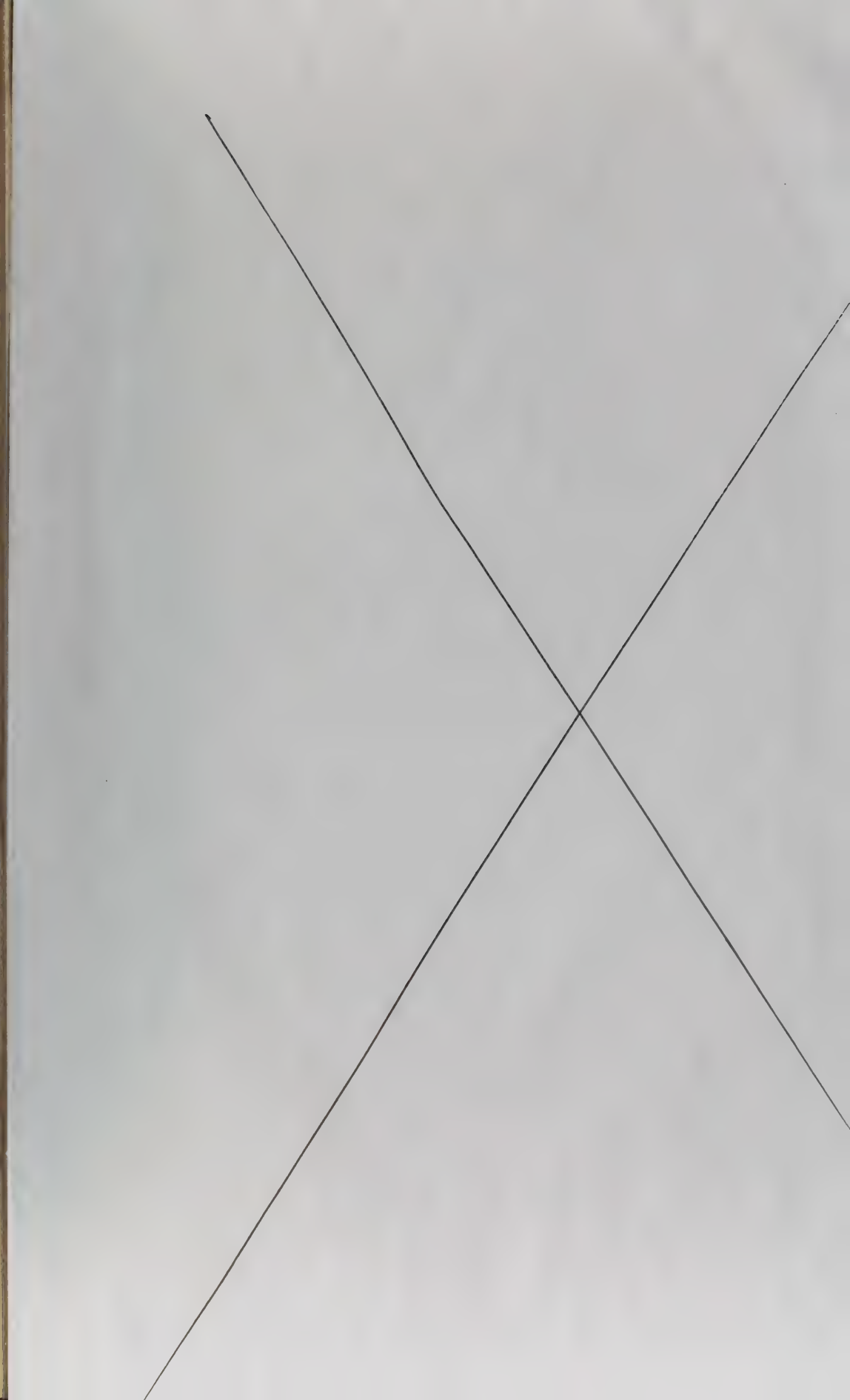
十九年爲第一年分，各品種行一本植，每種爲一千五百個體，經田間觀察後，乃選每種之優良者百系統，以供室內調查之用，其調查結果示於第四表，然後由此結果，更選出下列各系統。

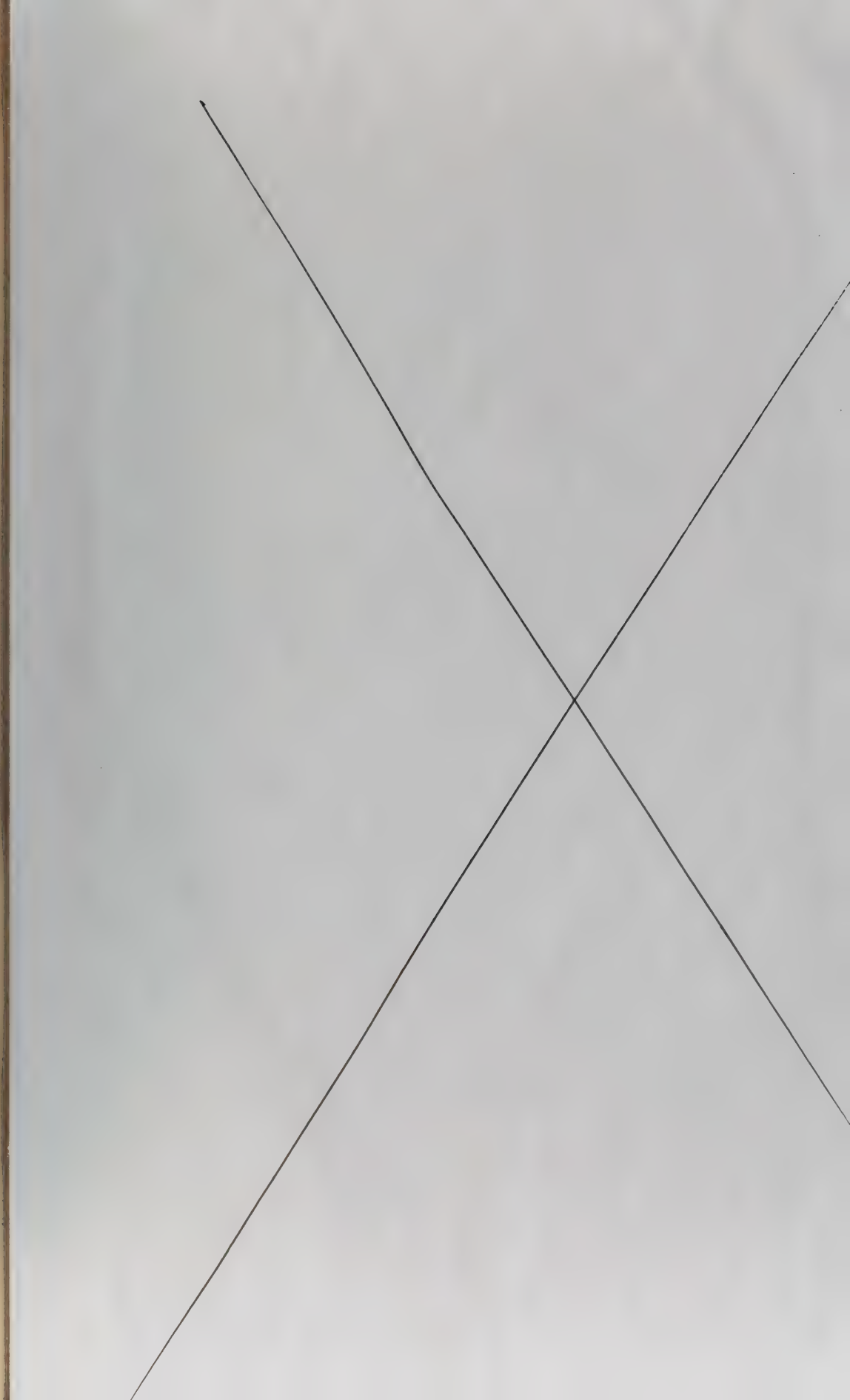
早稻　金早9系統，白早9系統，龜尾9系統，早58號9系統，早生大野6系統，計42系統

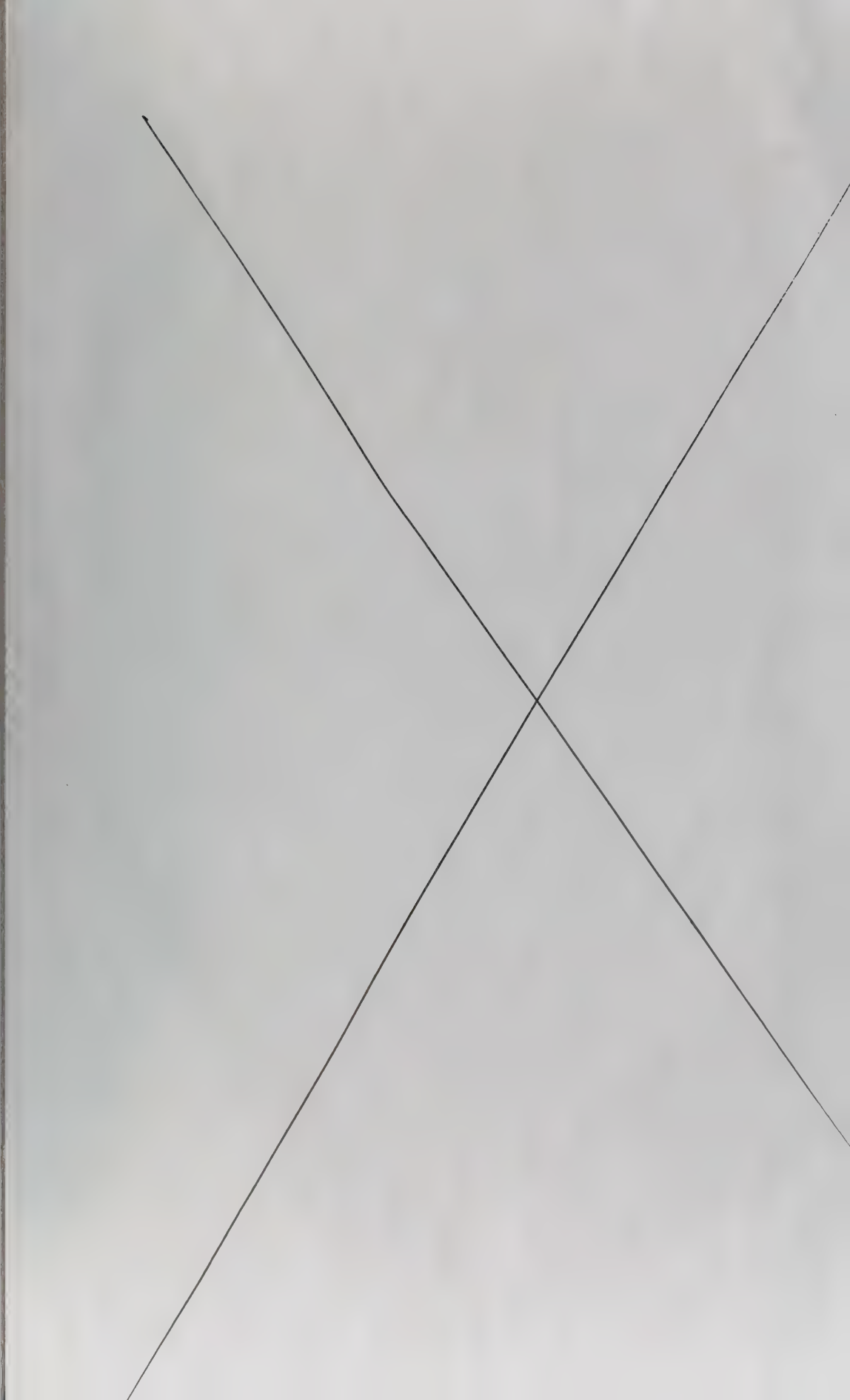
晚稻　青種黃尖30系統，快種黃尖22系統，白殼格仔22系統，計74系統。早晚種合計116系統，

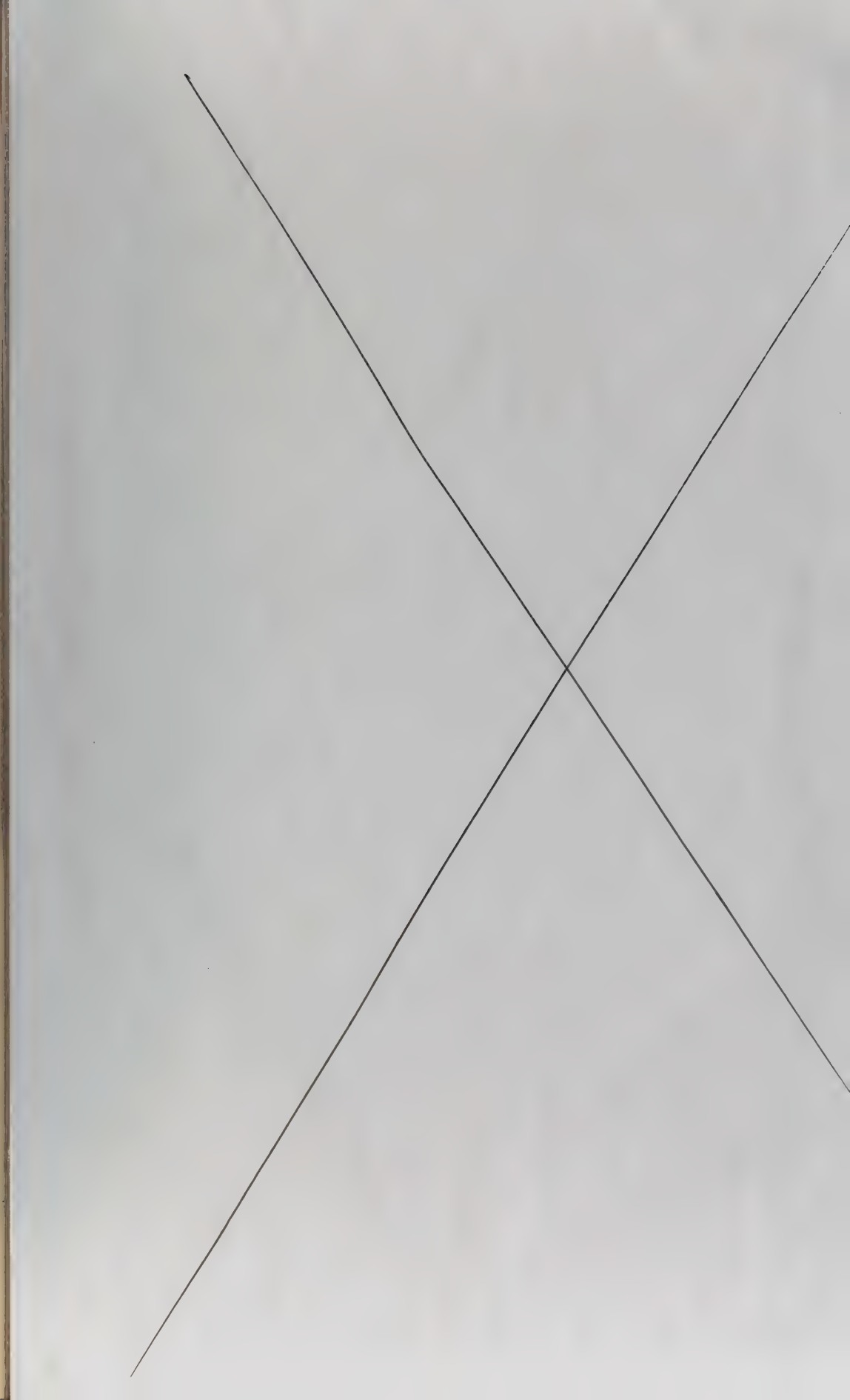
廿年乃行第二年之作業，每一系統，約區劃40平方米，依耕種概要而行一本植，在生育期中，調查生育概況，及收獲後，復調查其收量，其結果示于第五表，由上列之系統，更選擇其良好者，作爲第三年之作業。

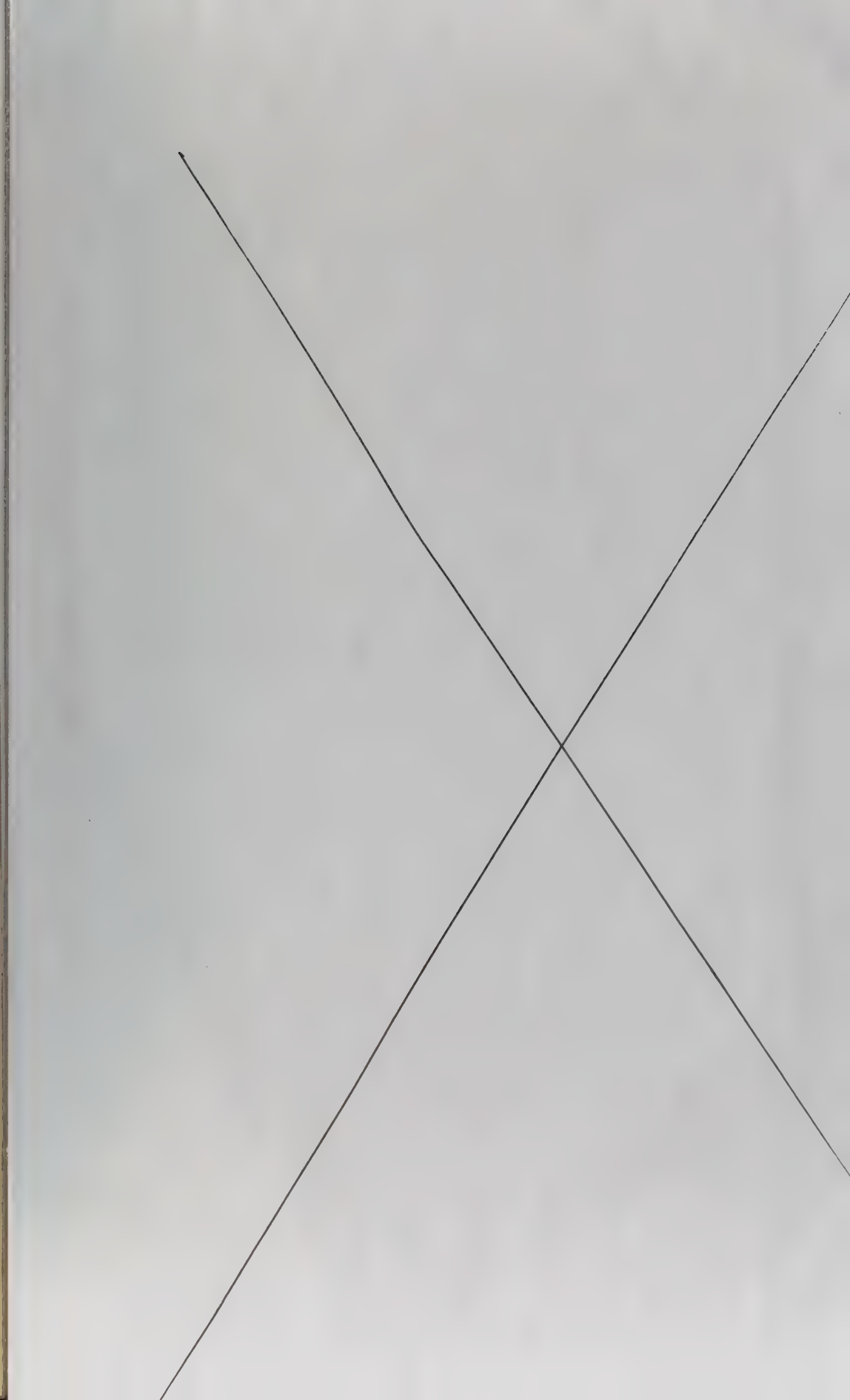


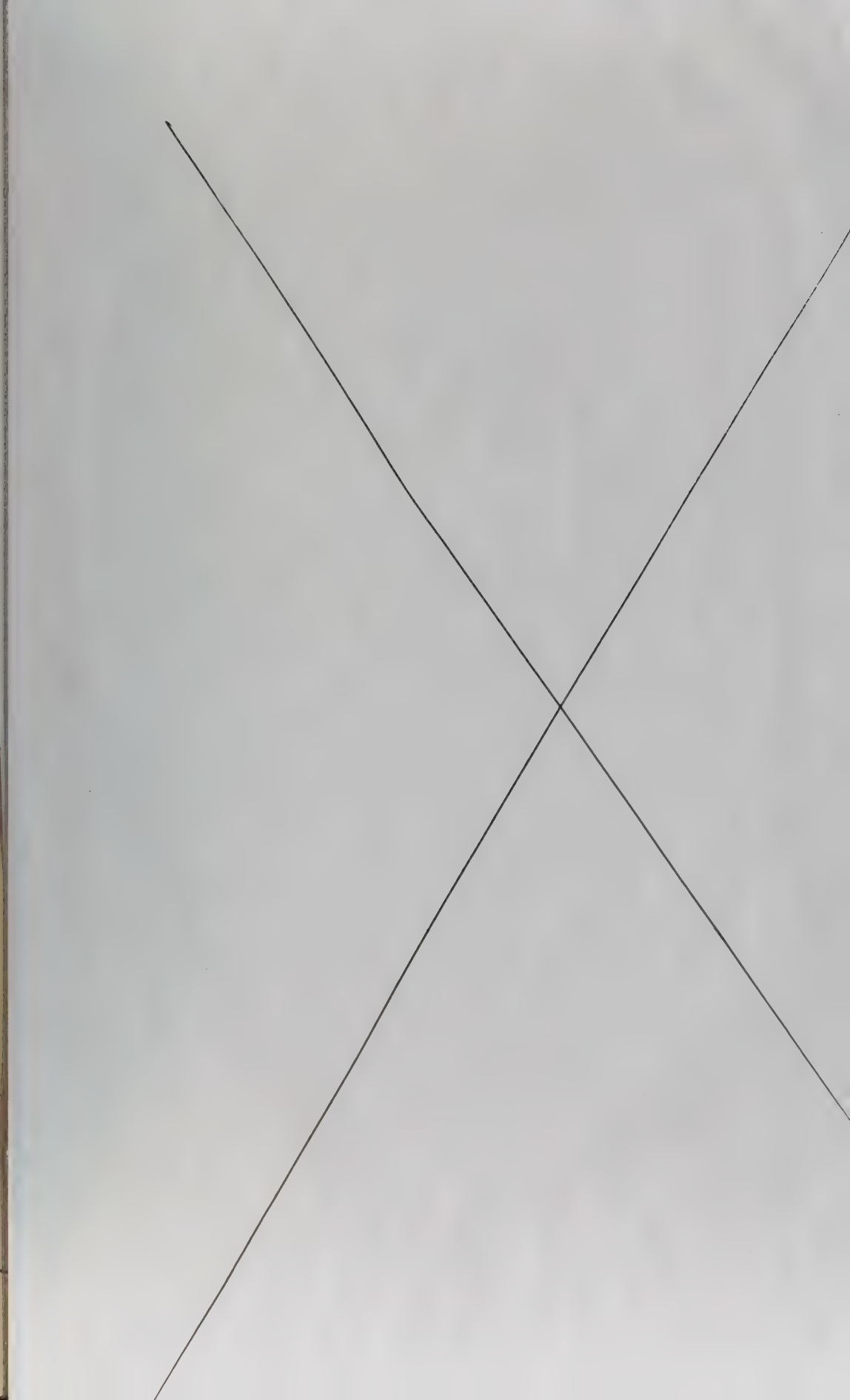


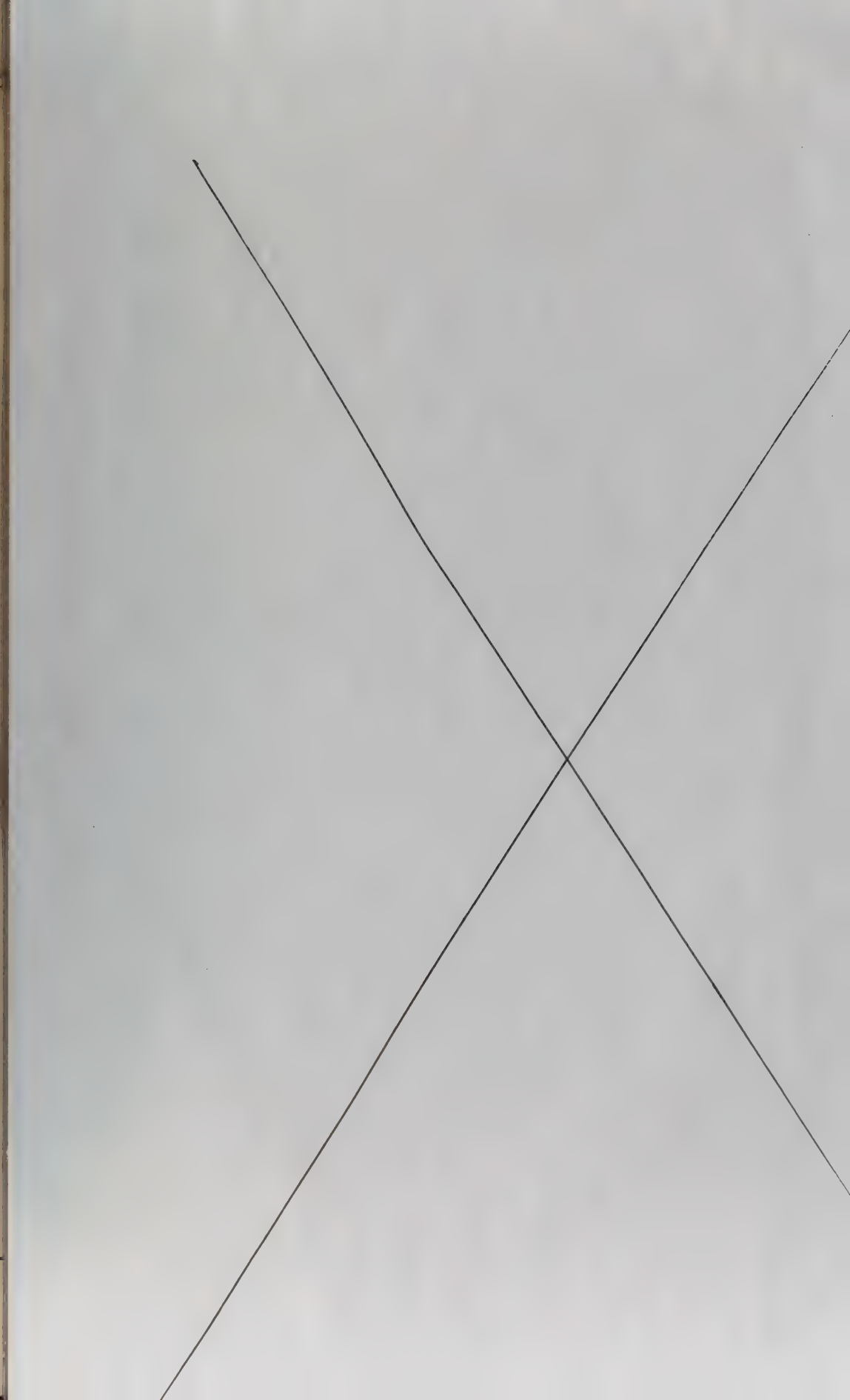


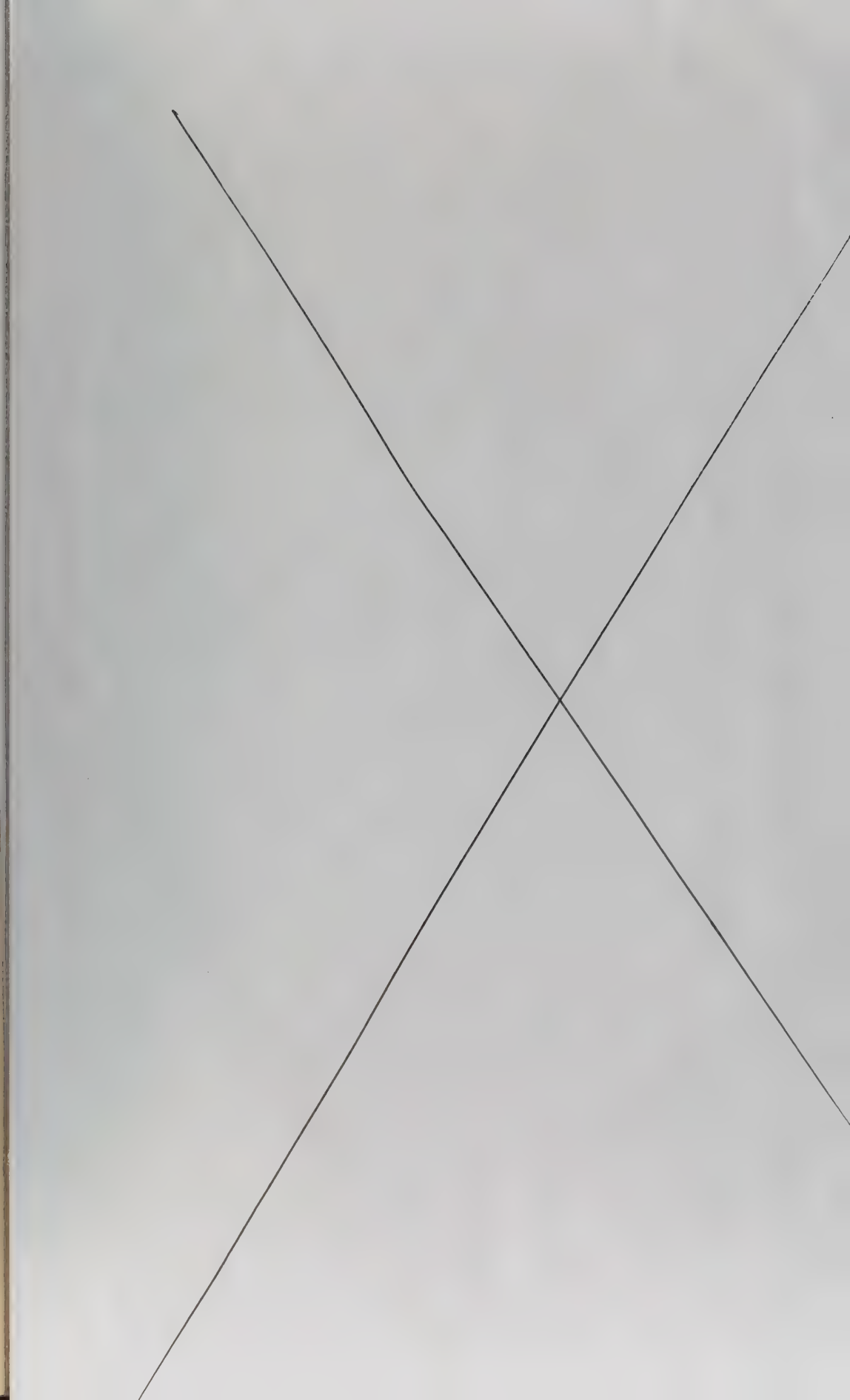


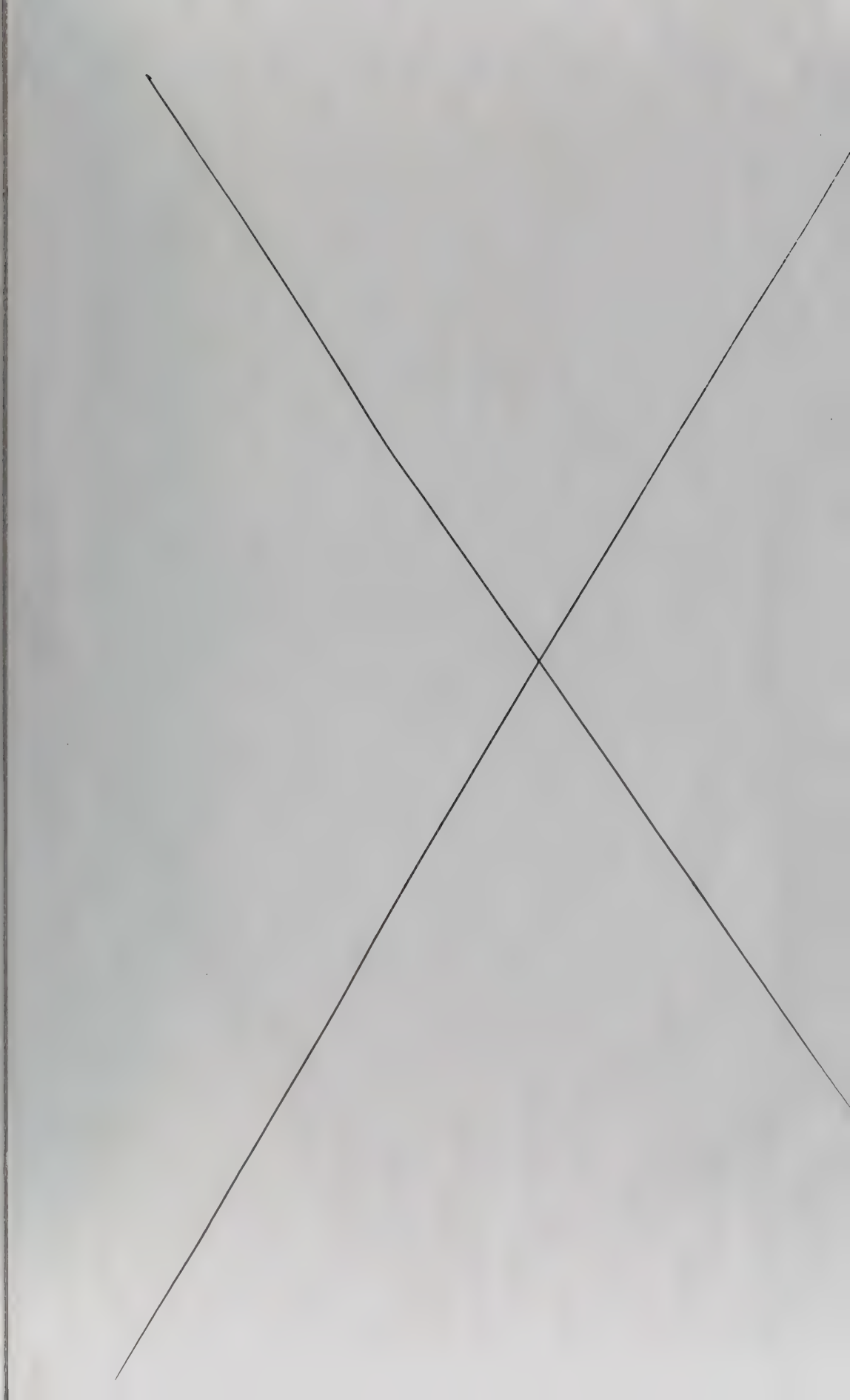


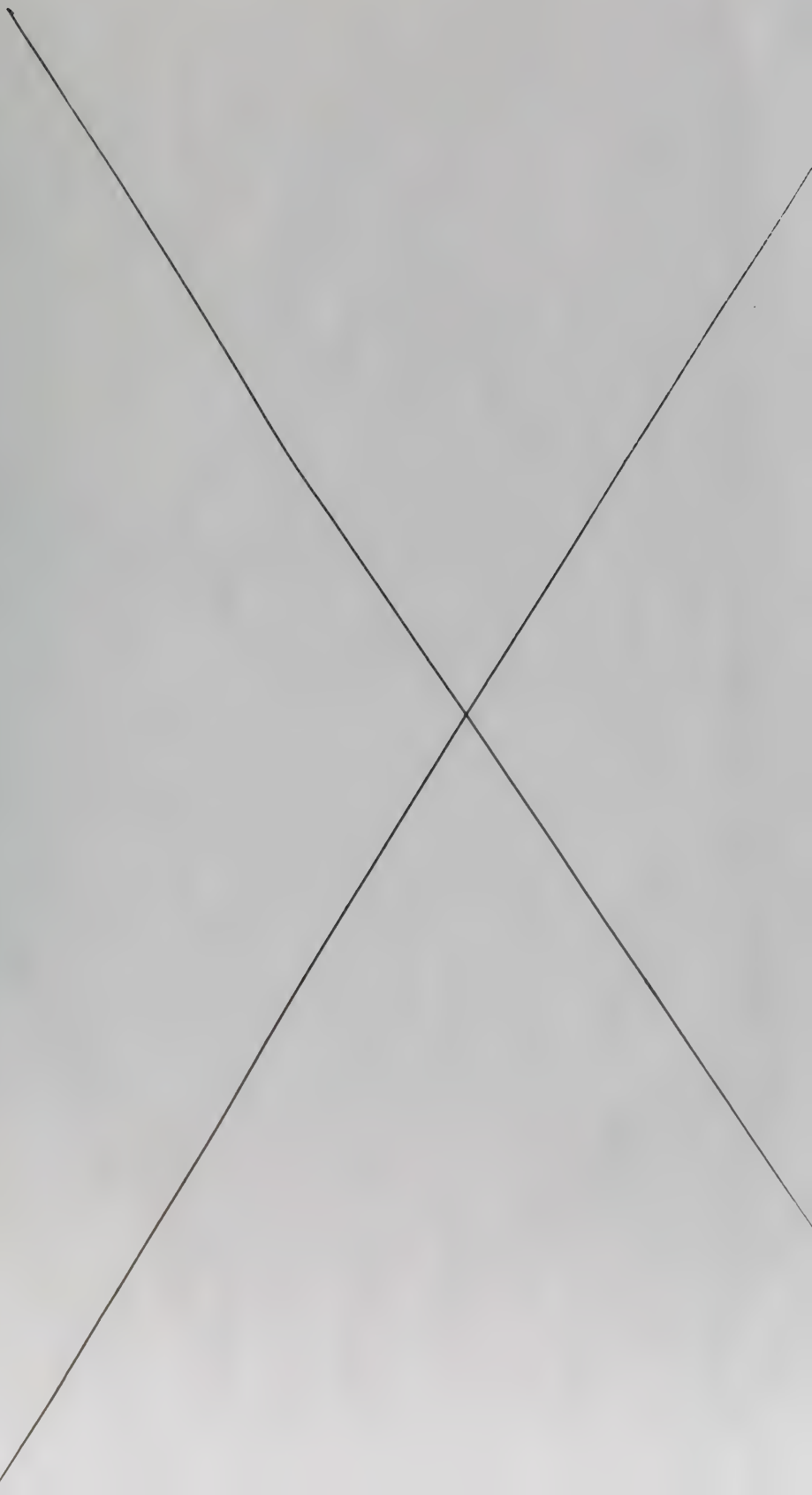


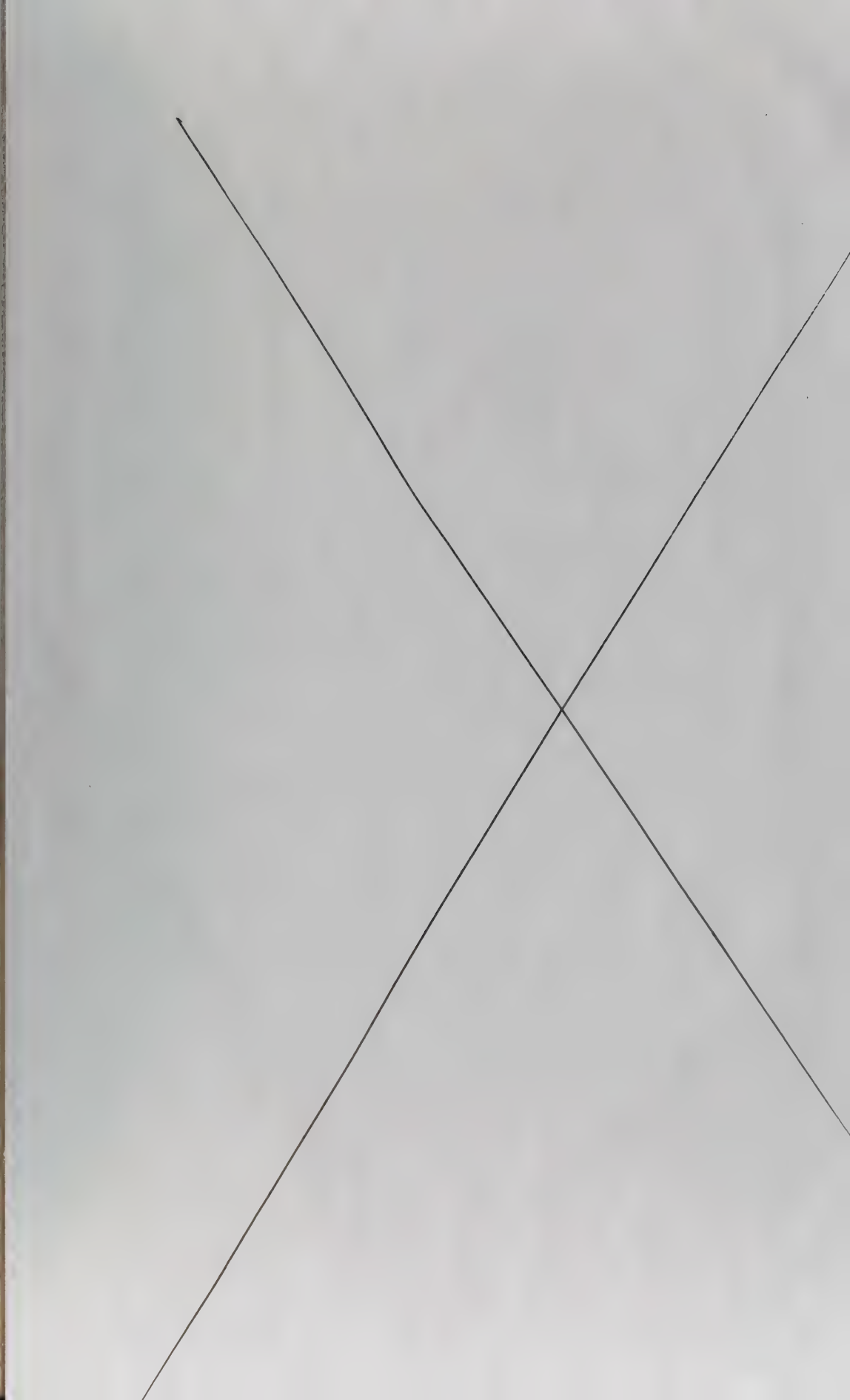


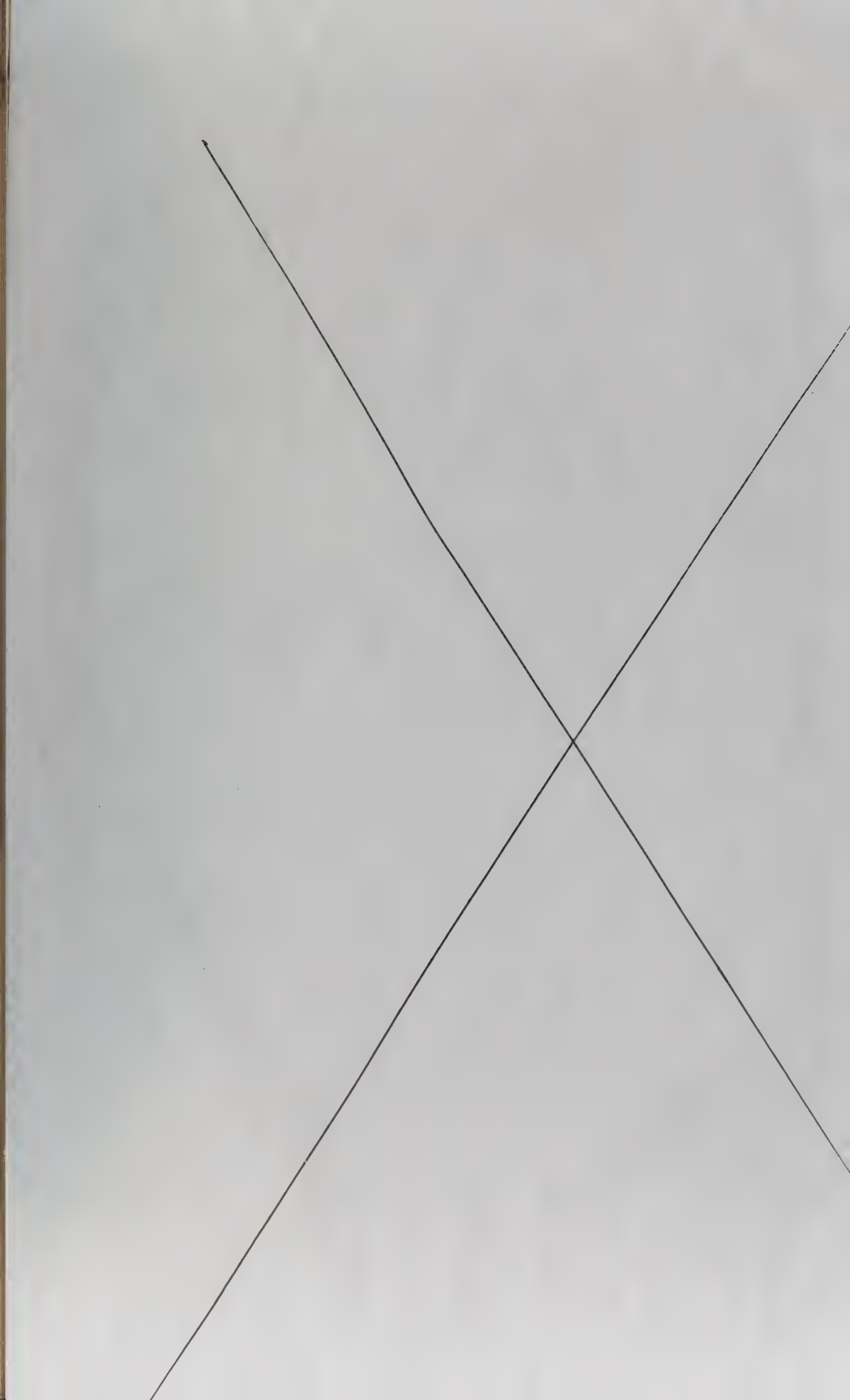


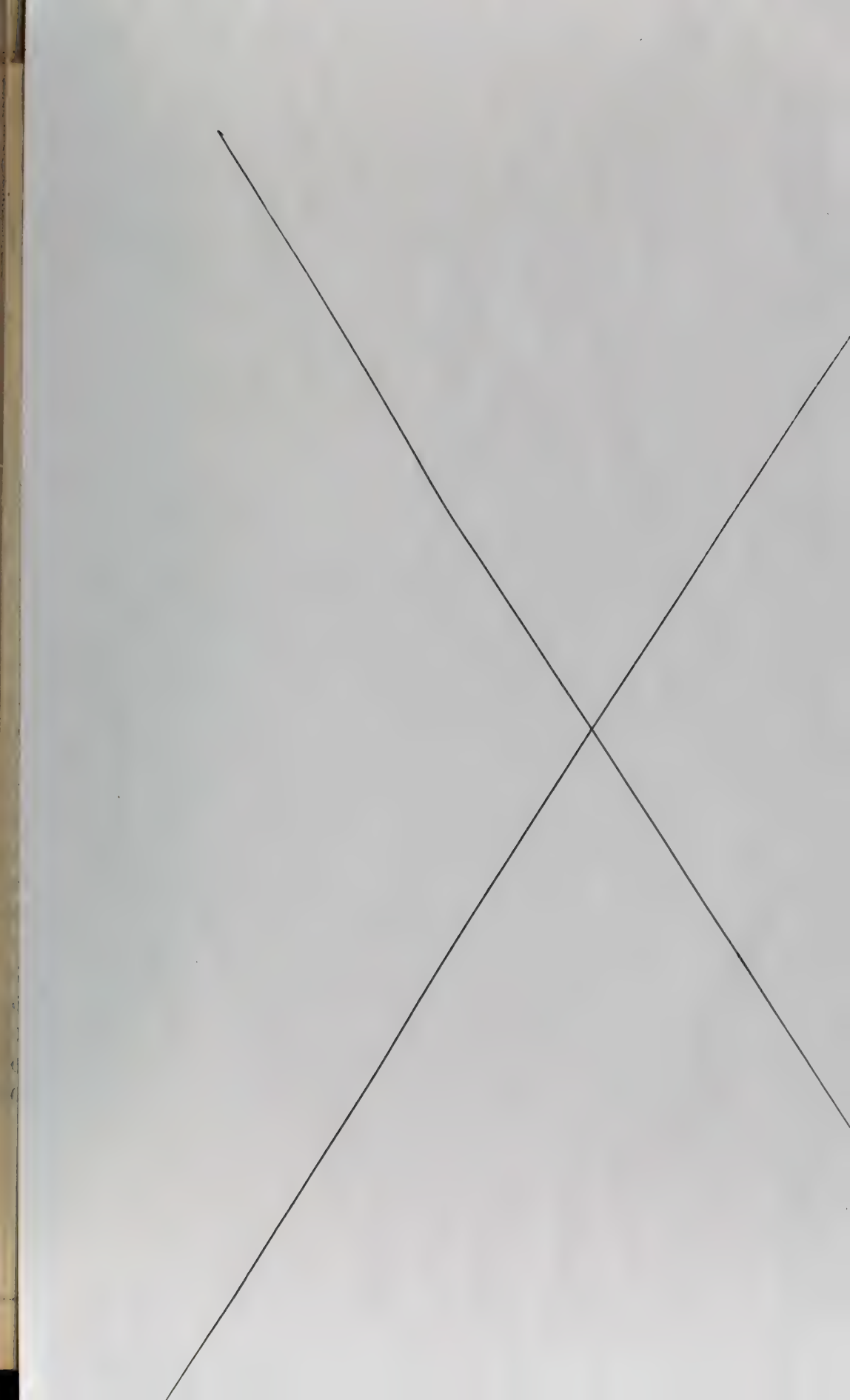












9010 6·3	2·91	10 11	87·90	8·92	4·12	2·30	2·62	2·
8510 4·7	2·81	10 - 9	87·90	6·00	0·51	7·05	2·20	2·40
9310 6·7	3·18	10 10	90·40	5·00	8·75	8·05	2·11	1·5
9410 7·6	1·50							
9310 8·7	2·12							
610 4·5								
6010 6·3								
6210 6·								
6·10 6·4	8·12	11						
6·10 6·1	3·00	10 9	91·58	5·52	0·27	3·21	2·1	21·18
8010 7·9	1·21	10 10	88·10	5·25	0·05	0·00	1·00	20·2
9010 7·5	5·20	10 11	81·10	8·00				

第三章　栽培法試驗

THE EXPERIMENT IN THE METHOD OF RICE CULTIVATION

第一項　不混作法之研究

The Study in the Method of Separate Planting of Early and Late Rice (A New Method)

(一)　不混作法之研究

A Study in the Method of Separate Planting

本研究爲本部創辦以來所行者，其十七，十八兩年間，依邱金枝君所作試驗大要，已由著者發表於本報告第一號。不混作法及本地法（混作法）之耕種概要，本報告第一章，業已說明，茲不復贅。不混作法之利點，係將從來早晚稻混作于一田者，先後分別栽植之，因之栽植株數增多，施肥除草等之作業便利，由學理上言之，極爲合理，又以本地種改栽外地改良種，因其播種期及移植期約早一月，生育期較長，故其收量增加，又以適應本耕作法之外地晚種，利用其短期生育及結實性於高溫期間，以代本地晚稻，由是，則其他條件，如肥料，除草作業等全然相同，較本地法應用本地原用種子者，可得有二成五分之增收，茲將其成績表示之于下。

年度	栽培法	早季斤	晚季斤	計	差異	指數
17	不混作法	225,00	324,06	549,06		100
	混作法	344,08	331,02	675,10	126,04	124
18	不混作法	254,04	367,08	621,10		100
	混作法	426,08	349,05	775,12	154,02	125,

供試品種{不混作法　早—龜尾　晚—白穀格仔
混作法　早—大早　晚—黃夫

但不混作法不利之點有二，(1)第一期作之秧地期間，適爲寒冷時期，故管理較爲困難。(2)第一期作收獲後，爲栽植第二期作，故須再行犂起田土，當此時季，一方收獲早作，一方準備晚作，以致作業重重，農家極感忙碌。不混作法既有上述不利點，且本地氣候，早稻成熟期前後，適爲多雨季節，氣候濕潤，因之米質不佳，成熟不良，影響收量，加之水利未改良，時遇洪水之虞，故一般農家，其希冀栽植晚稻，較早稻爲甚，蓋晚稻大半安全，品質亦優良也。不混作法之晚稻插秧日期，適爲七月下旬之晴天，灌溉水量極爲缺乏，作業上頗感不便，故如本地法在五月中旬，雨水充足時種植之方爲安全。

據上理由，不混作法之普及，甚爲困難，然由學術上決定，本耕作法之多收與否，實爲緊要之事也。惟歷來本部之試驗，皆係異品種，異時期栽培之，而比較兩法，故對于本問題，仍不得要領，爲欲確實解決本問題起見，本部曾于十九年度，以同一品種，早晚稻皆用本地種，同一栽培期及苗齡，而以各法不同之肥料種類及施肥法，施行如下之試驗。

試驗之設計

(1) 供試品種——早。大早　晚。黃夫　試驗區面積—— —英畝

(2) 試驗之區別　(一)不混作法　(二)混作法　各法之設施如下

(1)無窒素區(2)豆餅區(基肥)(3)豆餅半量硫酸銨半量區(基肥)

(4)硫酸銨區(基肥)(5)硫酸銨二回分施區(半量基肥半量追肥)

(6)硫酸銨三回分施區(三分之一基肥三分之二追肥)

(3) 肥料施用量(每英畝)

窒素 N——584 gr.　燐酸P_2O_5——780gr.　鉀K_2O——780gr.

燐酸用過燐酸石灰，鉀用硫酸鉀，而窒素用硫酸銨或豆餅，基肥施

于插秧前十日，(5)及(6)區之追肥，施于插秧後十日，(6)區之第二回追肥，更經十日而施用之。

(4) 播種期及插秧期如次

	第一期作		第二期作	
	播種期	移植期	播種期	移植期
混作法	3月19日	4月11日	4月4日	5月3日
不混作法	3月19日	4月11日	6月20日	7月23日

(5) 試驗之成績 如第五表及第一圖。

試驗結果之考察

第一期作收量之比較如下，

	無窒素區	豆餅區	豆餅半量硫酸亞半量區	硫酸亞區	硫酸亞二回分施區	硫酸亞三回分施區
混作法	391,斤4	567,9	561,2	593,3	630,9	611,3
指數	100	100	100	100	100	100
不混作法	466,8	668,0	656,0	646,4	664,5	697,8
指數	119	118	117	109	105	114
差	+ 75,4	+ 90,1	+ 94,8	+ 53,1	+ 33,6	+ 86,5

兩作法各區之收量差異平均爲13%，無過于20%，其差異之比例，無窒素區最大，如加用窒素質肥料，則混作法收量增加，其差異不大。混作法之栽植株數每平方米爲14株，不混作法者爲19株，其株間距離較不混作法爲大，其結果如表所示，分蘖期及成熟期之分蘖加多，一株重量加重，一株收量可得增加，不混作法栽植株數之較混作法比例加多，而增收則不能，又兩作法之出穗期及成熟期稍同，茲將第二期作之收量述之于下。

	無窒素區	豆餅區	豆餅半量硫酸鉀半量區	硫酸鉀區	硫酸鉀二回分施區	硫酸鉀三回分施區
混作法	364,斤77	397,71	426,64	417,24	445,72	389,68
指數	100	100	100	100	100	100
不混作法	346,13	400,26	413,87	416,53	435,27	387,19
指數	95	101	97	99	98	99
差	− 18,64	+ 2,55	+ 2,77	− 0,71	− 10,45	− 2,49

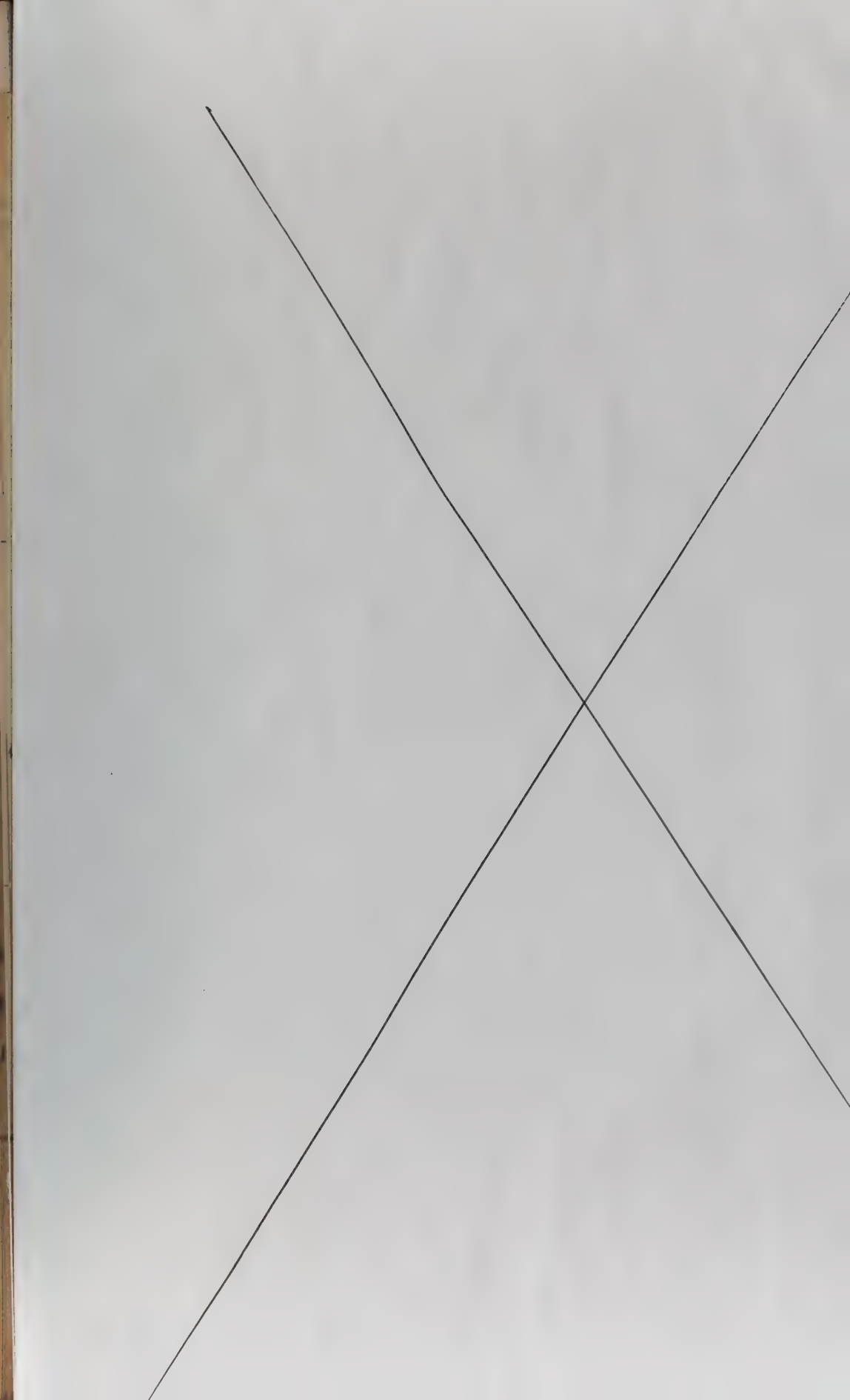
本期適與第一期作相倒，混作法之收量，反有稍多之傾向，然其量不過百分之五，分蘖情況與早稻同，較不混作法爲大，分蘖期之分蘖及有效分蘖特多，蓋生育期較長使然也。茲將兩期作之收量，合計如下。

	無窒素區	豆餅區	豆餅半量硫酸鉀半量區	硫酸鉀區	硫酸二回分施區	硫酸鉀三回分施區
混作法	756,斤1	965,6	987,8	1010,5	1076,6	1000,9
指數	100	100	100	100	100	100
不作法	812,9	1068,2	1069,8	1062,9	1099,7	1084,9
指數	110	111	109	105	103	108
差	+ 56,8	+ 102,6	+ 82,0	+ 52,4	+ 23,1	+ 84,0

不混作法早晚兩作之合計收量，難以超過混作法者百分之十，今若施肥于混作法，以圖增收之際，二者之相差甚微，卽以本地種行混作法，苟充分施肥，則亦可得與不混作法同樣之收量，故據不混作法之栽培效果，不如吾人所理想者之大也。

但在無窒素區，不混植法雖有少量增收，然此種試驗，若長期間行之，則土中養分，漸爲吸收，收量之減少，實意中事也。又觀測每法窒素肥料施用方法之差異，追肥區之收量均爲佳良，豆餅與硫酸鉀，其効力差異甚少。

由本試驗得探悉本地水稻之特性，其中早期種，生育期間短，分蘖力強



第一圖版　　PL. 1

1

混作栽培法之說明

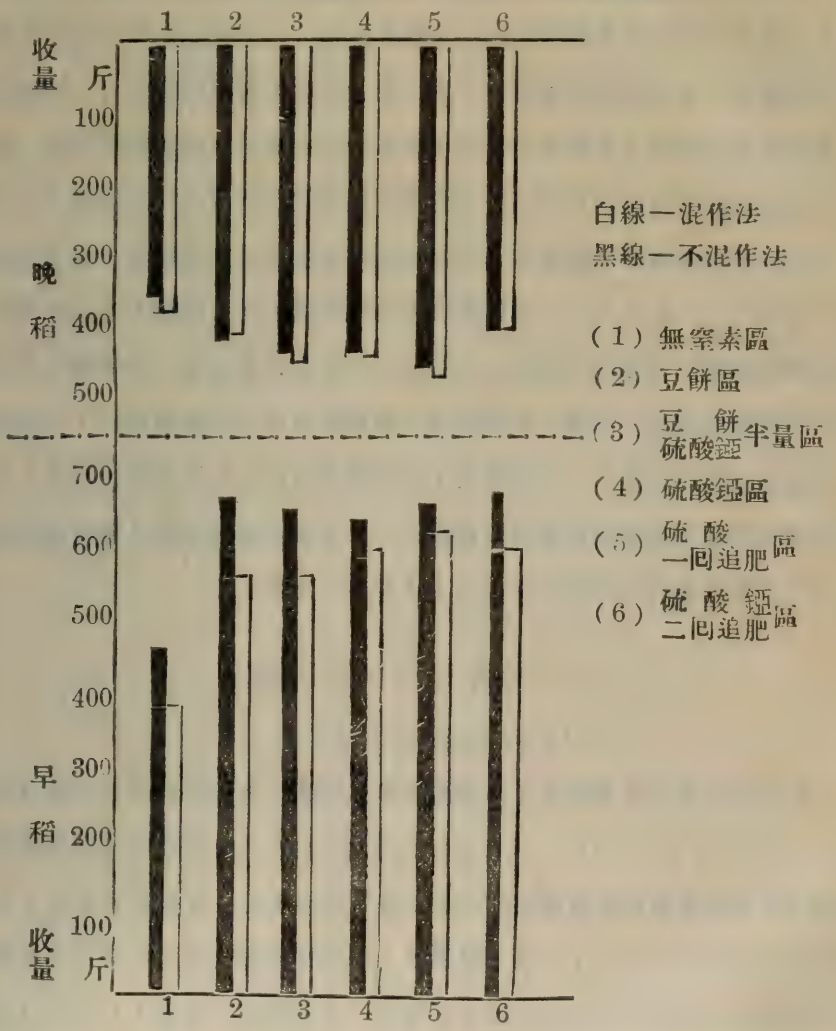
The Usual Local Method of Cultivation by Alternate Planting

圖示早晚稻栽植於同一田內。中間一株爲晚稻，其旁之二株爲早稻。早稻業已成熟，而晚稻則尚在生長也。

The photograph shows the late rice and the early rice in the same field. The middle clump is late rice and those on either both side are early rice, which have riped already, whereas the late rice is still growing

，晚稻生育期長，分蘖亦大，宜于疏植，本地種之栽培法爲適應早晚混作者。苟以合理的施肥，殊有充分多收之望，故欲謀本地水稻增收法，施肥改良，實爲重大問題，以本地種行不混植法，因第二期作故，費工不淺，且收量亦不見大增，誠無効果可言也。

Fig. 1　混作法及不混作法之收量比較



(二) 不混作法之農家實地栽培試驗

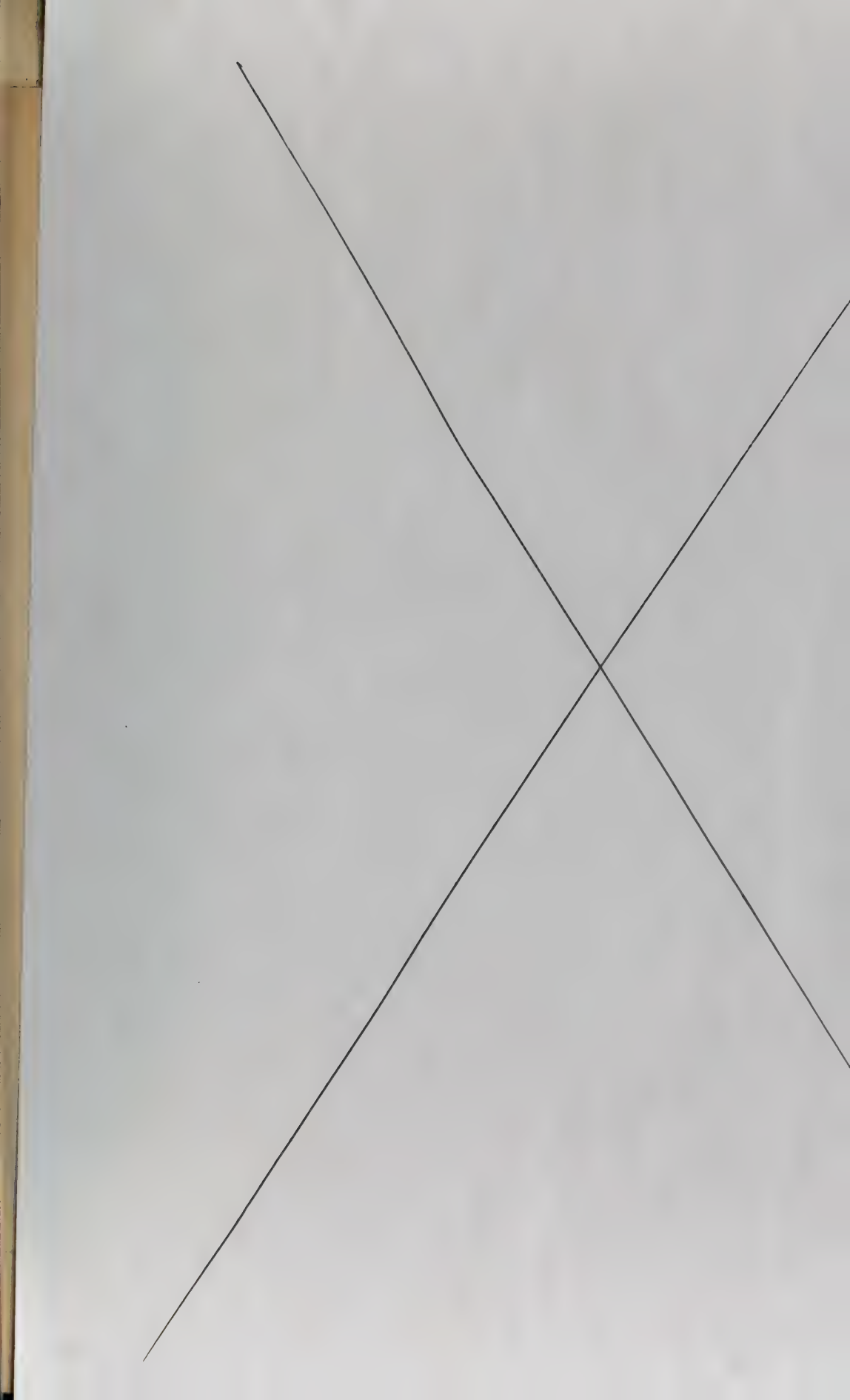
An Experiment where the Farmer Followed the New Method of Cultivation by Himself.

本地水稻品種，僅適于本地栽培法，而不適于不混作法，曾于前篇內述之。本地品種與他地改良品種比較之，則其吸肥性之不強(即多收困難)，穀粒之易落，收獲時或成熟中其一部之脫落損失，及米質不良等各點，實爲改良之要着也。本地水稻改良事業，爲一重大問題，實以同樣勞力，同樣經費，栽培良質之品種，于農家之獲益，誠非淺鮮。欲謀本地水稻增收之一法，宜栽較本地種優良之改良種，以適應其栽培條件而栽植之。本部過去三年間，以外地改良種而行不混作者，卽所以副此目的也。已如所述，欲于短時間解決品種改良，栽培方法，及經濟收支等諸問題，殊爲困難，過去及現在，所示種種試驗，就本地水稻栽培之增收上，是否皆爲良策，余等難以簡單斷言，然是爲多收之一法者，當可確信。苟以之作農民之參考材料，互相研究，共謀本地稻作之進步，則幸甚矣。本試驗之目的，皆依此主旨爲之。今若應用過去所行之栽培法試驗及改良種子，使農民實地栽培時，究有如何之結果乎，茲舉廿年所行之試驗成績如下，卽可以知矣。

科貢之試驗

An Experiment at Ke Kung

科貢之農事改良事業，本部創辦以來所行者，農事調查及其他事項載於第二篇"An Agricultural Survey of Ke Kung Village." 內。本水稻不混作栽培法試驗，係作科貢農事改良事業而行之。其所用之土地，在科貢之中部，名曰中湖，面積有五十二畝，土壤之肥沃度，適位于全鄉之中，自民國十九年冬至廿年春，續行耕地整理，每區作長方形，其面積爲十英畝，(10 ares)各區設灌溉及排水路，以電力抽水機施行灌溉，其栽培方法，皆依耕作概要（第



一章）之不混作法，並時受本部技術員之監督指導。至水稻品種，早期爲龜尾，晚季爲白穀格仔，第一期秧地期間，蒙水三日，禾苗受傷，第二期在出穗開前後，又逢旱天，以致不能得期待之收量。至其成績請閱第七表。又爲比較改良栽培法與本地從來耕作法之優劣起見，特將科貢中湖試驗區以外所調查之各區收量，列於第八表以資比較。試驗區之土壤肥沃度係平均，而其施肥用量亦照本地慣行法，故兩者之間殊有比較之可能，茲將第七表不混作法之總平均與第八表混作法之總平均比較之，則如下表。

每畝收量

	早稻		晚稻		合計	指數
	收量	指數	收量	指數		
混作法（從來法）	斤 199,4	100	262,8	100	462,2	100
不混作法（改良法）	271,3	136	288,1	110	559,4	122

即早期作之不混植法，較混植法增收36%，晚季作爲10%，合計有22%之增收，與本部三年間以改良種所行之試驗成績，完全一致。早稻改良種之米質，較本地者優良一節，已于報告第一號述之，但脫粒極爲困難，非利用脫穀器不可，爲本試驗應用故，本公司趙士安技師代製遠心力脫穀器七架供用，編者特此誌謝。

據本試驗及在螺洲三畝，鼓山廨院三畝，下道十畝，萬壽橋三畝及本地各處所行實地試驗，成績均優良，確信以改良種行不混作法，其收量必能增加，苟指導得法，農家亦易行之也。

第二項　不混作法之栽培條件試驗

A Study of the Conditions of Cultivation. Applying the Method of Planting Separately.

(一)　品種別耐肥試驗

Fertilizer Bearing Experiment

水稻之肥料吸收性，因品種而不同，有適于多肥栽培者，亦有施以少肥而能充分生育者。在一定面積之內，希冀多收之際，非多量施肥，精細耕作，並栽培肥料吸收力強之品種不可。本地品種之吸肥性，一般不著，多肥之際，常致倒伏，故施肥量雖頻頻加增，而收量則反不著，以其所得，不能償其所施與者，往往有之。本試驗之目的，係欲探悉各品種之耐肥性，並比較本地種與他品種之耐肥性質而行之也。

試　驗　設　計

供試品種　第一期作　衣笠，陸羽42號(耐肥性)陸羽 121 號(耐肥性)新大野，龜尾(不耐肥性)，金早(本地種)。

第二期作　仙石三號，黃尖(本地種)，白穀恪仔。

面積　每區一英畝，

試驗之區別　(1)　無肥料區；　(2)普通區，　(3)加五成區，　(4)加倍區。普通區係據耕種概要之標準施肥量，

成績　如第九表之一，二，及第二圖第三圖。

試驗結果之考察

考察試驗結果，知第一期作，耐肥性之陸羽42號，陸羽 121 號，皆因肥料量之增加，而有20％至30％之增收。新大野，衣笠二種，以生育期間較短，致不能有良好之成績，然肥料增加，其收量亦增。又加肥于龜尾，較不施肥區，普通區，其收量亦有增加，但因加用施肥量之增收，最不顯明。本地

種類似龜尾，在無肥區至標準肥料區內，如施肥量增加，其增收甚顯，然逾此程度、肥料雖增，而收量不著，尤以本試驗之各區，本品種之倒伏特多（照片卷末）。第二期作之黃尖，白穀格仔，仙石三號，因施肥量之增加，收量顯增，得稍類似之結果。惟本地種黃尖之藁，較他品種爲多。

早稻金早爲本地品種中之最良好者，然行多肥栽培時，頗爲不適，觀本試驗明矣。又晚稻黃尖，雖可利用其生育期之長點，施與多肥，藉圖增收，然以藁量特多，肥料分之一部分，爲葉莖所吸收，故于經濟的利用肥料之品種，實有攷慮之必要也。

Fig. 2

1—衣　笠
2—陸羽42 號
3—陸羽121號
4—新大野
5—龜　尾
6—金　早

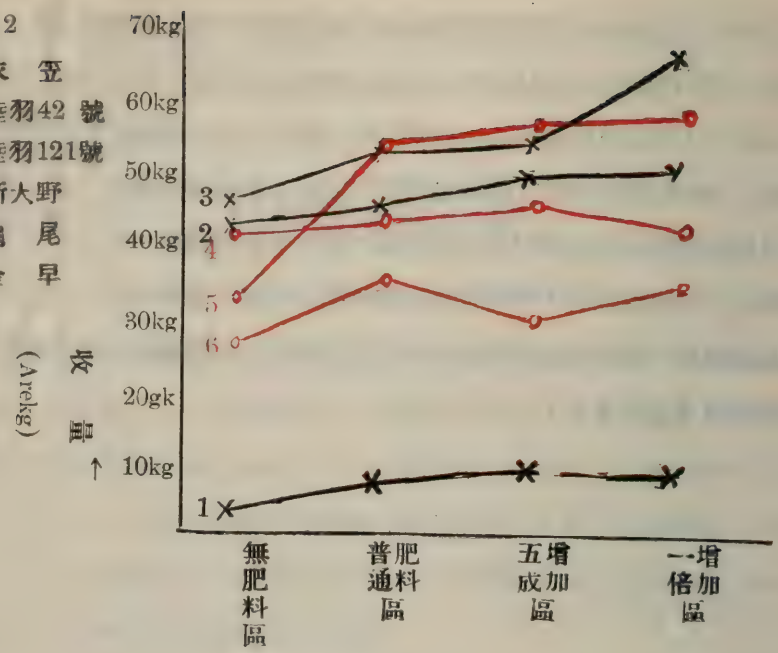
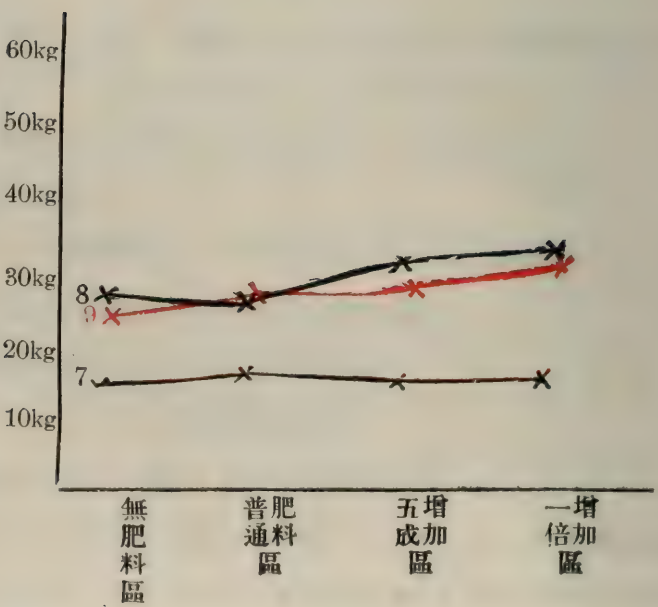
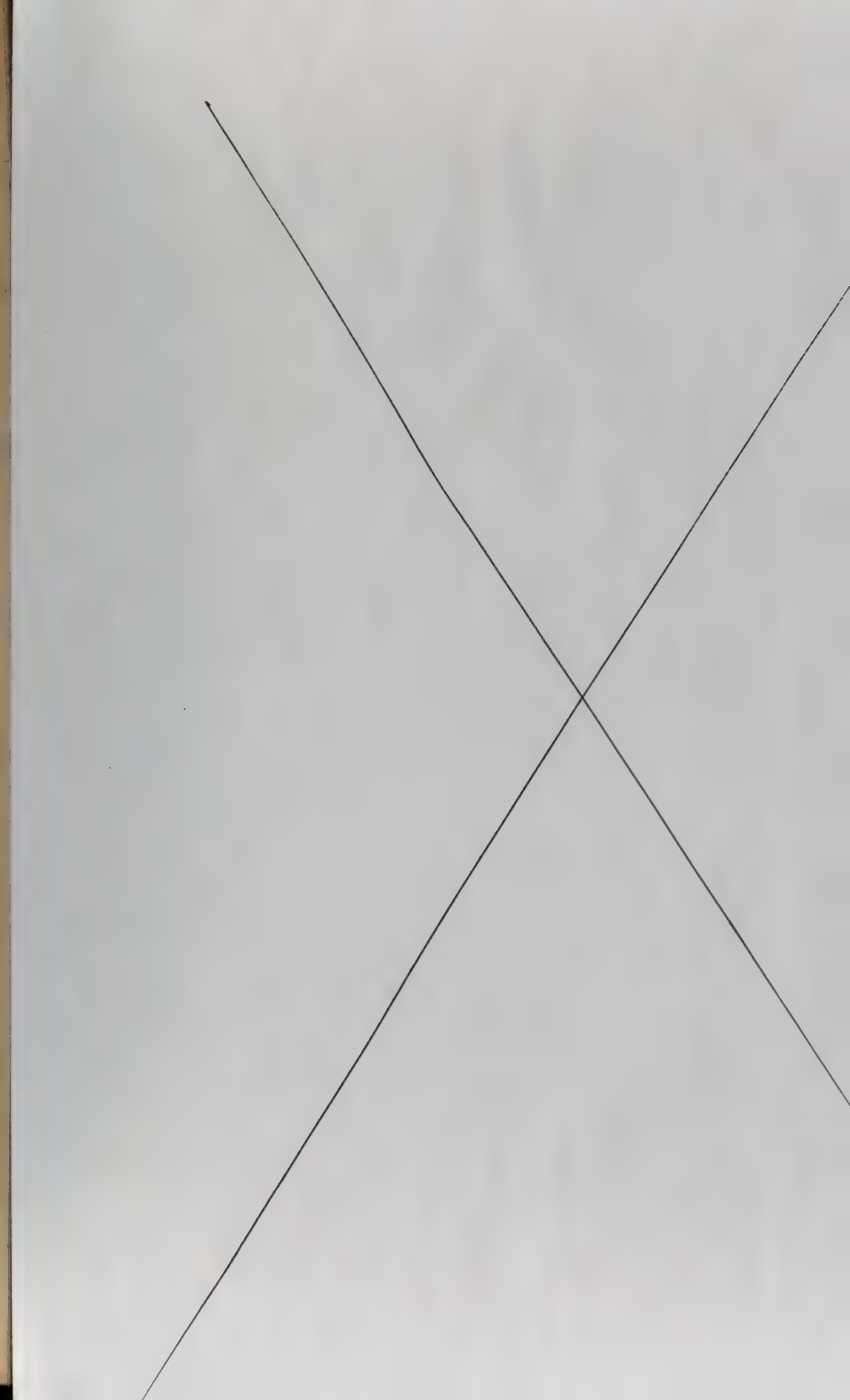


Fig. 3

7—仙石三號
8—黃　尖
9—白穀格仔





第 九 表 (2)

品種 Variety	肥料 Fertilizer	出穗期 Date of heading	成熟期 Date of maturity	稈長 Culm length cm.	分蘖 Culms number	穗長 Panicle length cm.	穀重量 Weight of grain Are. Kg	穀重量 Weight of grain 畝斤 M. C.	指數 Index number	藁重量 Straw weight Are. Kg
仙石三號	無肥料	9.24	11.4	54.8	14.1	16.3	15.062	154.23	100	25.310
	普通肥料	9.25	11.7	59.3	14.2	17.1	17.300	177.15	114.9	24.154
	五成增加	9.25	11.7	51.2	14.9	16.0	17.661	180.85	117.3	25.040
	加培施用	9.24	11.7	52.4	15.3	17.0	19.415	198.81	128.9	26.046
黃尖	無肥料	9.28	11.4	81.6	13.9	20.6	26.724	273.65	100	45.030
	普通肥料	9.27	11.5	81.0	16.6	19.8	27.203	278.56	101.8	53.374
	五成增加	9.27	11.5	84.0	13.3	21.3	33.635	344.42	125.9	52.983
	加培施用	9.27	11.5	82.1	16.5	20.8	36.651	375.31	137.2	55.271
白穀恪仔	無肥料	9.28	11.8	92.3	18.1	21.3	24.282	248.65	100	36.100
	普通肥料	9.27	11.8	93.0	17.6	20.6	28.161	288.37	116.0	38.046
	五成增加	9.28	11.8	92.6	16.0	20.3	29.816	305.31	123.1	34.310
	加培施用	9.27	11.8	91.7	17.4	21.3	32.800	335.87	135.1	32.767

2

耐肥試驗

Fertilizer Bearing Experiment

圖示前行之本地種(金早)，如增施肥料，則莖稈因無力支持其重穗，以致倒伏。列於後行者爲外地改良種，適與前者相反，且收量亦增加。

The local variety of rice (Kin Zao) which is in the front rows shows that if more fertilizer is added, the plant fall down, owing to the weekness of stems bear the added weight of more heavily developped heads. The plant in the back rows shows that the improved variety is just the opposite and increaes its yield advantagously

(二) 播種期及移植期試驗

An Experiment to learn the Time for Sowing and for Transplanting

(A) 秧地日數相同而播種期移植期不同之時

When the period of seedling cultivation is kept constant and changes are made in the time for sowing and for transplanting

水稻之品種間，對於氣候之感應性各有不同，某品種在某氣候之下，始能適應，其播種期及插秧期始可存在。依本地氣候狀況，欲知本地種之播種插秧期，究以何時最能增收，又外來種之播種插秧期以何時爲最適，凡此諸點，實爲緊要之問題，本試驗之目的，卽爲解決此事而行之也。

供試品種。　大早(本地種)　早生大野(外地早生種)

龜尾(外地中生種)　旭　(外地晚生種)

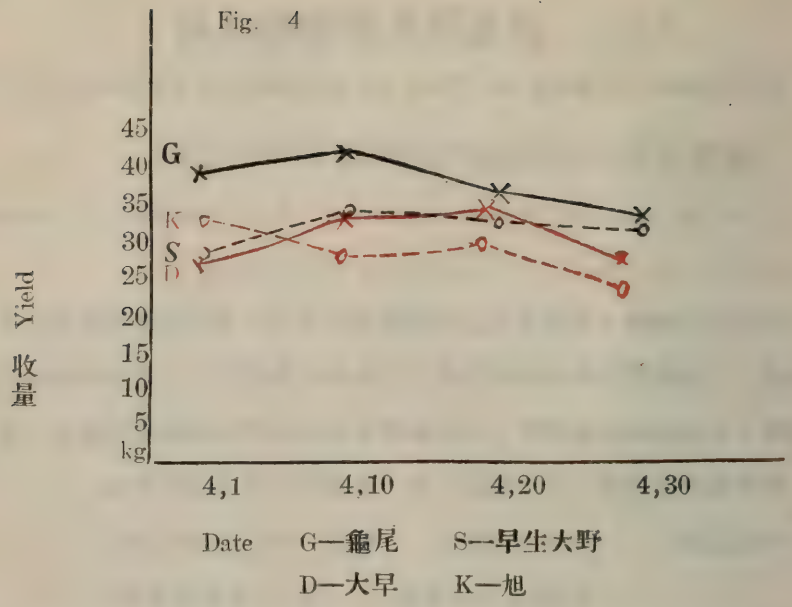
試驗之區別。

	1	2	3	4	5
播種期	2月26日	3月1日	3月10日	3月20日	3月30日
移植期	4月1日	4月1日	4月10日	4月20日	4月30日
秧地日數	33日	31日	31日	31日	31日

成績。　如第十表及第四圖

本地種之大早，其移植日期以四月二十日前後爲最良，適與本地歷來之栽培時期同。大早之移植期早，則出穗亦早，其感應之程度較他品種爲敏銳。早生種之早生大野，係寒地品種，移植日期，寧以早爲良。龜尾之移植期，以四月十日以前爲最適。晚生之旭種，亦以早爲佳，至本地品種係適于暖地之早生種，觀此試驗稍可知矣。

Fig. 4



(B) 移植期同而播種期栽培株數及肥料用量不同之時

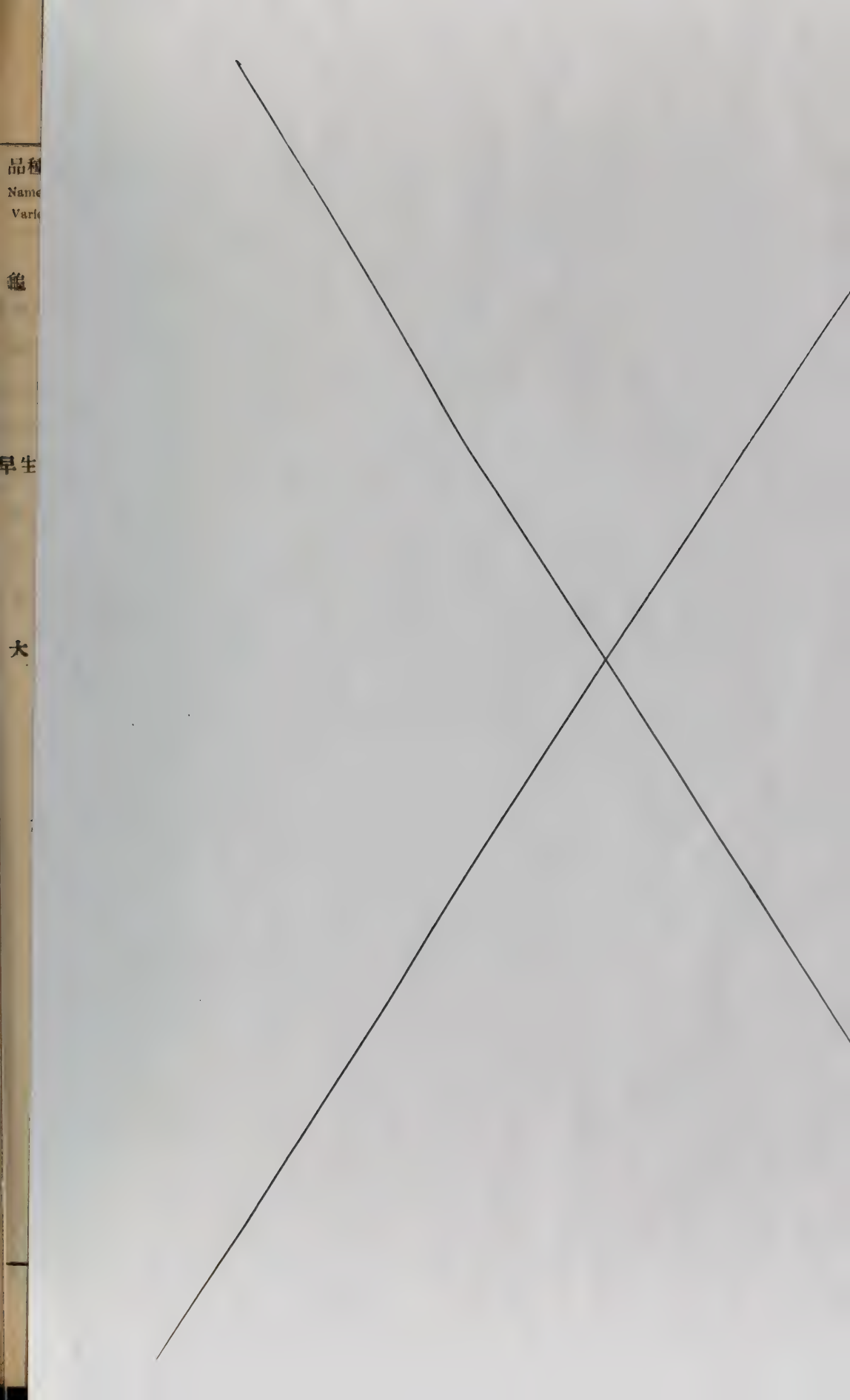
When the time for transplanting is kept constant and changes are introduced in the time for sowing, in the number of plants for transplanting, and in the quantity of fertilizer to be used,

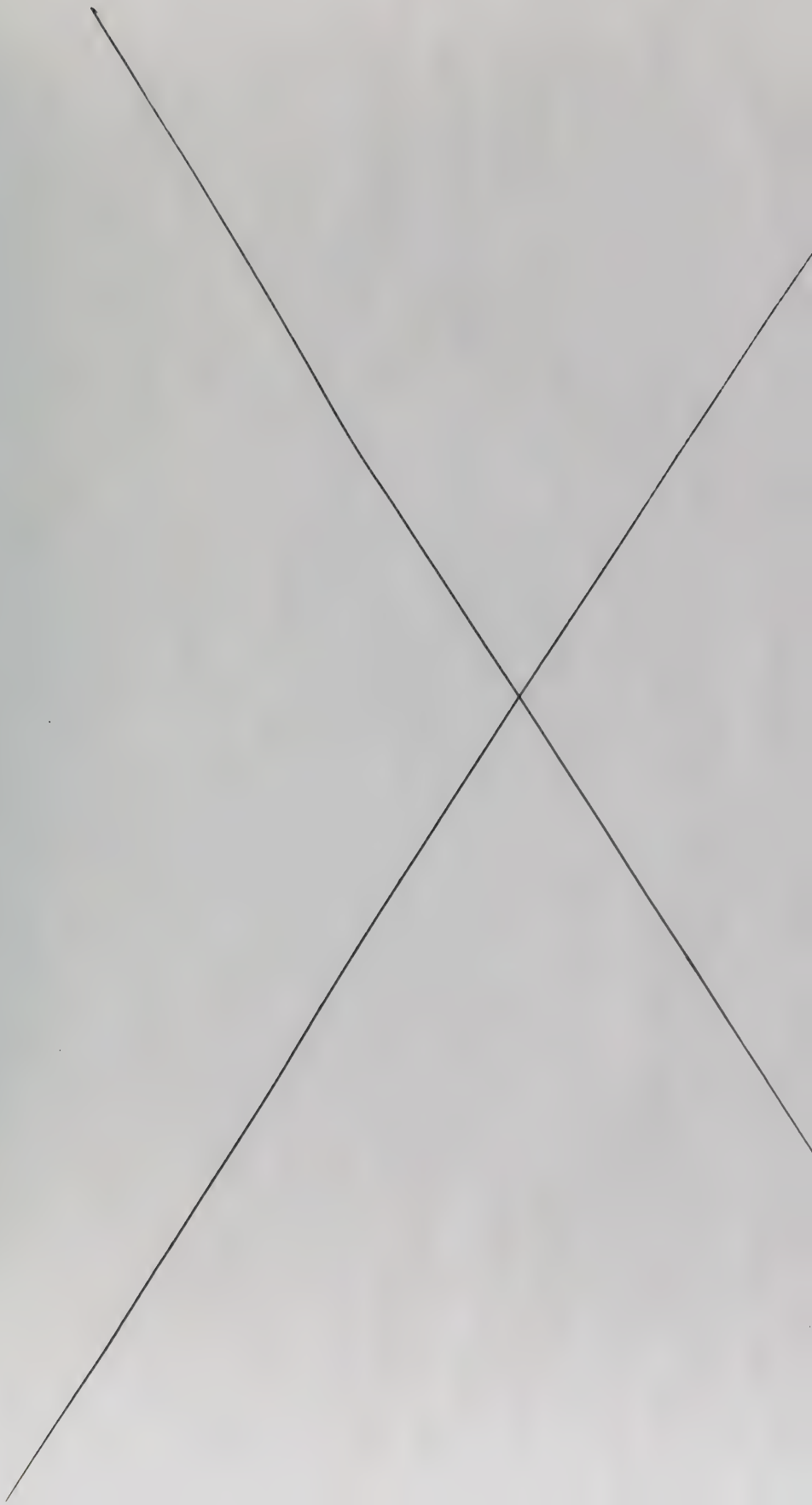
本試驗之目的係欲探悉適當之苗齡及其栽培條件，如播種量，播種期，培栽株數，肥料用量等而行之也。

供試品種。　大早。　竹成 174號。

試驗之區別。

	1	2	3	4
播種量	0,3L	0,3	0,42	0,42
秧地面數	30	20	30	40
栽培株數	27	27	19	19
肥料用量	普通	加倍	普通	普通





成績。　如十一表

據試驗結果，知本地種因苗齡（秧地日數）及栽培方法之變更，增收不明。然外地種其苗齡與栽培方法如變更，收量差異甚顯，其中須特別注意者，即本地種與外地種收量之差異甚大，又栽植株數增加，出穗期常致遲延由本試驗明矣。

(C)　播種期插秧期及秧地日數不同之時

When the time of sowing, of transplanting and of seedling cultivation are all varied.

變更播種期及插秧期，影響于收量一節，已在第一期作，以秧地日數同一之條件，而行試驗矣（A及B試驗）。據歷來之試驗，插秧期在七八月間，氣温最高之際，于稻之生育，影響更大。故在本試驗，其秧地日數亦與以變化，試驗範圍因之較大，曾于第二期作行之。

供試品種。　黃尖（本地）　白穀格仔（台灣）　仙石三號（日本）

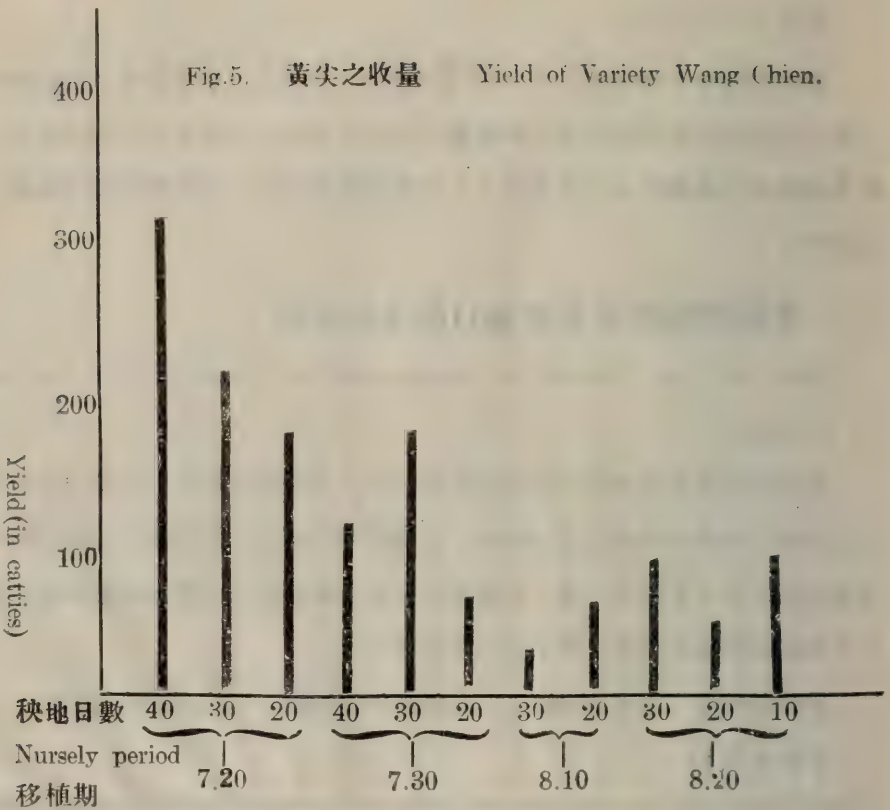
試驗區別。

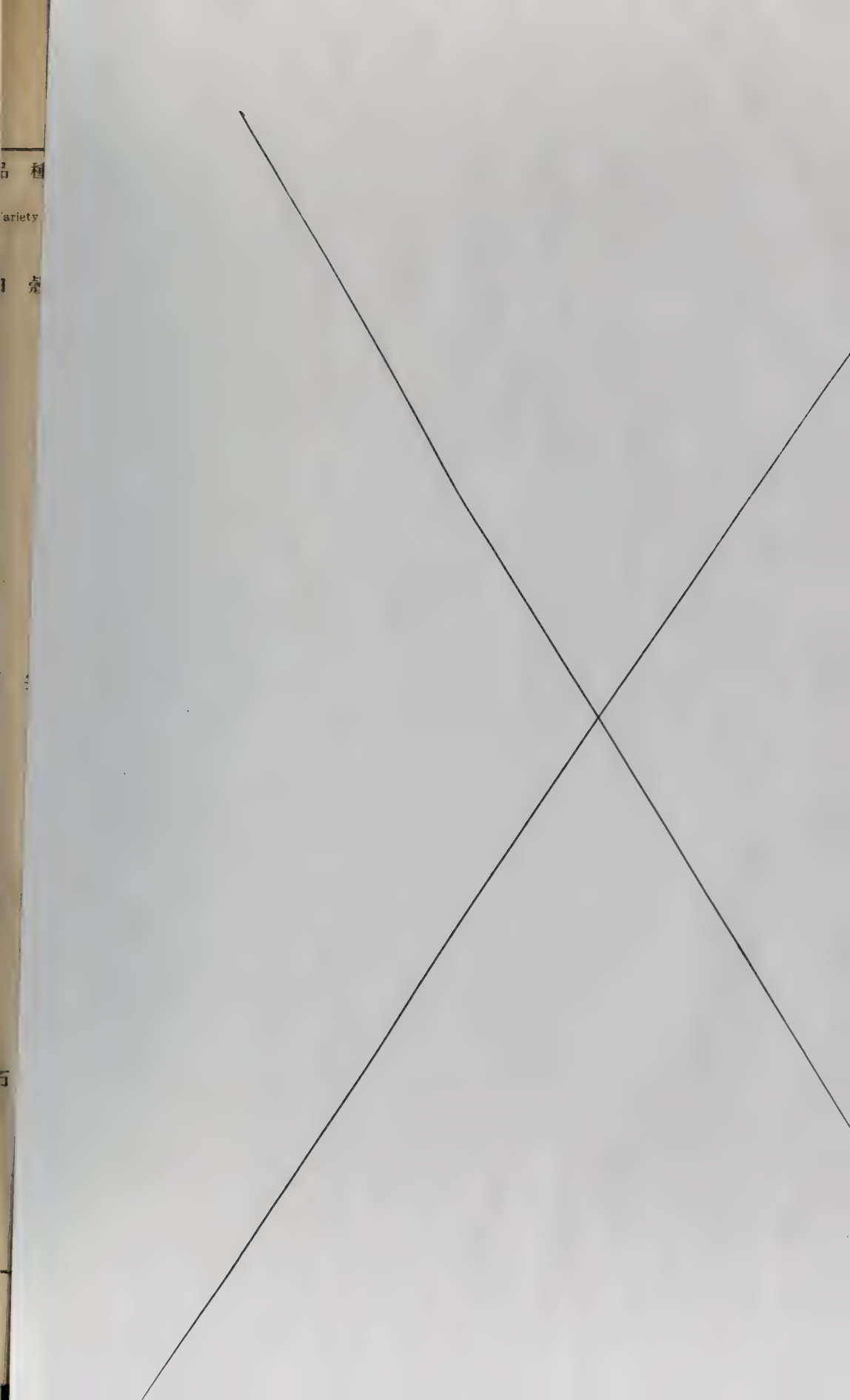
	1	2	3	4	5	6	7	8	9	10	11
移植期	7,20	7,20	7,20	7,30	7,30	7,30	8,10	8,10	8,20	8,20	8,20
秧地日數	40	30	20	40	30	20	30	20	30	20	10
播種期	6,10	6,20	6,30	6,20	6,30	7,10	7,11	7,21	7,21	7,31	8,10

成績。　如十二表及第五圖

黃尖之移植期愈早，則收量愈多，如移植期遲延，宜用幼苗，即秧地期間短少者爲得策。白穀格仔亦與此同。仙石三號生育期較短，故在七月下旬以前，以幼苗移植，可得優良結果。第二期作之移植期，如過于遲緩，影響甚劇，而收量大減，有時因移植期之差異，減收四分之一者亦有之，故在此情形，寧改栽其他作物較爲有利也。

Fig.5. 黃尖之收量 Yield of Variety Wang Chien.





第三項　混作栽培法(本地栽培法)之研究

A Study of the Usual Local Method of Cultivation by Alternate Planting.

本地水稻之栽培法，其自身亟應改良者甚多。惟驟然應用農家習慣上與其他關係上所異之水稻品種及栽培法，殊爲困難，故宜先經相當之設施及合宜之指導後，方能實行。然本地栽培法，若施以若干之改良，其操作手續化爲簡便，而行水稻之改良，農家之利益，定非淺鮮。本部於此二年間所行之本地水稻栽培改良，卽本此意旨也。

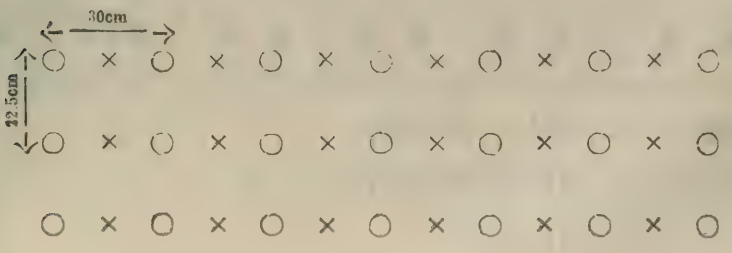
(一)　栽植株數及肥料用量之增加試驗

An experiment in the number of plants for transplanting and in the quantity of fertilizer to be used

本地從來早晚稻之栽培方法，如下圖所示，東西爲30cm.，南北22,5cm，其東西30cm. 距離間，植栽晚稻。早晚稻株數，每平方公尺，不過十四株，疏植之。本試驗之目的，卽欲探悉增加栽植株數及施肥量後，究有若干之增收也。

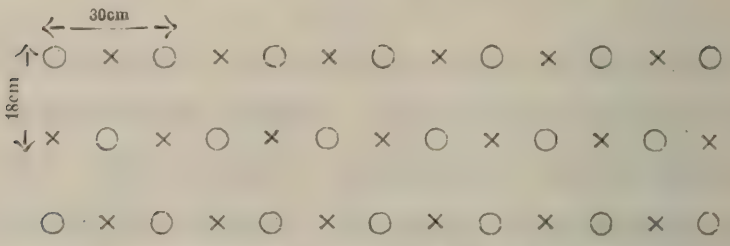
試驗之設計

(A)　本地習慣法　早稻(○印)之栽植距離，東西爲30cm. 南北22,5cm. 其東西30cm. 距離間，植栽晚稻（×印）一株，如是每平方公尺面積內，早晚稻各植十四株。

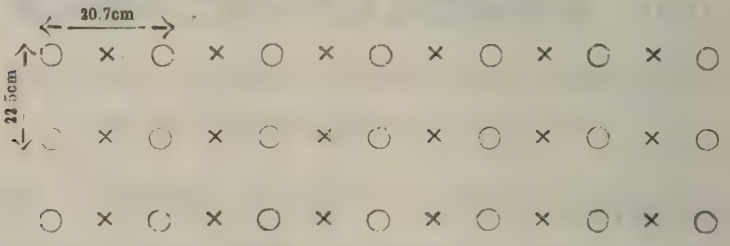


改良法

(B) 十八株植法　每平方公尺植十八株，東西爲30cm. 南北18cm. 早晚稻交互栽植，呈三角形，其圖如下。



(C) 二十二株植　每平方公尺植二十二株，東西爲20,7cm.南北22,5cm.晚稻植于早稻間，比較本地習慣法密植55%也。



據上述三項栽培法，各以施用不同肥料用量而行試驗，標準施肥區之早晚稻施肥量及種類，皆依照耕種概要之肥料項。

肥料施用區別

區別 / 作別	1	2	3	4	5
早期	無肥	無肥	標準	加五成	加一倍
晚期	無肥	標準	標準	加五成	加一倍

品種　早 大早　晚 黃尖

其他栽培法，皆依耕種概要施行之。

成績　如十三表第六圖。

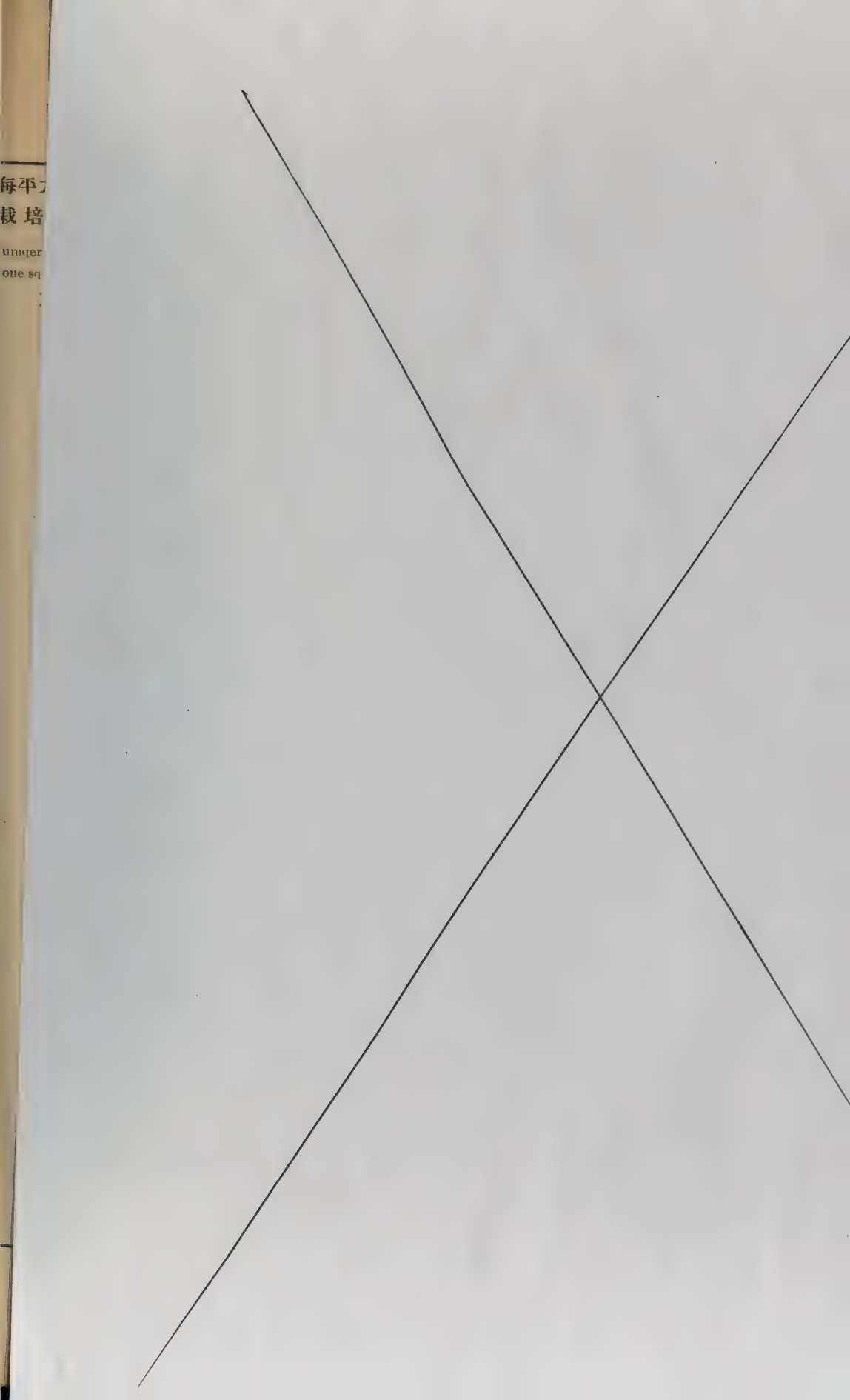
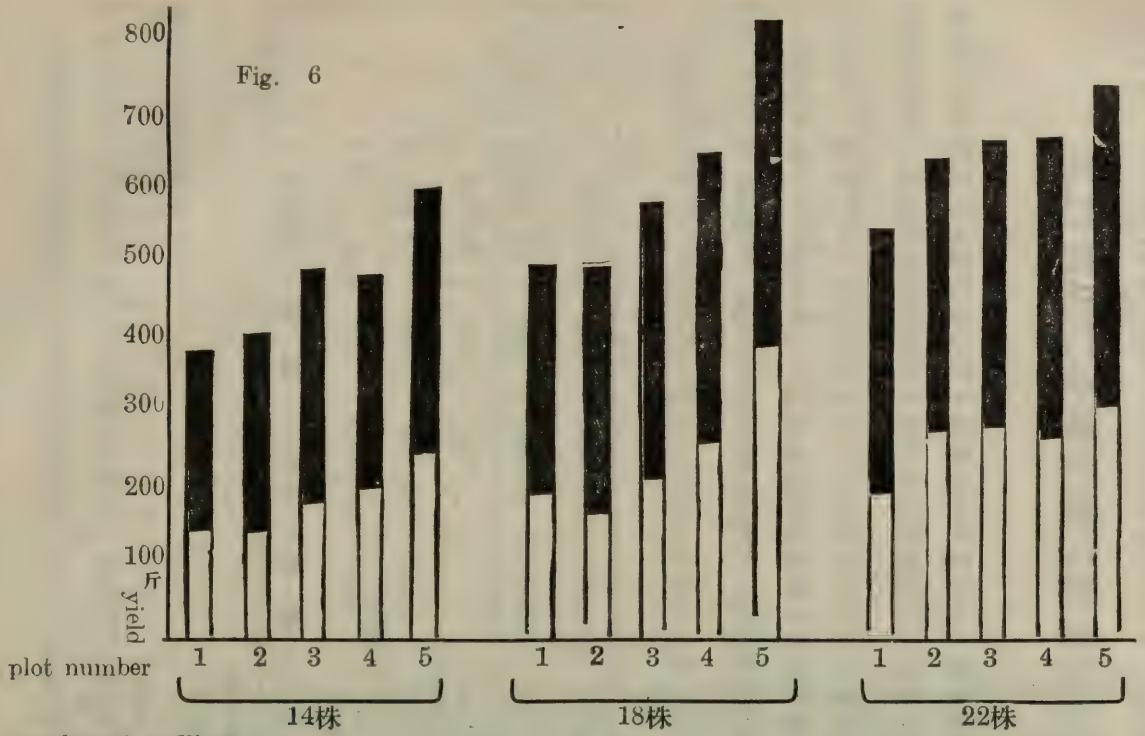


Fig. 6



肥料用別

說明	1	2	3	4	5
早期	無肥	無肥	標準	加五成	加一倍
晚期	無肥	標準	標準	加五成	加一倍

白……早稻　　黑……晚稻

試驗結果之考察

由該試驗成績觀之，可知栽培株數增加，收量亦顯然增多。今以從來方法之14株植，各區收量爲100，而與18株植，20株植，各區比較之，則其早晚稻合計成績如下。

（每畝收量　斤）

	14株植	指　數	18株植	指　數	22株植	指　數
1	383,斤89	100	497,斤16	130	551,斤44	144
2	408,87	100	500,85	123	644,11	153
3	499,72	100	581,77	117	671,84	135
4	491,43	100	650,49	132	666,72	135
5	603,55	100	830,36	137	750,92	125

卽18株植有25％至20％之增收，22株植有增收30％以上之可能。今若以14株植第三區（標準區）與18株植第五區比較之，則其收量差異達340斤以上，卽可增收68％。故較本地法，若更增加施肥用量及栽植株數，而達50－60％之增收，實非難事。又比較第五區14株植區與其栽培株數增加區，則可知如加用肥料，須增多其栽培株數，使充分利用肥料，以爲增多收量也。卽就本地稻作方法言之，若畧加改良，亦必有顯著之成績，觀本試驗卽可明矣。

(二) 混作法外地品種之栽培試驗

An Experiment in Applying the Local Method of Cultivation to the Imported Varieties of Rice

本試驗爲欲知外地品種以混作法栽培時，究有如何之結果，而行試驗也。惟外地品種，以適于本栽培法者使用之。

試驗之區劃如次

		早季	晚季
1,	早晚季本地種。	大早	黃尖
2、	早,外地種。 晚,本地種。	早58號	黃尖
3,	早,本地種。 晚,外地種。	大早	仙石三號
4,	早,本地種。 晚,外地種。	大早	蕃仔

耕種方法皆依耕種概要

成績 如第十四表

第十四表

			稈長 Culm length	分蘖 Culms number	穗長 Panicle length	收量 畝斤 are. kg. yield m. c.	收量 畝斤 are. kg. yield are. kg.	兩期合計畝斤 Total m. c.	指數 Index number
Early-local	1 早晚本地種	早	97,60	18,30	17,80	348,99	33,648	747,67	100
Late-local		晚	108,05	23,60	21,42	398,68	38,929		
Early-imported	2 早外地晚本地	早	76,14	34,60	17,38	357,00	34,778	773,32	107
Late-local		晚	109,00	22,30	20,94	416,32	40,683		
Early-local	3 早本地晚本地	早	95,00	29,50	17,65	293,61	28,520		
Late-imported		晚							
Early-local	4 早本地晚外地	早	96,12	24,35	17,80	341,91	33,212	683,56	91
Late-imported		晚	108,22	16,50	21,77	341,65	33,386		

據本試驗，則除第三區外，皆得相似成績。本地種旱稻大旱爲草丈高之品種，第二區以外地種旱58號代用之，因本種爲草丈低及分蘖強之品種也。草丈低者，六七月間與黃尖混植時，則日光之投射于黃尖較多，可得良好之生育。旱58號之出穗期雖較大旱稍遲，然無妨黃尖之生育，且有良好之收量，卽晚稻亦能充分生長也。晚稻黃尖，極適于本混作法，且米質頗良，故目今尙無代此之品種。旱稻大旱，雖有外地種代之，然須注意其栽培法，而于外地種之幼苗爲尤甚。

(二)年一回作栽培法試驗

An Experiment in the Cultivation of Rice Once a Year

本地四五月間，低窪之田，時逢大水，排水困難，因之不能栽培旱稻，多行年一回作。又氣候不順，不適于旱稻栽培時，寧以節省勞力，舉行一回作較爲有利也。本地行年一回作法時，其耕作法多依混作法之晚季作，栽培品種爲黃尖，大半移植二次。本試驗係依下記之栽培法，僅行一次移植，至供試驗品種，除黃尖外尙用下列三種。

品種。　黃尖，　蕃仔，　晚二號，　仙石三號，

播種期，　4月5日　　移植期　5月4日

一區面積　一英畝

施肥用量　用豆餅，過燐酸石灰，木灰三種。每畝施各成分N. P_2O_5. K_2O 各 4.5 kg. 半爲基肥，半爲追肥，追肥分三次施用，第一次在移植後二星期，以後每隔十日施用之。

栽培事項　皆依不混作法之第二期作。

第　十　五　表

品種 Variety	出穗期 Date of heading	穗揃期	成熟期 Date of maturity	分蘖 Culms number	稈長 Culm length	穗長 Panicle length	收量 畝斤 Are Kg. Yield mow catties	Are Kg.	藁收量 畝斤 Are Kg. Straw Yield mow catties	Are kg.
黃尖	9.7	9.15	10.17	23.3	115.0	21.30	391.67	38.27	2302.62	225.01
蕃仔	9.8	9.16	10.20	23.7	113.8	22.44	400.71	39.16	2262.09	221.05
晚二號	7.29	8.10	9.12	12.1	99.0	22.08	282.19	27.58	1002.86	97.99
仙石三號	8.19	8.27	9.27	16.3	98.15	21.09	643.38	62.87	970.71	94.85

本地種之成熟期類似台灣種之蕃仔，殆得同樣之收量。晚二號，仙石三號等之成熟期均早一箇月，且收量亦不惡。然上列各品種之收量，較混作法晚季作不良，故于適應一回作之栽培方法及品種，更有研究之必要也。

第四項　肥料試驗

Fertilizer Experiments

民國十九年，以直徑25centimeter 之 Wagner 氏肥料試驗用植木鉢，舉行下列各試驗。

(一)　三要素試驗

An Experiment in the Fertility of Soils

取本地方四處之土壤，卽下道(閩侯)，鴨姆洲(閩侯)，科貢(閩侯)，鶴上鄉(長樂)，以供試驗之用。

播種期　4月5日　　移植期　5月4日

每鉢栽植株數　　5 本

成績　如十六表及第三圖版

第十六表

地方名 Name of place	肥料別 Fertilizer	8月26日出穗前 稈長 8,26before heading culm length	分蘖 culms number	出穗期 date of heading	收穫後 稈長 Culm length	穗長 Panicle length	分蘖 Culms number	總重 Total weight	穀重 Grain weight	穀指數 重數 Index number of grain weight
		cm			After the harvest cm	cm		gr	gr	
下道	完全區	93.7	55	9.20	103.5	21.2	37	218	34	100
	無窒素區	98.0	50	17	108.2	21.6	27	184	28	82
	無燐酸區	96.5	61	18	105.0	22.0	34	216	32	94
	無加里區	96.5	67	20	107.0	20.8	23	212	31	91
	無肥料區	93.0	35	19	90.0	20.4	19	96	14	41
鴨姆洲	完全區	118.0	68	19	109.0	24.2	62	294	43	100
	無窒素區	101.5	55	19	100.0	20.7	58	190	28	65
	無燐酸區	115.2	59	15	103.5	22.5	52	203	29	67
	無加里區	110.0	67	17	100.0	22.7	53	256	37	86
	無肥料區	103.0	45	17	109.0	20.8	42	202	29	67
科貢	完全區	101.2	67	20	106.5	22.8	53	244	35	100
	無窒素區	112.0	32	20	101.0	22.1	43	155	22	63
	無燐酸區	106.0	52	15	103.5	20.4	51	169	25	72
	無加里區	90.0	50	18	102.5	22.4	58	186	27	77
	無肥料區	89.2	34	17	99.5	22.6	30	81	11	31
鶴上	完全區	96.5	64	18	106.5	20.6	50	262	38	100
	無窒素區	90.0	35	17	93.5	19.4	50	205	30	79
	無燐酸區	119.0	52	17	96.5	23.8	48	233	35	92
	無肥料區	105.0	52	19	107.0	21.7	49	179	26	68

3

NoFertilizer N.P N.K K.P. N.P.K.

（鴨牳洲土壤）

4

No Fertilzier N.K. K.P. N.P.K.

（長樂土壤）

5

No. N N. 0.5 N. 1 N. 2 N. 3

黃尖（生育期）

6

N. 2 N. 1 N. 0.5 No. N No N.P.K. 2 N.P.K. 3

Fertilizer

黃尖（收獲前）

7

No Fertilizer N. 0.5 N. 3 N.P.K. 05 N.P.K. 2

晚二號（收獲前）

8

N.P.K.3 .N.P.K.2 N.P.K.05. NoFertilizer N.0.5 N.1 N.3

晚二號（生育期）

上列四處之土壤，無窒素區之生育皆惡劣，無燐酸區及無加里區稍良，而無肥區亦不佳，故有肥料加用之必要。由本試驗，可知本地各處土壤，其土地生產力之差異頗大，又其所需要之各種養分，亦畧有差異也。

(二) 窒素肥料施用試驗

An Experiment to Learn the Quantity of Nitrogen Fertilizer to be Used.

供試土壤爲下道田土壤，自無窒素區至三克加用區，漸次增加窒素用量而行試驗，藉以探悉該土壤之窒素使用量(栽培水稻 及黃尖(本地種)晚二號(外地種)二品種之窒素吸收之差異。燐酸及鉀之施用量，每區各爲二克。

栽培品種　黃尖及晚二號。　供試土壤　下道田土壤

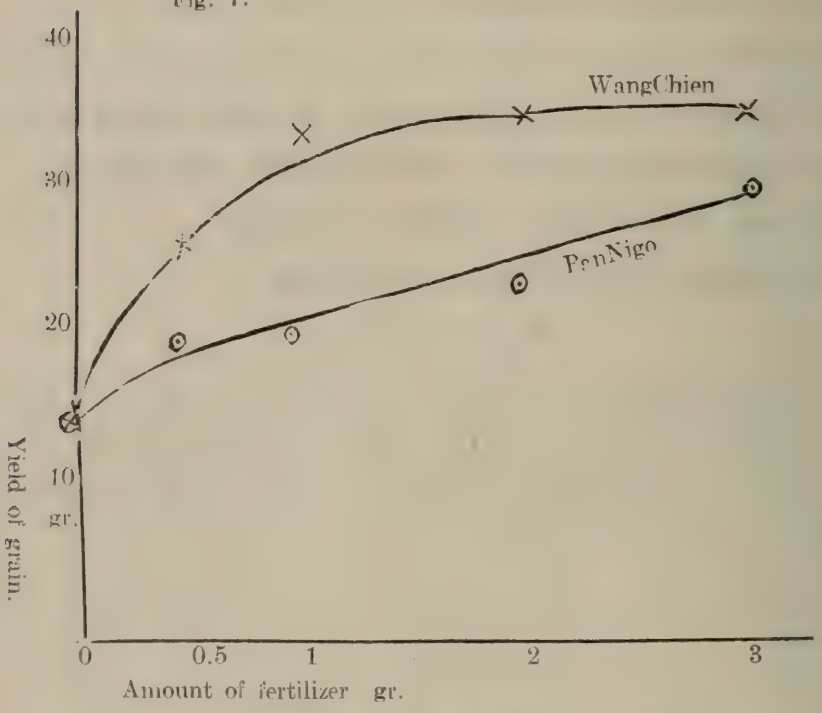
管理。均依前項試驗。成績如第十七表及第七圖

第 十 七 表

肥料用量	品種	8月26日出穗前 稈長	8月26日出穗前 分蘗	出穗期	收穫後 稈長	收穫後 穗長	收穫後 穗數	收穫後 總重	收穫後 穀重	穀粒指數
Quantity fo fertilizer	Variety	8.26 befo culm length	8.26 befo culm number	Date of heading	After harvest Culm length	After harvest Panicle length	After harvest Panicle number	After harvest Total weight	After harvest grain weight	Index number of grain weight
No fertilizer	黃尖	93.0	35	9.19	90.0	20.4	19	96	14	100
0.5gr.		102.7	61	18	101.0	20.4	24	180	27	119
1.		93.7	55	20	103.5	21.2	37	218	34	243
2.		106.5	72	17	104.5	20.4	38	225	36	257
3.		104.0	83	19	104.0	22.2	40	242	37	264
No Fertilizer	晚二號				71.5	20.1	18	63	14	100
0.5					72.0	22.1	22	88	20	114
1.					75.0	21.0	23	89	21	115
2.					69.5	19.6	19	95	25	118
3.					71.5	20.8	25	140	32	229

黃尖品種，因窒素用量之增加，其効果甚大，然至二瓦，已充分生育，若施至三瓦，則不見肥料之効果，晚二號雖至三瓦，猶未充分利用肥料。今將兩者之收量，以曲線表之(如第七圖)，則晚二號之曲線上昇程度較黃尖爲大，卽下道田土壤，如施用窒素二瓦，栽培黃尖，已可得充分生育矣。

Fig. 7.



(三) 完全肥料施用試驗

An Experiment to Learn the Quantity of Complete Fertilzer to be Used

自無肥料，漸次增加完全肥料至三瓦。窒素，燐酸，加里，皆爲同量，而行完全肥料施用試驗。 成績如第十八表及第四圖版，管理均照前項試驗

第十八表

肥料用量	品種	8月26日出穗前		出穗期	收獲後					穀重指數
		稈長	分蘖		稈長	穗長	穗數	總重	穀重	
Quantity fo fertilizer	Variety	8.26 befo culm length	heading culm number	Date of heading	After haruest					Index number of grain weight
					Culm length	panicle length	Panicle number	Total weigh	grain weight	
No fertilizer	黃尖	93.0	35	9.19	90.0	26.4	19	96	14	100
0.5gr.		92.0	61	17	101.0	21.6	38	214	31	221
1.		93.7	55	20	103.5	21.2	37	218	34	243
2.		114.0	64	20	102.0	22.4	50	375	55	393
3.		114.5	64	20	102.5	21.6	58	348	51	364
No Fertilizer	晚二號				71.5	20.1	18	63	13	100
0.5					77.0	20.4	25	88	20	154
1.					75.0	21.0	23	89	21	163
2.					78.2	21.7	32	127	29	223
3.					75.5	23.2	26	151	35	269

黃尖種在二瓦區已爲最高之生育，適與前窒素單用試驗同。惟晚二號則不然，雖至二瓦區尙未充分利用肥料。本試驗施用完全肥料，故其收量較前窒素單用試驗爲良。據以上二試驗可知本地種黃尖栽培于下道土壤，每鉢二瓦之施肥，已爲極度之生育，其與晚二號之吸肥性之差異極可注意之事也。

福州水稻改良之意見

On the Improvement of Rice Cultivation in Foochow

改良水稻品種多具下記四優點：

(1) 能適應其地方氣候土宜，且具有多產性。

(2) 較原用種勞費少，而能得同樣及較多生產量。

(3) 病虫害之抵抗力強。

(4) 品質優良。

本地現用水稻品種，未經科學的改良，故其收量品質均不佳，今如能獲得具有上述各項及一二項優良性質之品種，分配農家栽植，又講究現用栽培方法，卽以適應水稻之生育理論，及農人耕種條件爲基礎，而行改良，利已莫大。謹將農村電化部從來對於本地水稻之改良事業及現在鄙人所取之方針與希望，述之如下，以資諸君之參考。

吾人所栽植之水稻之原種，今日南洋羣島，猶有生存。此野生種水稻，如達成熟之期，其種粒卽行脫落，改良種則不易脫落，此誠爲栽培上極重要之性質，亦卽人類加意干涉結果之一性質也。野生稻之種實成熟，以不受鳥獸侵害之前，速埋土中爲利，其自然淘汰，寧使種粒易于脫落，惟經人類之栽培，須先收獲，然後播種，其不經人手收獲者，則不能不殘滅其子孫，如是種粒，易於脫落者，漸歸消滅，而有留存難於脫落種之傾向矣。

觀此因有所感焉。福州之稻種，早稻，晚稻均屬容易脫落者，據鄙人個人之觀察，穀粒於收獲或運搬時，因脫落損失，至少佔5 %。夫經久遠人爲之淘汰，何以猶有此種易于脫落之品種，究其原因，末始非在乎從來所使用之脫穀器。蓋用此脫穀器時，人用兩手捧住稻莖，向之打落穗頭穀粒，如是

以少力行脫落，過於粗劣之所致，彼不能脫落之品種，因此不受歡迎，終歸淘汰。又 5%以上之損失，若以閩侯全產米額三百五十萬担計算，其最低數爲十七萬担，每担以值五元計之，則有八十萬元之譜，實爲吾閩農民之大不幸也。本地沿閩江一帶，洲田甚多，其中所栽水稻，皆係高稈又脫粒困難之品種，此因洲田地勢低窪，時遇大水。今若改植易于脫粒者，勢必脫落殆盡，損失殊大。然一般農民，對于是項品種之脫穀作業，因無適當器具，頗感困難，故不脫粒之損失，想爲數亦甚巨也。

又查糙米之比率，本地種第一期作之糙米，比外地改良種少，第二期作亦少，茲列舉本地種與外地種之糙米比率如下：

	早　期	晚　期
本地種	大早 71%	黃尖 77%
外地種	龜尾 80%	晚二號78%

又查吸肥性，本地種大都質弱，而不耐多肥。如將來農業日趨集約化，而於一定面積內，希望較多之收量時，非多施肥料，難圖增收，則目今之品種，決非其所需要也(第一篇第三章16頁)。

脫落性，糙米比率，吸肥性，及其他多產性質之急宜改良，已如上述，然改良法中：其事簡而易行，且收効最速者，莫如向外國輸入改良品種之一法，蓋外地種之穗長，穗重，着粒粗密等均較本地種爲大，具有多產性質，且脫落性，糙米比率，吸肥性等，均較本地種爲優。茲將二者穗長等各點，比較如下：

本地種大早等(品種號碼1至10) 與外地種龜尾等(品種號碼201－210)之穗長，穗重，及着粒粗密之階列。

（1） 穗長之階列 （單位cm.）

9

秧 地 片 景

The nursery bed for the experiment investigating the varieties of rice in Foochow

種類	總數	17	18	19	20	21	22	23	24
本地種	10		2	1	3	2	2		
外地種	10			2	3	2	1		2

（2） 穗重之階列 （單位gr.）

種類	總數	12	14	16	18	20	22	24	26	28	30	32
本地種	10		1	1	1	2	2	2		1		
外地類	10					2		1	4	1		2

（3） 着粒粗密 （10cm.穗長中之粒數）

種類	總數	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5
本地種	10		3	1	2	2	2					
外地種	10				1	2	1	2	2	1		1

本部於牧畜方面，曾輸入外國改良猪種勃克希哀種及鷄種勒項等，而繁殖之，以供分讓一般社會之需，卽應用此法也。但水稻對於氣候土宜之適應性，不如家畜之易豢，故輸入之先，在氣候上，農耕上，更宜考慮--適當之品種，暫行栽培之試驗，確定其可能生育後，始可分配農家栽培。本部曾採日本北部早熟性品種，在本部作早季之栽培試驗。據試驗結果。改良種生育期較本地種早稻爲長，故欲使與本地種早稻同時收獲，並可仍行水稻之早晚二期作法，在本地氣候之下，其播種期須較本地種早一月上下，俾得提前移植本田始可(第一篇第三章9頁)。

查本地氣温，二月約爲十度，而稻之播種，最低氣温須十度，（依品種稍有差異）故二月中旬卽可播種。稻之秧地期間需温十五度，插秧期爲二十至二十五度，本地三月之氣温爲十七度，四月爲二十一度，根據理論，三月在秧地，四月初旬移植，極爲適合，卽較本地方法，三月中旬播種者，猶可

提早一月也。更由利用自然恩惠如日光，土地生產力，水中養分等各點觀之，若提早一月栽植，即多利用一月之天然要素，故于土地經濟原則上言之，亦極合宜也。

農村電化部試驗優良水稻品種個數

	本地種	外地種	合計
民國十七年	10	5	15
十八年	10	26	36
十九年	17	89	106
二十年	25	92	117

外地改良種之栽培及栽培法試驗，已進行四年矣。據試驗結果，知於本地栽培改良種，宜用不混植法，若以本地慣行法（混作法），栽培改良種，則結果不良（第一篇第三章26頁）。茲將改良種用不混作法與本地種用混作法比較之成績，列表于下：

改良種用不混作法與本地種用混作法之比較

栽培法	品種	年度	每畝收量 早季	晚季	計	指數
混作法	本地種	17	225,00	324,06	549;06	100
不混作法	改良種		344,08	331,02	675,10	124
混作法	本地種	18	254,02	367,08	621,10	100
不混作法	改良種		426,08	349,05	775,13	125

至于以本地種栽培不混作法，本部亦曾舉行試驗，其成績在本報告第三章10頁。查其收量，雖有多少增加，然其所得似難償所費勞力，故欲謀現用本地種增收起見，甯以多施肥料及加若干改良（卽增加株數等）爲最得策也。

據四年來試驗之成績，吾人深信本地有栽培外地改良種之可能，如輸入

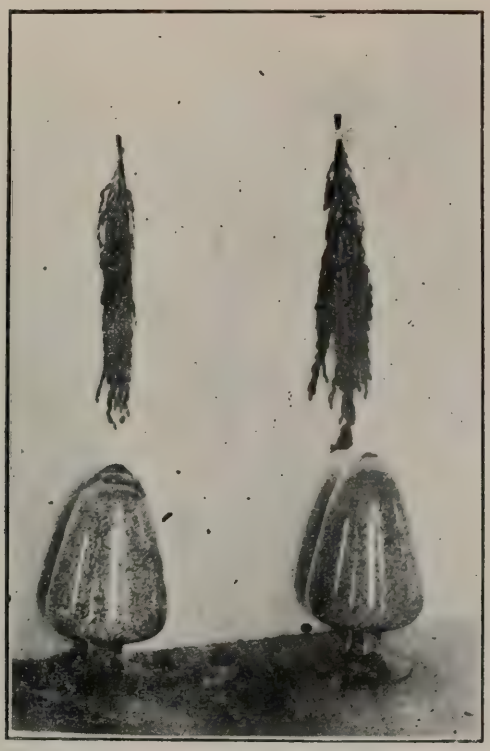
10

品種試驗
（最右者係本地種）
An Experiment in the Variety of Rice
(extreme right is local variety)

11

純系淘汰試驗
（大早及龜尾）
An Experiment in the Pure Line Selection
(Ta Zao anb Kamenoo)

12



本地種與改良種稻穗及米質之比較
左； 本地種 右； 改良種
Comparison of the local variety of rice with improved variety
Left ; Local variety Right ; Improved variety

13

農 家 模 範 田
左； 本地種 右； 改良種
The Model Rice Field for Farmer
Left ; Local variety Right ; Improved variety

外地改良種，應用適當之栽培法，既可以免除本地種之脫落性，糙米比率，吸肥性，以及其他品質上種種劣點，又可以得優良收獲，所謂收量增加至30％者是也。

民國二十年本部曾舉行大規模之改良栽培法實地指導，但實行指導之先，不免有下列種種困難，（一）播種期提早一月，則歷來之栽培法，勢必完全改變，將從前之習慣一概革新之，（二）播種期適當舊歷之正月，實是月爲農人休養娛樂之期，農人胼手胝足，終歲勤勞，少得閒暇者，僅是月耳。際此舊歷尚在盛行新曆猶未普及之秋，若欲改變耕種日期，非將農人心目中之『舊正爲一歲娛樂之期』轉移爲『新正爲一歲娛樂之期舊正爲一歲耕作之萌』不可，否則恐難收効果也。

故是年雖在科貢一57畝，鼓山一 5畝，漚田局試驗場一 2畝，螺洲一 3畝，及本公司附近所有田20畝，完全用不混植法，以栽培改良種，而行試驗，然秧苗全部，由本部育成後配給之。此外肥料問題，如改良種須多施肥，故仍宜研究肥料配合之方法，用量，及配給之方法等。至脫穀問題，則準備一種遠心力脫穀器。又第二期作須俟第一期作收獲後，方可栽植，並犂起田土及種種準備，故其時農家之忙碌倍蓰平日，然若行之既久，如閩南台灣等，當亦漸成習慣。本部爲農家初次實行不混作法起見，特爲按置電力抽水機，藉以減省其勞力，而便澈底進行本耕作法。又第二期晚稻所施用之肥料，亦配合供給之，如此辦法，極像新種之初來中國，爲其成育，一切妥爲準備關照，無微不至。至食味問題，一般人士從未知改良種之美味良質，惟改良種之炊飯方法係蒸熟而食，非如本地種之加水而煮之者，故不生米汁，不合本地養猪之習慣，宜另給與米汁。致對于改良種之普及上，不免又生許多困難問題。關於此項農家指導成績，請參照本報告第一篇第三章14頁。

農業之改良，既有關氣候土宜等天然的要素及勞力經濟習慣等人爲的要

素。故不能如工業之盡量應用外國所研究之方法。農夫各異其環境，各異其機會及各異其社會上之需要。故甲地甲時之良法，不能應用于乙地之乙時，故農事改良，須具有廣大之眼光與精密之觀察，長久之計劃，方能見効。據改良一地方所得効果，以全盤計算，所費似頗巨，若農人能應用之，以每畝一擔之增收計之，假使改良田爲七十萬畝，卽有七十萬擔之增收，其價值爲四百萬元左右，收入亦不爲不巨，不過從事改良之初，宜考慮各種優良之方法耳。又例如本地多處于第二期收獲後種植油菜或大麥，其收獲適當四月中旬，爲不混作法插秧之期，故獎勵改良種之栽培，誠屬不可能，於是前年日由本四國高知縣地方採集早生種，作品種之試驗，于四月下旬插秧，觀察其生育，但結果不良，將來對此問題，猶有研究餘地也。

在都會附近，獎勵栽培裏作，如油菜小麥西瓜及其他蔬菜等，爲有利之事業，其法以裏作爲第一期作物，使其充分利用水田，以水稻爲單番作，其栽培法似中國中部及日本所行者。去年本部曾行關於此項之試驗，其結果畧見成功，當行單番作試驗時，麥之播種時期之試驗，亦曾行之。此項試驗，亦在第一篇第三章18頁述之。惟麥之播種期試驗尚未發表。

前年曾以本地法(混作法)栽培外地種之試驗，試驗方法，分爲三種：

(1) 代用本地早稻栽培外地種。

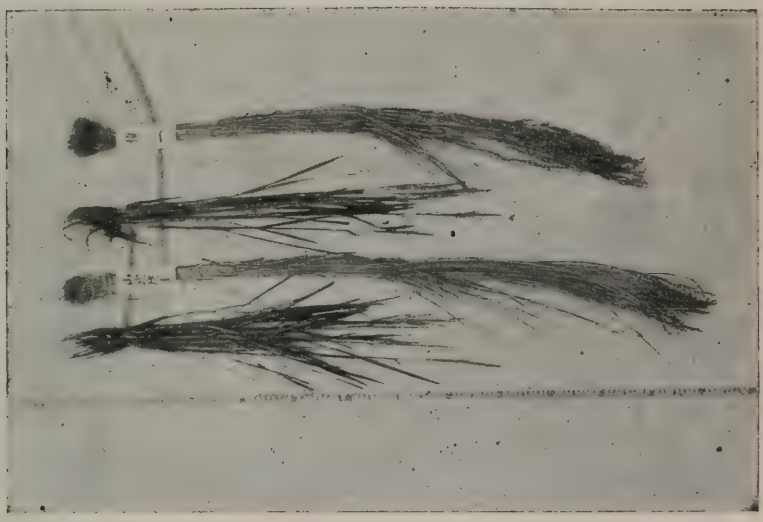
(2) 代用本地晚稻栽培外地種。

(3) 用本地種。

據試驗結果，以早稻栽培外地種之成績，稍見優良。晚期栽培外地種，因其生育期間溫度較高，促短生育期，遂使早日出穗，所得結果不良。此項試驗在第一篇第三章26頁。

由上列各種試驗結論，外地種是否有價值獎勵，惟據鄙見殊不敢斷言。蓋外地種須用其適當方法栽培之，始可得優良之成績也。

14

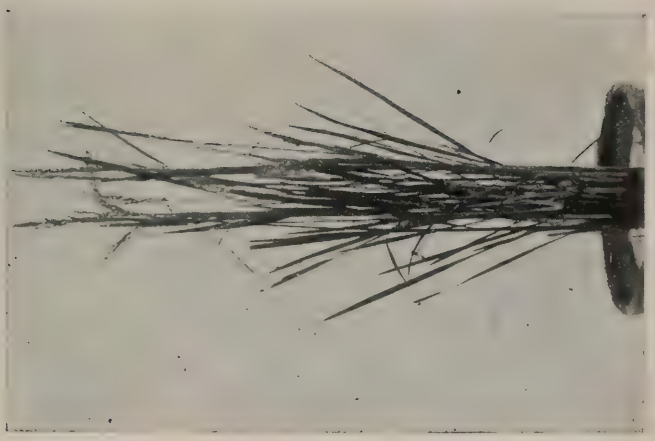


凡栽培日本種或外地種於本地時，首宜决定其栽植日期，以圖增收。圖一四，一五，一六係示選一，山北坊主二種不同之品種，栽培於一月至六月(上)及六月至十月(下)之生育狀況，由斯結果，知此二品種，如上圖所示若栽培於早期作，則有良好之產量也。

To plant a Japanese or imported variety of rice in the climatic conditions of Foochow, we should determine the season to plant them in order to get good crops. The photographs (14.15.16) show the contrast of varieties which were planted February to June (above) with the same varieties planted June to November (below), indicating that both of these two varieties, the Senichi and the Yamakitabozu, when planted in the season for the early rice, make great gain in height and yield.

15

16



茲更換問題，就本地種之改良及本地栽培法之改良研究之。

本地品種改良法有三；

(一)純系淘汰法。　由一品種中選擇其形質相同之優良純種。此法前年已行之。自六品種六千系統中，選出三十系統，本年已進第三期之試驗。由此所選品種，除收量增多外，更能適應本地栽培法及習慣，且本地種之變異甚大，故鄙人深信能選出豐收之優良系統也。

(二)選出類似本地種之品種　民國二十年曾由浙江移入十七種，江蘇四十一種，廈門十種，共六十八種以供試驗，藉以選求更優良之品種。查試驗結果，優良品種甚少，其効果不良，江蘇浙江係中國第一良質米之產地，而其成績尚如此，可見今後我國之米穀，誠有許多改良之餘地也。今年更就廣東，廣西等之品種，續行本項試驗。

(三)　雜種法。　據台灣中央研究所農業部報告，台灣種（其一部分祖先係中國南方所來者)與日本種之雜種，多成不登熟性 Sterity)，即第一代雜種無生殖可能。是故台灣種之交配事業，雖歷三十年之久，終不能成就台灣種與日本種之優良雜種，故本地種與日本種之交配，似屬難行，已可想矣。但江蘇浙江品種之米質良好者與本地種行雜交之時，或可得優良之雜種，將來甚希作此試驗也。

以上所述係本地水稻品種改良之方針及實際所作之事業，此外關於栽培試驗，肥料試驗等過去已行之，其成績結果，曾於本部報告第一號發表之，但其試驗多係証明外國已行之試驗，比較重要者，須行他處從未曾行之試驗，爲其第一步，即行本地法(不混作法)栽培及肥料施用法等試驗，此項試驗之成績亦發表本報告第一篇第三章23頁。由其成績觀之，知本地混作法，如施若干改良即有相當的增收，且此種改良事業，既易於實行又速於普及也。

至本地各處土壤生產力之試驗及施肥標準調查豫備試驗，曾於民國十九年以 Wagner 植木鉢行之矣(本報告第一篇第三章29頁)。據本試驗，得悉本

地各處之土壤，其生產力之差異殊大，其中大半缺乏窒素，故肥料應加適量之窒素，方可達增收之目的，本試驗對於農家肥料之節省及合理的施用，甚關重要也。

改良稻作之事甚爲困難，然如事業有成，則收効殊大，甚望社會人士互相努力協助，眼光須遠大，尤宜精思極慮種種事實，以謀最適合之方法而選多數最優良種子並講求栽培之。前與本地協和大學教授同來參觀之外洋人士，曾問及如果試驗多種不同品質之水稻品種，則本地所產之米穀亦不免紛雜，販賣上是否有不利之點。渠言確有理由，本部因現今尚在試驗時期，故未曾考慮及之，甚望目下輸入多數品種，選出優良者分配農人，他日由農人本身能力自選良種以維持之，則末始不可解決也。

本報告所彙集水稻品種改良事業及栽培法改良試驗等，猶屬初步工作，將來有賴于各界人士及農業同志之繼續研究者正多。又以創辦伊始，實驗室之研究，未能儘用，成効不著。至于推廣指導工作，以其事業宏大，非藉官民通力合作及對本事業有確定之認識及計劃，難收實効。尙祈社會人士羣策羣力，咸致力于斯事。致日臻于進步。則地方幸甚農民幸甚。

陳振鐸識

於福州電氣公司農村電化部 23,5.1932

17

農村電化部辦事處

The Building of the Department of Rural Electrification

18

水稻研究室

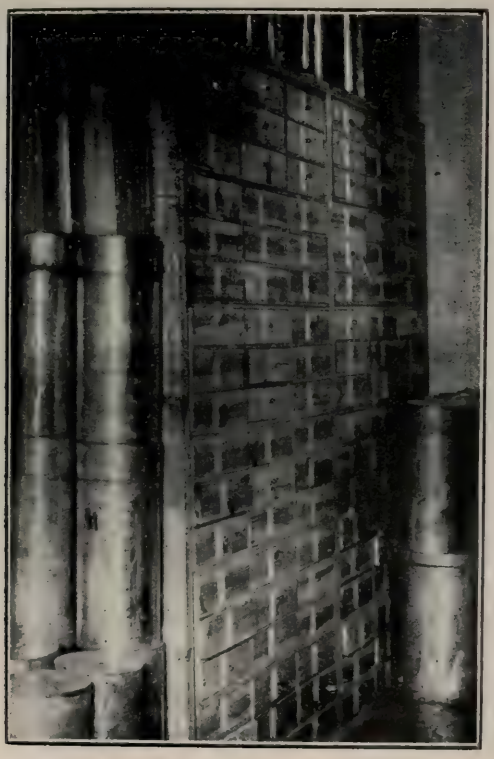
The Laboratory for Rice Research

19

農村電化部事務室

The Office of the Department of Rural Electrification

20



水稻品種貯藏箱

The Storage Boxes for the Varieties of Rice

21

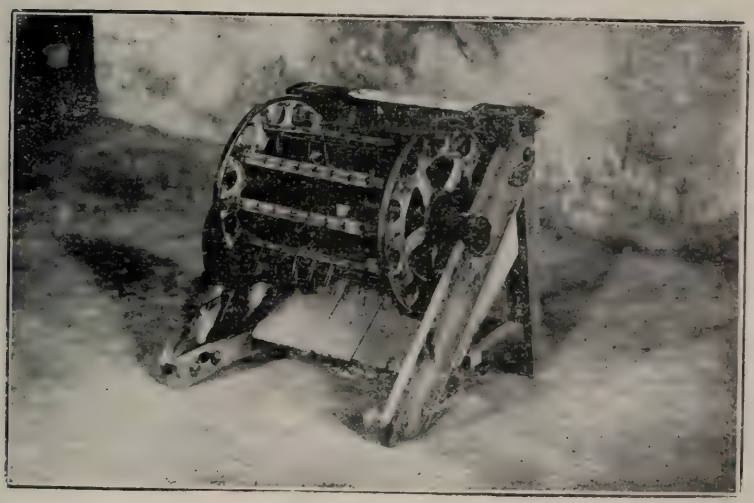
深 耕 犁

(福州電氣公司製造)

Improved Plow for Deep Plowing

(Made by Foochow Electric Co.)

22



脫 穀 卷

(福州電氣公司製造)

Rice Threshing Machine

(Mabe by Foochow Electric Co.)

第 二 篇

SECOND PART

SECOND PART

AN INVESTIGATION OF THE VARIETIES OF RICE IN FOOCHOW *(Preliminary Report)*

By

C. T. Chen K. C. Kiu K. P. Low

Introduction

It is understood that to investigate the various strains of rice and to make clear the relation of each to its environment is very important. To secure the best crop for the climatic and the soil conditions, and to get an improved variety that is better adapted to its particular location are worthy objects of effort. Our local varieties of rice are low in production and poor in quality. There is great room for improvement. In order to get some knowledge of the various strains of our local rice, and to aid the work of general improvement in rice culture, we made an investigation of the various strains of rice commonly grown in Foochow in the year 1930.

The number of varieties of local rice collected was 20 of early rice and 9 of late rice. For comparison, we made an investigation of 17 varieties which I had secured from Che Kiang Province. For this investigation I followed an article of Dr. Edwin Brigham Coperland. ("Rice." 1924, page 29.) describing varieties of rice. The standard for the investigation is based on Dr. Iso's research in the Formosan rice plant with special reference to the culture and crossing of plants. (Department of Agriculture, Government Research Institude, Formosa, Report No. 37)

Plan of the Experiment

A general description of the cultivation is the following:

Temperature:— Table of meteological observation, in 1 st chapter of part 1.

Soil :— Alluvial clayey loamy soil.

Dimension of field for each variety:— One are

Numder of plants:— Single seedling was planted 20 cm. apart; in one square meter; there were 19 seedlings.

Fertilizer:— Fertilizer used in one are was as follows;

Kg. per 1 are

Fertilizer	Base manure	Additional manure	Total	N	$P_2 C_5$	$K_2 0$
			Kg	Kg		
Barn manure	60 kg		60	0.348	0.180	0.300
Bean cake	5	4	9	0.568	0.099	0.142
Ammonium Sulphate	0.5	1.0	1.5	0.300		
Acid phosphate	2.9		2.9		0.500	
Straw ash	8.9		8.9		0.187	0.400
Total				1.216	0.966	0.842

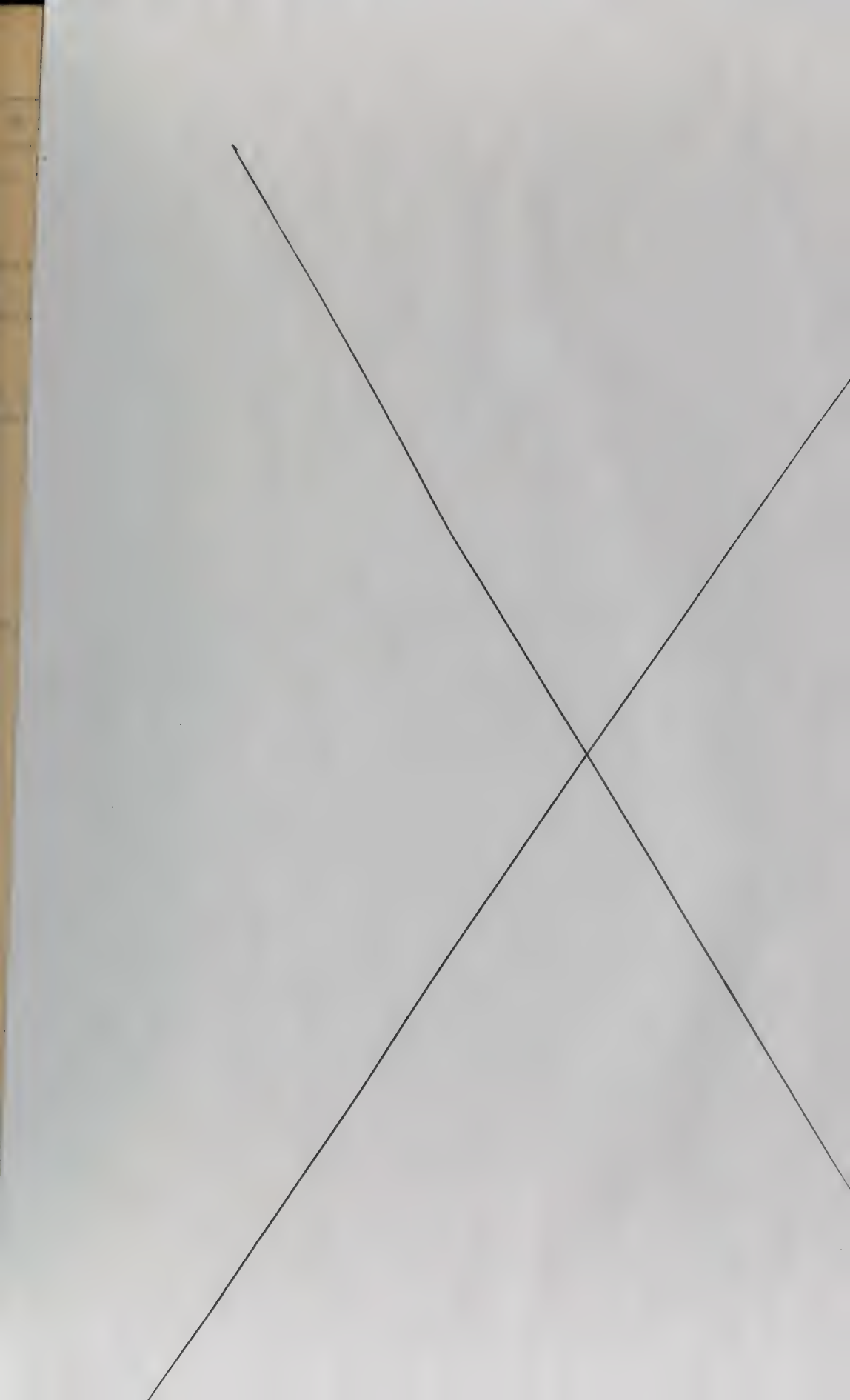
The date of sowing, transplanting and harvesting:—

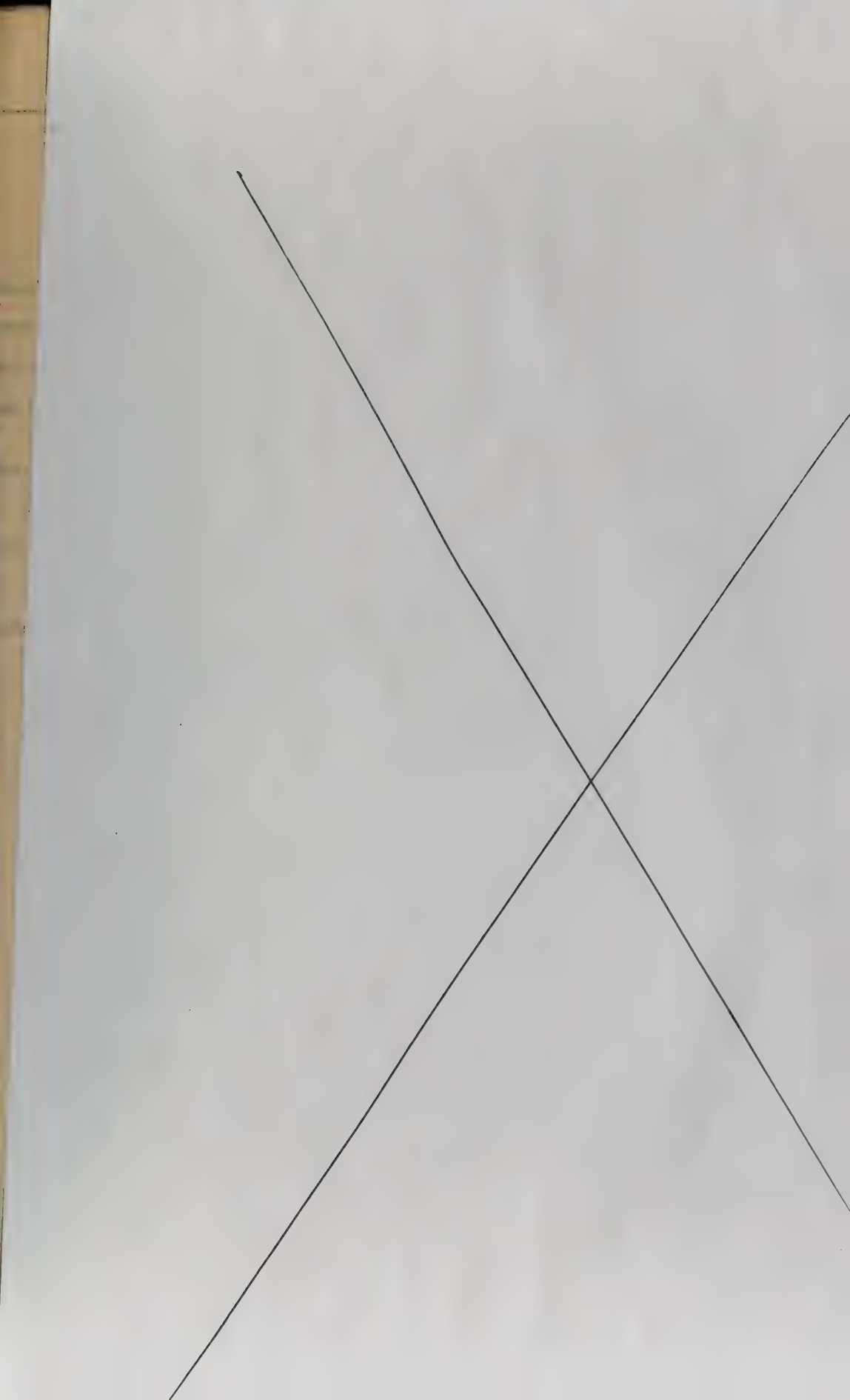
	Early rice	Late rice
Date of Sowing	25th February	26th June
Date of Transplanting	1 st April	31th July
Date of Harwesting	Late in July	Late in October

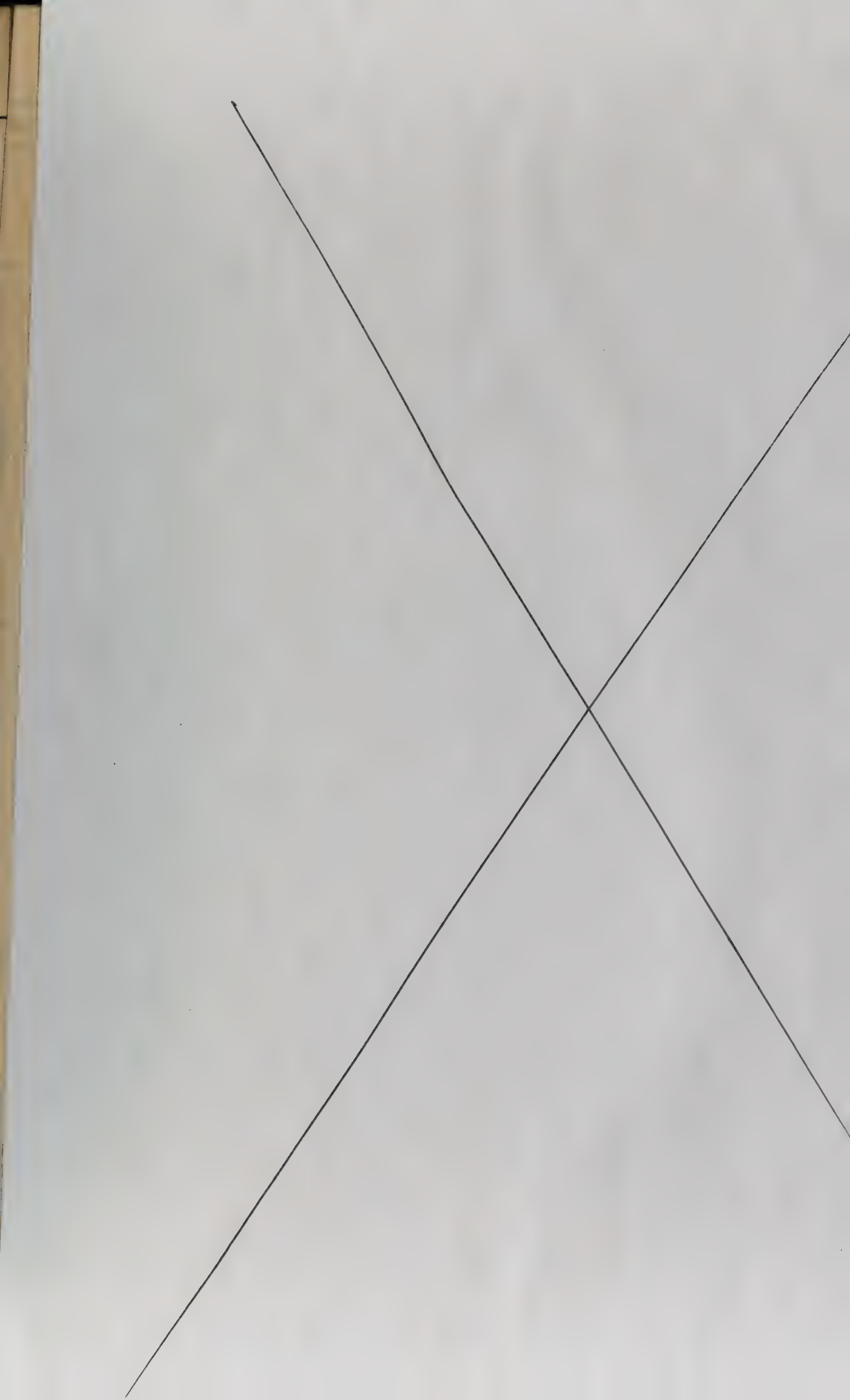
Che Kiang varieties were planted with the late rice of local varieties.

Result of Investigation.

The results of the investigation are written in table 1 -and in table 2. Of these table 1 is for local varieties and table 2 is for the Che Kiang varieties.







A STUDY OF THE PRESERVATION OF RICE

By

C. T. Chen K. C. Kiu K. P. Low

Introduction

There are three ways of preserving rice, first as grain, second as unpolished or husked rice, and third as polished rice. Of these, preservation as grain is the safest. In Foochow, rice is preserved as grain, and in the market, the unit of weight; 1 picul (1 picul equals 100 catties or 133 lbs.) is usually used. It is different in Japan where a unit of volume is used. Farmers sell their stored grain according to the market price and the circumstances of their own households, so there are no definite seasons for marketing the stored grain. Nevertheless, the most busy seasons for dealing in grain are the beginning of August, when the early rice has been harvested, and the end of November, when the late rice has been harvested.

The physical and chemical changes of grain during storage were studied by Dr. Kondo (1) and others (2), (3). It is known that a change of humidity during the storing has an effect on the weight and the volume of the grain, and on the percentage of husked rice. When the humidity is increased, the grain absorbs water which makes expansion. The surface becomes humid; friction occurs, generating heat, and volume weight decreases, and the percentage of husked rice increases. The opposite phenomena occur when humidity is reduced.

It is important to know such changes for our local variety of rice during the period of preservation in the ordinary storage houses, under our climatic conditions. In other words to understand the best conditions for the local variety of rice in both the harvested and the husked forms for each season of year

during the period of preservastion is very important. These problems are important not only for the producer, the farmer, but also for the rice merchant and the consumer.

The experiment outlined here, was done for the purpose of discovering the physical changes in rice as grain and as cereal during storage in a granary. The experiment was carried on from August 1930 to June 1931. According to the report of old farmers, the climatic conditions of this period were average; so the result of this experiment should show no great differences from what would obtain in other years.

Material and Subject of Experiment

The storage house supplied for this experiment is a complete storage house for the crop of the Foochow Electric Company. It is made of brick, 50 ft. high, 150 ft. long, and 50 ft. wide.

As to the grain for preservation, two local varieties were used, Ta Tsao, (大早) an early rice, and Huang Chien, (黃尖) a late rice, and also a Japanese variety, Kamenoo, which was cultivated at our experiment station. Those were packed in hemp bags, net weight 133 lbs. = 100 catties, as customarily done in Foochow, and were put in the storage house. For observation of the weight changes during preservation, two bags for each variety were selected, and for the other experiments also two bags respectively were used.

Investigations were made on the weight of grain, on the percentage of husked rice, on the weight of grain and of husked rice in volumes of one hectoliter, and on the percentage of water both in the grain and in the cereal forms. Records for these data were made every ten days from the 20th of August 1930 to the 30th of September of that year, and every 15 days from the

30 th of September to the end of June 1931.

Restuls of Experiment.

(1) Humidity

The humidity of the storage house and of outdoors during the experiment was observed every day at 10 o'clock a. m. The means of the results of observation in each period of experiment were written in the 1st and 2nd line of table 1.

The humidity of the storage house is higher than that of outdoors the whole year round. The difference between them is biggest in the beginning of March, it is about 15 degrees (relative humidity). When the indoor humidity is still high, on the other hand, the outdoor humidity begins to decrease. At other times, there is a proportional relation, that is, when the outdoor humidity increases, the room humidity is also increased. (Fig. 1) The humidity of the storage house is highest the first half of February, about 90°, and the lowest in the end of October 63°. From the end of August it decreases to the end of October, and then increases till the end of January, and then decreases again. In Foochow, the dry season is in Autumn, and the wet season is in the late winter and the spring. Thus the humidity of the storage house is seen absolutely to correspond to the changes of the season.

(2) Weight

There are small changes in weight as shown in table 1, corresponding to the humidity of the storage house. They decrease till October and afterward increase. The degree of change is greater in the Japanese variety. The reason seems to be that its content of husked rice is bigger than that of the local variety.

(3) Percentage of Water

For storage it is necessary to dry grain after it is harvested. When it is damp, or not dried enough, the sweating of the grain becomes violent. The fugi, or bacteria, grow rapidly aud change the quality. Sometimes putrifaction occurs. Such grain also is easily injured by insects. For storing, it is safer when the percentage of water in the grain is low, but when it is dried too much, the rice kernel cracks and is not good to eat. Dr. Daikuhara, (4), who studied the drying of rice, says that the grain must dried to 11% of moisture in order to be safe for preservation. In Europe and in America, it is reported that good dried grain has 12% of water. The grain supplied for this experiment was dried to 9% for early rice, and 12% for late rice. The method of drying was that habitually used by local farmers. After the grain had been harvested it was exposed to the sun two days for early rice and three days for late rice on the surface of cemented ground, or on mats. The water percentage of early rice is too low, the reason is that it is dried too much by the direct exposure to the violent sunshine of August. This may be one reason why the quality of early rice is not good. On the problem of drying the early rice, we wish to make definite study in the future. The water percentage was observed by Hoffmann's method. The percentage of water in early rice, in both the unhusked and husked forms, after these had been deposited in the storage house, at the end of August, made small increase. Later it decreased till the middle of November. The percentage of water was 9% at the lowest, and then increased again. It was highest in the end of March when it reached 13%. The difference between the two is 4%.

The change in the percentage of water for husked rice is more obvious than that of grain and the percentage of water is itself greater. The local variety contains much more water than the Japanese variety. The percentage of

water has a distinct relation to the humidity of the storage house; when the humidity there increases the percentage of water also increases.

(4) The Volume Weight

During the period of storage, according to the seasonal changes, the rice kernel expands or shrinks, making a change in measure; so that there is a difference in the volume weight. When the humidity and the temperature are high, the kernel absorbs water and expands. The surface becomes moist, friction occurs; and the weight of a constant volume is decreased. In this experiment the volume weight of husked rice changes distinctly, decreasing rapidly toward the end of December (Table 1), when the percentage of water was increasing. This phenomenon is alike for the local variety and the Japanese variety of rice. For the late rice, Huang Chien, this characteristic is not so distinct as with early rice varieties. In grain, there is no great change.

For the Japanese variety, Kamenoo, its volume weight of unhusked rice is smaller than for the local variety, but of husked rice is greater. For reference see the weight of one thousand grains and kernels of erch variety in this table:—

Variety	unhusked	husked
Kamenoo	25.010 gr.	20.325 gr.
Ta Tsao	27.595	22.395
Huang Chien	22.545	18.320

The shape of the kernel in the Japanese variety is round;on the other hand, in the local variety, it is long and slender. This is one reason that the volume weight of the Japanese husked rice is greater.

(5) The Percentage of The Husked Rice.

It is known that when the drying is well done, the percentage of husked

rice is increased. In this experiment, the change in the percentage is not distinct, but it is clear, that in the middle of November, in the drying season, the percentage of husked rice is high.

Summary

(1) In the climatic conditions of Foochow the humidity of the storage house is at a minimun in the middle of October when it is about 56° of relative humidity, and at the maximun in the beginning of February, when it is about 87°.

(2) The percentage of water for both uuhusked and husked rice is at a minimun in the middle of November and then increases till the beginning of January. After that there are only small changes.

(3) The change of volume weight in unhusked rice is not distinct, but in husked rice, the change is clearer. At the end of December it decreased suddenly and afterward there was no change.

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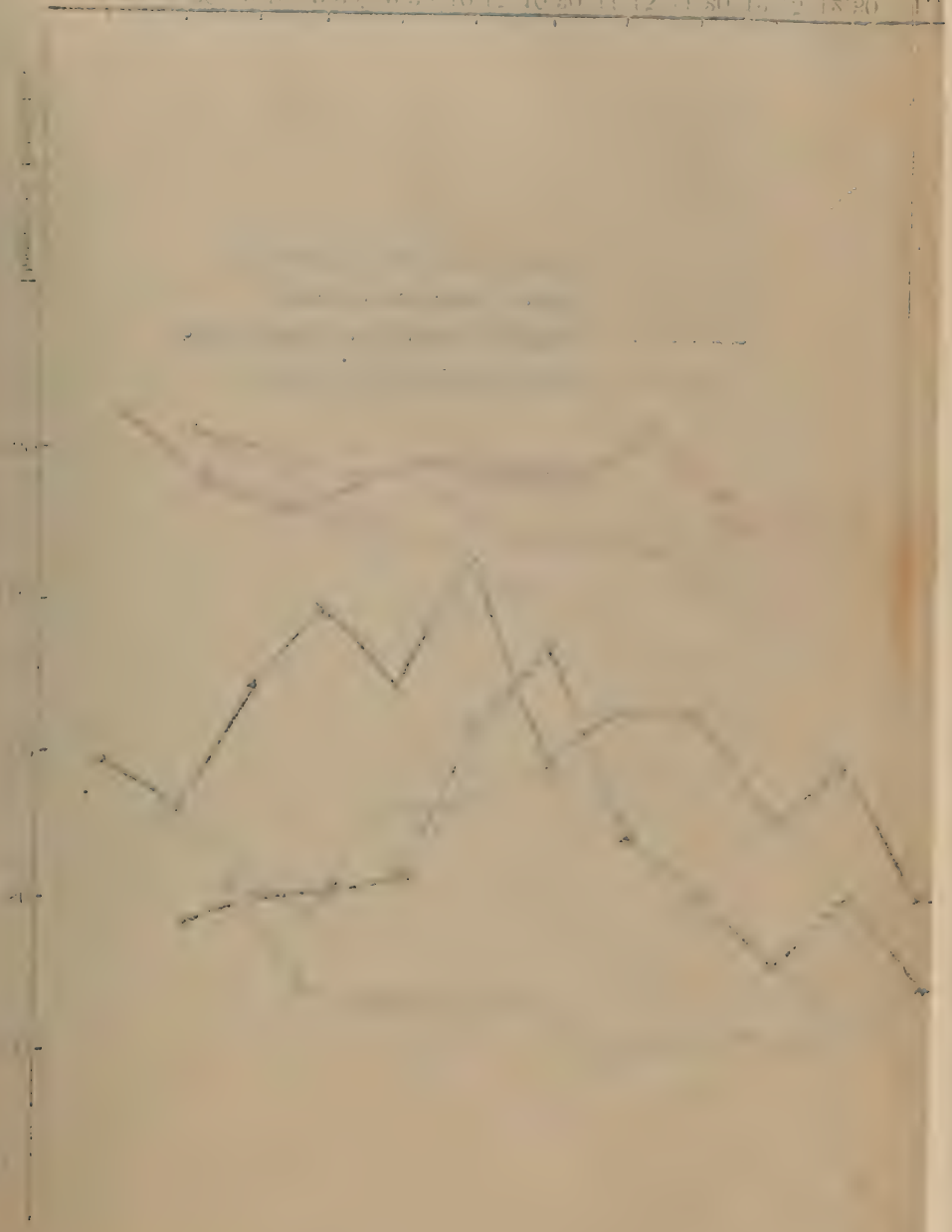


AN EXPERIMENT IN USING POTASH AS ADDED FERTILIZER FOR THE *Elochxis Dulcis* OR WATER CHESTNUT

By

C. T. Chen K. P. Low S. T. Sung

Eleochxis Dulcis. (Burn. f.) Trin. is called " Muili. " 荸薺 (尾梨) in Foochow. It belongs to the *Fam., Cyperaceae* 沙草科 Its rootstock looks very much a large chestnut. Each one is about 8 grams in weight, and from one original bulb it can grow 30 to 35 bulbs. The surface is brown and the inside is white. It contains much carbonhydrate. It can be eaten fresh, and has a good sweet taste. It makes a very good summer fruit. In Chinese medical science, it belongs to the cooling medicines, and it has some effect on children with measles.

Muili is planted in great quantities in Foochow, It is a special product of this locality. In late June, the farmer makes the seedbed and plants one bulb every 10 centimeters. It grows stalks very fast, and after forty days, in the beginning of August, when it is 30 cm. high, it is transplanted to the paddy fields, where the early rice has been harvested. The distance in planting is 60 cm. for each seedling.

For fertilizer, night-soil, farm manure, and bean cake are usually used. The quantity of nitrogen meant for 1 mow (about 6 ares) is 8 catties (one catty is-600 gr.), corresponding to 0. 8 kg. for one are, costing about $ 10. of Foochow currency. Muili is weeded three times and harvested in the middle of December. The average yield is 15 piculs (one picul= 100 catties) of

bulbs per mow, and the value for each picul is from $ 3.20 to $ 3.00.

Muili can be kept in the ground a good long time. For this delayed harvesting, the soil of the surface is not removed. If kept until June of the next year, the price rises to $ 6. a picul. With care rottenness can be reduced to 20 or 30%. These last few years, the export to outer places has much increased, and the value has also risen, so the profit from the cultivation of muili is pretty good and the area of planting has much increased.

In Foochow, the farmer is habitually using only nitrogen fertilizer for the cultivation of muili. He does not make any study of the effect of other important fertilizers. When we consider that potash fertilizer has much effect on carbonhydrate assimilation, it is clearly a very important factor for the kind of plants in which we wish an increase of carbonhydrate. Then we may easily conclude that by adding a proper amount of potash, the quantity as well as the quality of muili will be improved. The purpose of the following experiment is to discover the effect of potash fertilizer on the cultivation of muili.

(1) The plan of the Experiment

Seedlings of the same growth, 30 cm. tall were selected, and on the 30 th of July, five seedlings were transplanted to each of several plots at distances of 45 cm. from each other. The area of a plot was one square meter. It was made of hardwood, 60 cm. in height, without bottom, and was buried 50 cm.deep in the middle of an ordinary muili field. The sort and the amount of fertilizer given are as follows.

Plot number	Amount of Element (in gram) Nitrogen	Phosphoric acid	Potash
1 & 1'	0	0	0
2 & 2'	0	0	10
3 & 3'	0	0	20
4 & 4'	10	10	10
5 & 5'	10	10	20
6 & 6'	10	10	30

Fertilizers used: Nitrogen — Ammonium Sulphate; Phosphoric acid — Acid Phosphate; Potash — Potasium Sulphate.

For each method of fertilizing, two plots were used. The unit quantities given for each plot — 10grams—, correspond to one kilogram for one are. On the 14th of October, we harvested the bulbs of each plot, washed out the surface soil carefully, and found the weight and the number of its bulbs for each plot. Table 1 is the result of these observations.

(2) Result of the Experiment

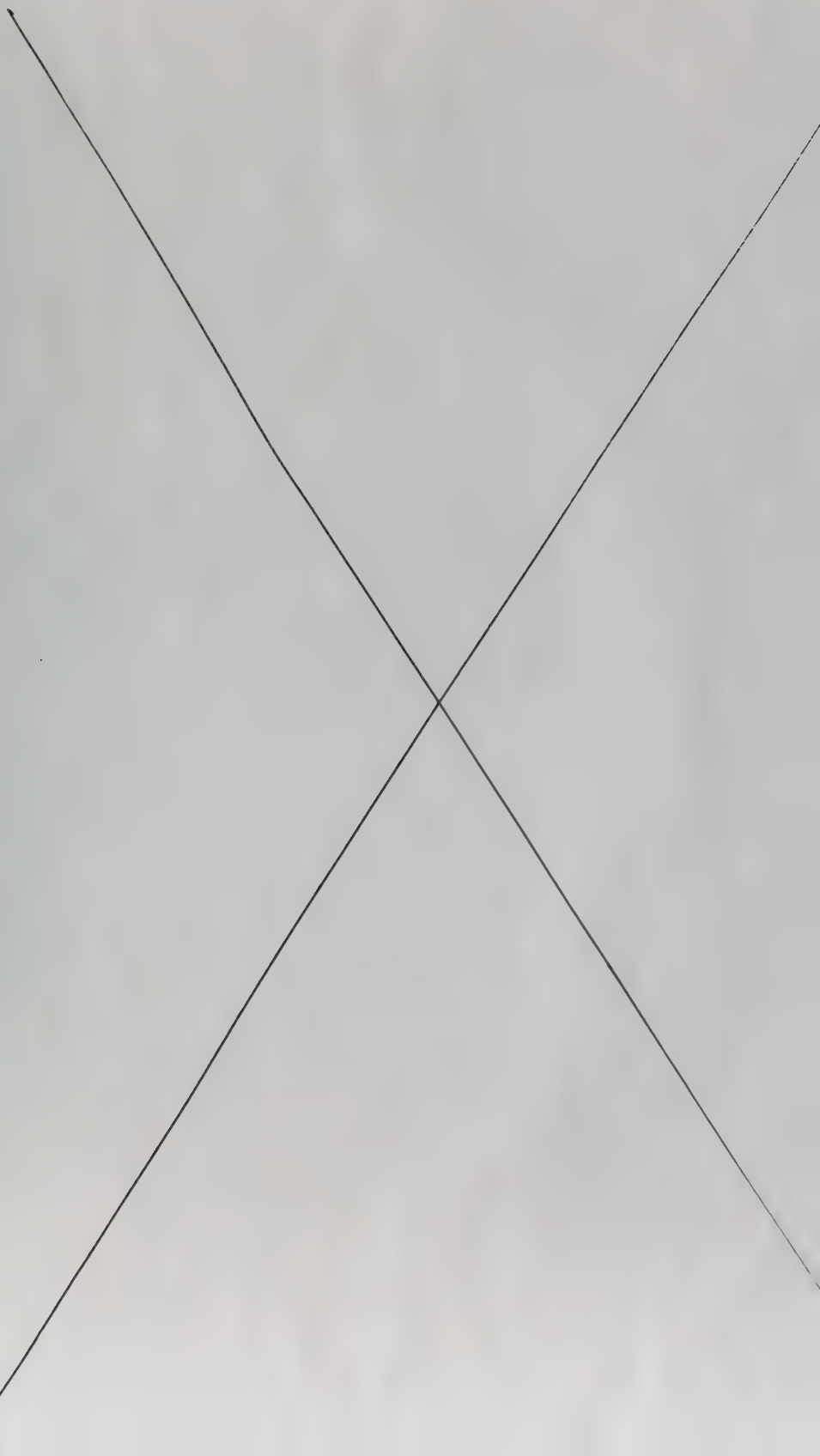
By comparing the yield of the 1 and 1' plots with that of the 2 and 2', 3 and 3' plots, it may he known that by adding potash fertilizer to the unfertilized soil, the number and the weight of bulbs are both increased; but it seems there is some limitation, in that, above 10 grams, the effect is not obvious. The percentage of big bulbs is increased in weight as well as in number. The graph (Fig. 1) shows the weight of bulbs for each class of plot. Noting the record of the 1, 2, and 3, plots,we see that by adding potash fertilizer, the weight of big bulb is obviously increased.

Adding potash to the complete fertilizer, with which we experimented in plots 4, 5, 6, 4', 5', and 6', we got the result, as shown in table 1, that the weight and the number of bulbs are both increased, and the rate of increase is more notable in this case than in the other where potash is added only to unfertilized soil. Fig. 2 shows the weight and number of bulbs in plots 4,5 and 6.

The mean weight of bulbs in each experiment is shown in table 2. Those of the 4, 5, and 6, plots are smaller than those of the 1, 2, and 3. The reason is, as shown in the bottom of table 1, in the line of index number for total weight and total number, in the case of complete fertilizer the increase in number is greater than the increase in the weight; so the mean weight of a bulb is decreased, but actually, the bulbs increased both in number and in weight. As shown in table 2, the standard deviation is much greater with complete fertilizer. This suggests that the possibility of growing big bulbs is greater in the case of the complete fertilizer than in that of adding potash only.

By this experiment it is known that by adding potash fertilizer to muili, the yield is much increased and the quality is also improved. It would be very good for farmers to use potash fertilizer in order to develop their products.

The potash fertilizer of this experiment was supplied by the N. V. Overzeesche Kali Export M I J. Amsterdam China Delegation, for the kindness we express our hearty thanks.



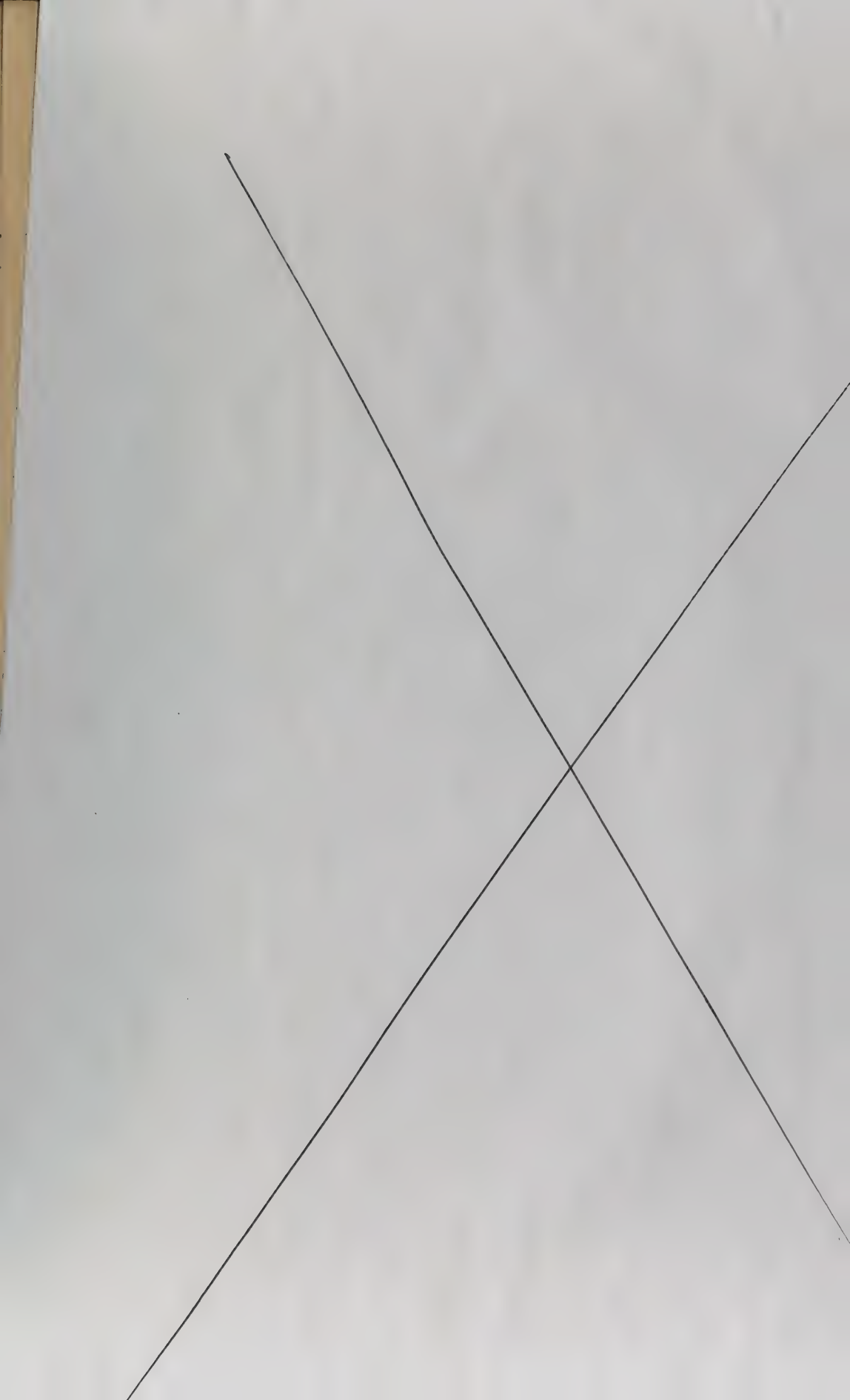


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Fig. 1

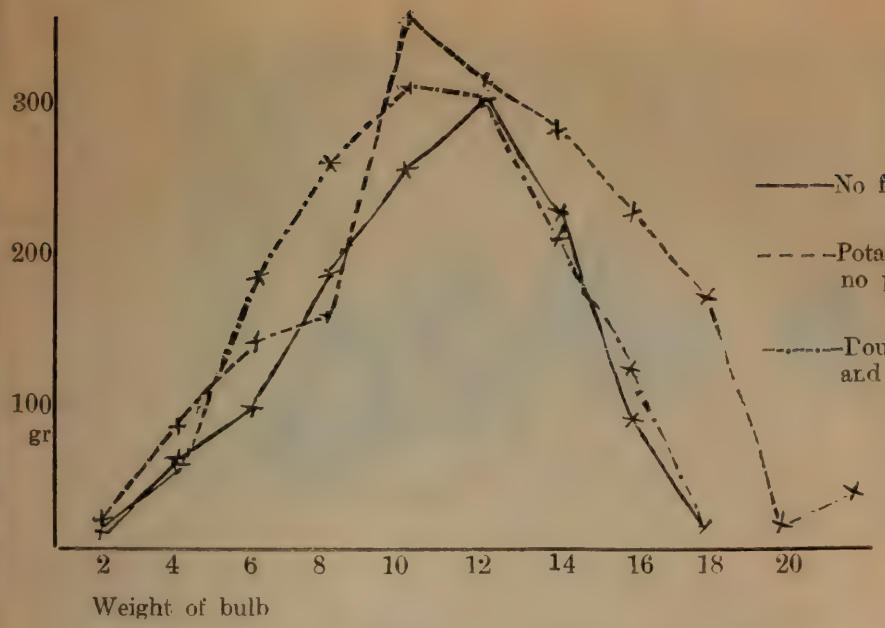
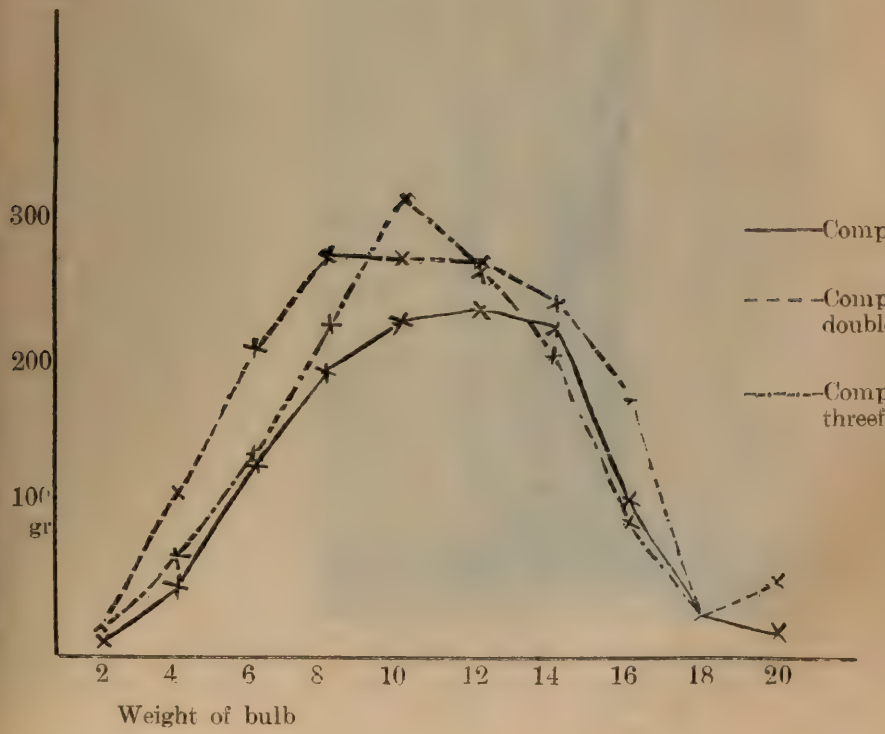

300
200
100
gr
Total weight (gr.)
2
4
6
8
10
12
14
16
18
20
Weight of bulb
No fertilizer
Potash no nitrogen and no phosphoric acid
Double potash no nitro
and no phosphoric acid

Fig. 2


300
200
100
gr
Total weight (gr.)
2
4
6
8
10
12
14
16
18
20
Weight of bulb
Complete fertilizer
Complete fertilizer with double potash
Complete fertilizer with threefold potash.

23

Fulbs of Eleochxis Dulcis

荸薺之球莖

24

Elochxis Dulcis or Water Chestnut

荸薺（尾梨）

AN EXPERIMENT IN CATCHING RICE MOTHS BY LIGHT TRAPS

By

C. T. Chen　　I. Lo

In Foochow, the rice is injured by a moth 二化虫螟 callad *chilosimplex Butl,*, or 三化螟虫 *Schaenobius incertellus* Wk. The injury is pretty serious. Nevertheless, the farmer does not guard against the moth, and we have heard of no preventive measure taken against the damage. In the Philippines and in Japan, as preventitive methods, removing stalks when the colour changes, and installing light traps are methods very generally used to lessen this great damage.

The moth, as a larva, invades the stem of rice, absorbs the nourishment, and ten or twelve days later, emerges and flies about, laying eggs on the leaf of rice. Using the phototropic response of insects, to entrap the moths at this time is a method widely known. As a source of light, electricity is much used. In order to know the precise season of moth flight in Foochow, we made the following experiment.

Plan of the Experiment

The type of trap shown in Fig. 1, A was installed in the rice field of our experiment station. Essentially, the trap consisted of a pan of watar with a light hung a few inches above it. Two 40-watt and two 20-watt clear glass, type-C, Mazda lamp were used in the traps. These two kinds of trap were installed diagonally in pairs, each lamp having a distance of 200 ft. from its nearest higher or lower grade light respectively (See Fig. 1, B.). The light

were operatad every night from 27th of March until 11th of October.

The lights were turned on about six o'clock every night and off again shortly after five in the morning. Each trap was examined during the day and moths were counted.

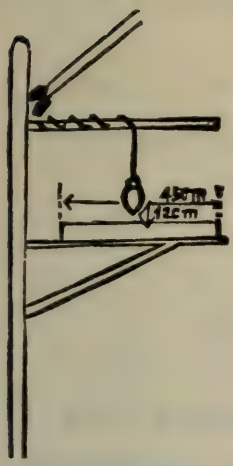
Result of the Experiment

The result of observation is as stated in table 1 and Fig. 2. This graph shows three high points of moth flight, the end of May, the beginning of July, and the end of September. The number of moths entrapped was 1246 for the 40-watt lamp, and 775 for 20-watt lamp. In both traps the number of female and male moths was almost same.

Table 1.

Date		40 watt lamp average of two lamps			30 watt lamp average of two lamps		
from	until	male	female	total	male	female	total
m. d.	m. d.						
4,27	4,30	18	17	35	20	12	32
5, 1	5,10	24	28	52	12	18	30
5,11	5,20	20	29	49	11	19	30
5,21	5,31	45	56	101	18	24	42
6, 1	6,10	20	26	46	8	12	20
6,11	6,20	30	39	69	8	9	17
7, 1	7,10	53	39	92	46	27	73
7,11	7,20	31	56	87	13	34	47
7,21	7,31	18	18	36	12	13	25
8, 1	8,10	27	23	50	6	5	11
8,11	8,20	8	9	17	4	3	7
9, 1	9,10	56	87	143	43	45	88
9,11	9,20	80	95	175	84	52	136
9,21	9,30	111	104	215	87	74	161
10,1	10,10	50	23	73	42	9	51
10,11	10,16	4	2	6	5	0	5
Total		595	651	1246	419	356	775

A Fig. 1 B



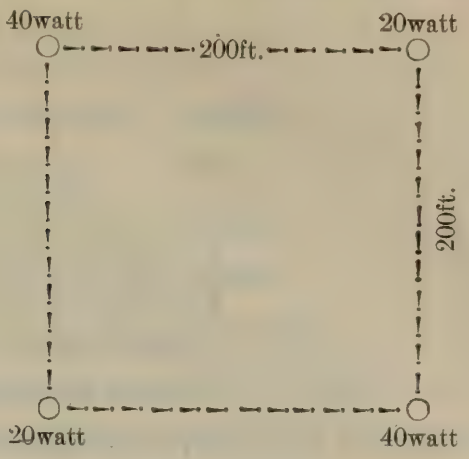
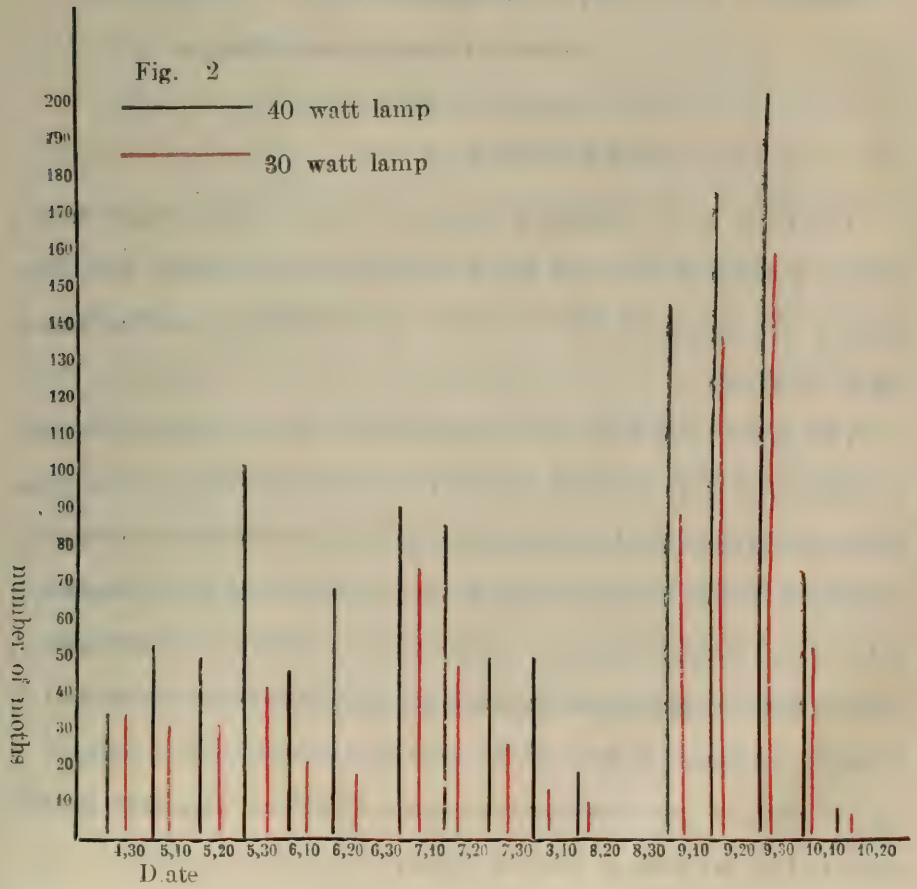

40watt
20watt
200ft.
200ft.
20watt
40watt

Fig. 2


40 watt lamp
30 watt lamp
number of moths
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
4,30 5,10 5,20 5,30 6,10 6,20 6,30 7,10 7,20 7,30 8,10 8,20 8,30 9,10 9,20 9,30 10,10 10,20
Date

AN AGRICULTURAL SURVEY OF KEKUNG VILLAGE

By

C. T. Chen K. P. Low W. I. Chang

Contents

1. General Description
2. The Organisation of the Village
3. Educational Data
4. Data on Agricultural Management
5. The Distribution of Land
6. Economic Condition of the Villagers
7. Agricultural Improvement
8. Conclusion

This paper is an agricultural survey of KeKung village, located west of the city of Foochow. The total area of this village is 50 hectares. The village has only 209 population and 40 houses; one of the many small villages in the Foochow area.

This survey was done in the summer 1931. We completed the actual investigation in three weeks. We do not think this paper can state the living conditions and agricultural management of the farmer in the vicinity of Foochow completely, but we believe this paper can give some light on problems such as the social structure and land distribution of a small village in Foochow, showing how the agricultural resources are undeveloped and the standard of living for the farmer is low.

We shall be very glad to receive some advice and suggestions on this report and on the work at KeKung Village.

(1) General Description

(1) Name of Place ;— Kekung Village, Minhou Province, Fukien.

(2) Situation ;— East, Hsia An Village 下安鄉

West, Min River 閩 江

South, Si Pien Village 西邊鄉

North, Huai An Village 懷安鄉

10 Kilometers west from the West Gate of Foochow City.

(3) Geological Position ;— East, west and south, the village is surrounded by hills 300ft. high, beyond which lie the village stated above. Hence the village is just like the bottom of a pan.

During the latter part of spring and early summer, as a rule, the rice fields are flooded, because much water is pouring down from the surrounding mountains. On the west side is situated the Min River. Under ordinary conditions, the water level of the rice fields is nearly the same as the river, but when the river rises, the water pours into the village, and there is no way to drain the water off. On the other hand, when the river is low, mostly in the summertime, the water level is too low for farmers to irrigate. The only chance for farmers to succeed is in normal or workable conditions. At other times, they will have no harvest. This chance is very slight, because in eight out of ten cases the village suffers from surplus of water and in one out of ten cases from lack of water. It is only in one out of ten cases that things are in a normal workable condition and farmers can get a good harvest.

(4) The soil ; — Dilluvial clayey loamy soil.

(5) Climatic Conditions:

(A) Maximum temperature all the year ; — 34.47°C.

(B) Minimum temperature all the year ; — 5.36°C.

(C) Early frost ; — Middle of December

(D) Late frost ; — Late February

(E) Rainy season ; — May and August

(F) Stormy season ; — Middle of July

(G) Dry season ; — November

(6) Communication:

There are only two small streets 3 feet wide. They go to Si. Pien village and Huai An village. Vehicles can not go owing to the roughness of the stone paring. Sedanchairs can be used. River boats run along the bank of the Min River.

(7) Area:

Total area	800	mows (1mow=6.5 are).
Rice field	289	mows
Pond	70	mows
Fields	30	mows
Other	111	mows
Mountain	300	mows

(2) The Organization of the Village

(1) Number of families : — 40

(2) Number of population : — 209

(3) Relation between the number of houses and their families.

Number of person in a family	1	2	3	4	5	6	7	8	9	10	Total
Number of families	0	4	4	6	9	8	4	2	2	1	40

The largest family is ten ; the average, five.

(4) Table of ages and sex of the villagers

Ages		1–10	10–20	20–30	30–40	40–50	above 50	total number
Males	total	30	21	20	14	15	12	112
	married		1	11	11	12	12	47
Females	total	20	29	14	11	13	10	97
	married		7	14	9	12	10	52

(5) Occupations of the villagers

	Occupation	Total number	Percentage of the total families in the village
Agriculture	Landed farmer	1	2.5
	Landedfarmer at the same time tenants of others land	17	42.5
	Tenant farmer	11	27.5
	Tenant farmer who has other subsidiary business	6	15.0
	Hired farmer	1	2.5
	Total	36	90.0
Merchant		2	5.0
Other		2	5.0
Total		40	

(3) Educational Data

There is one village primary school. The number of students is 63, the number of teachers two. The amount of expenditure is six hundred dollars a year, one hundred and fifty dollars is collected by villagers and the rest; four

hundred and fifty dollars is subscribed by the Foochow Electric Company. The course is same as that of ordinary government primary schools but there are added three hours a week on agriculture.

The age and number of students.

Age	7	8	9	10	11	12	13	14	15	16	17	Total
Number of students	3	3	5	13	11	3	10	4	5	4	2	63
Boy	3	2	4	11	11	3	8	4	4	3	1	54
Girl		1	1	2			2		1	1	1	9

(3) Data on Agricultural Management

(1) Principal crops;- Rice

Area of rice fields ; — 281.57 mows, of which owing too low of land only 40% could be planted with early rice.

Yield per mow ; — Early rice, 272 piculs, Late rice 435 piculs (the average of four years past.)

Time of sowing, transplanting and harvesting ; —

	Early rice	Late rice
Time of sowing;	Middle of March	End of March
Time of transplanting;	Middle of April	Middle of May
Time of harvesting;	End of July	End of October

Method for selling ;— Sale to rice merchants according to the market price and economic condition of the family.

(2) Principal Fruit trees

Kind of trees	Number of trees	Percentage of the total fruit trees	Number of families	Average for one family
Olive	251	21. 18%	28	8.96
Lungan	850	71. 73	21	40.48
Others	84	7. 09	4	21.00
Total	1185			

(3) Domestic Animals

The kind and number of animals fed by villagers

(40 families investigated)

Number of Animas fed / Kind	1	2	3	4	5	More than 5	More than 10	More than 20	Total number of animals	Number of families which fed animals	Average number of animal per one family
Cattle	7 families	3 families	1						16	11	0.40
Swine	14	7							28	21	0.70
Fowls	1	1	2	3	4	6	6		155	23	3.88
Geese			1						3	1	0.08
Ducks				1				2	151	3	3.78

(5) The Distribution of Land

(1) The relation between the number of householders and the area of their owned land.

Classification		Number of householders	Percentage to the total area of the land owned by the villagers
Ricefield	0—1 mow	9	42.86
	1—2 mows	10	47.62
	2—3 mows	1	4.76
	more than 10mows	1	4.76
	total	21	100.00
Otherfield	0—1mow	3	42.86
	1—2mows	3	42.86
	more than 2mows	1	14.28
	total	7	100.00
Mountain land	0—1mows	3	60.00
	more than 2mows	2	40.00
	total	5	100.00
Pond		1	

(2) Relation of the number of householders to the area of their cultivated land

(34 families investigated)

Area in mows	Number of householders	The percentage of the total houses of village
0—1		
1—2	3	8.82
2—3	3	8.82
3—4	6	17.65
4—5	1	2.94
5—6	6	17.65
6—7	2	5.88
7—8	2	5.88
8—9	3	8.82
9—10	4	11.77
15—20	3	8.82
20—15	1	2.94
total	34	100.00

6) Economic Condition of the Villagers

(1) Data on Incomes and Expenditures.

(1) The Incomes (34 families investigated)

Classification	Total amount	Aveaage for each family	Percentage of the total amount
Income by crops	$ 2.625.00	$ 77.20	46.05
Income by fruit trees	1.523.00	44.79	26.70
Income by domestic animals	685.00	20.14	12.00
Other income	868.00	25.53	15.23
Total	5.701.00	167.66	

(2) The Expenditure (34 families investigated)

Classification	Total amount	Self - produced %	purchased %	Average for each family
	$			$
Seed	284.70	94.78	4.22	8.37
Fertilizer	920.00	13.70	86.30	27.06
Domestic animals fodder	838.00	30.07	69.93	24.64
Labour				
Agricu ltural implements	182.00		100.00	5.32
Light	218.00		100.00	6.41
Living	8.830.00	65.46	34.54	259.70
Cloth	564.00	8.87	91.13	16.58
Furniture	181.00	1.66	98.34	5.32
Education	95.00		100.00	2.79
Social expenses	435.00	32.41	67.59	12.79
Micellaneous	33.00	43.48	56.52	0.97
Total	12.580.70			370.02

(2) Relation between the number of houses and theamount of its expenditures and incomes (37 families investigated)

Amount of Incomes in dollars	Number of families	Amount of expenditure in dollars	Number of families
$		$	
1 – 50		1 – 50	3
50 – 100	2	50 – 100	4
100 – 150	3	100 – 150	9
150 – 200	2	150 – 200	7
200 – 250	6	200 – 250	1
250 – 300	7	2 0 – 300	7
300 – 350	3	300 – 350	1
350 – 400	2	350 – 400	
400 – 450	3	400 – 450	
450 – 500	1	450 – 500	1
500 – 550	1	500 – 550	
550 – 600	2	550 – 600	
600 – 650		600 – 650	
650 – 700		650 – 700	
700 – 750	3	700 – 750	
more than 800	2	more thrn 800	1

(7) Agricultural Improvement

Ke Kung village, in its location, as stated in the general description, is unfortunate by nature. Out of ten cases nine suffer from flood or lack of water. The village has long been in great sorrow. They have no way to change the natural phenomena, because they are beyond the reach of human power. In the year 1927, The Foochow Electric Company began to use electric 5 & 45 H. P. pumps for irrigation and drainage, since 1928, the losses caused by water have been avoided. This has made possible the improvement of the agricultural affairs in the village.

We shall state the work which has been done in past 5 years in the following table;—

year	Work done
1927&28	(1) Installed 5H.P. electric pump for irrigation. (2) Instailed 45H.P. electric pump for drainage during flood season.
1929	(1) The rearrangement of cultivated land. (2) Raising the level of the land. (3) The establishment of the Rural Primary School.
1930	(1) The rearrangement of cultivated land, continued. (2) Encouragement in raising improved Berkshire pigs. (3) The continuance of the Rural Primary School.
1931	(1) The encouragement of improved methods of rice cultivation. (2) The rearrangement of rice fields and the installation of ideal methods of irrigation and drainage. (3) The continuance of the Rural Primary School.

25

Pumping Station for Drainage at KeKung Village
科貢鄉之排水機

26

Pumping Station for Irrigation
科貢鄉之抽水機

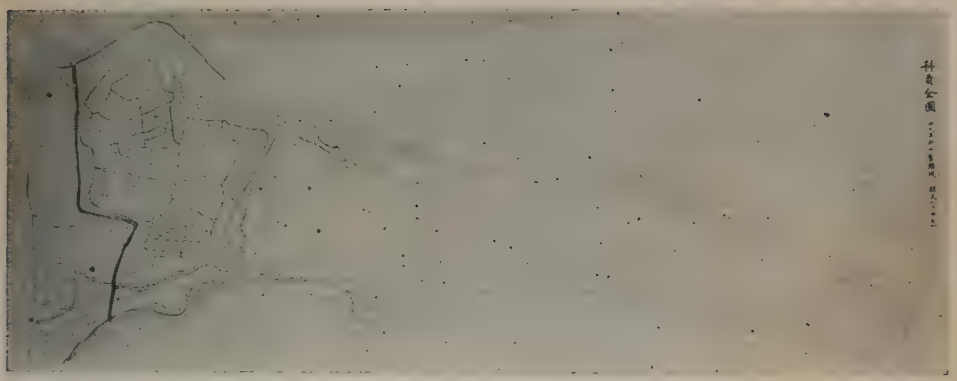
27

The Rearranged Rice Fields
耕地整理後之稻田

28

The Rice Fields not yet Rearranged
耕地尚未整理之稻田

29



The Map of KeKung Village(after the rearrangement of the rice field)
科貢鄉地圖（耕地整理後）

The Students of the Village Primary School
科貢鄉村小學學生

The following table shows the results of the above work:

The Increase of Production of Rice from the Total Area of Rice Fields

Year	Early crop	Late crop	Total	
Before 1928	140 piculs	400 piculs	540	piculs (According to the best of past years)
1928	280	290	570	
1929	276	434	710	
1930	206	498	704	
1931	325	520	845	When improved seed and new cultivation methods were used.

From the above table, we see that in the local early crop increase has been from 140 piculs in the beginning to 325 piculs, and in the late crop from 400 piculs in the beginning to 520 piculs. The total increase in production for the four years averages 167. 75 piculs per year. This comparison is based upon the best of the past records, if we compare with those years in which disasters occurred the difference in production would be increased greatly.

In addition to the rice improvement, we are encouraging the raising of Berkshire pigs. The object of this work is to increase the income of farmers by raising good pigs and reasonable fodder, and at the same time to use the manure as farm fertilizer to improve the soil of the fields, thus economizing in the expense for fertilizers. The results of this work do not yet fully show.

(8) Conclusion

According to this investigation, KeKung Village has 800 mows area, of which 300 mows approximately are rice fields. The total population is 209, of which number 112 are male and 97 female. Among them 100 persons are below 20 years of age and those whose ages are above 50 years number 22, so the rest whose age are between 20 to 50 are 87, who are the workers of this village. The number of families is forty, the smallest of two persons, the biggest of ten, the average being five.

Most of the people of the village are doing agriculture, of whom only one owns his entire land. The rest are in part or entirely tenants on the land of others, who own the land of KeKung Village but do not live there.

There is a primary school. Three years have passed since its organization. This year there are 63 students. The other boys of the village who do not go to this school, have gone over to the city to learn business and handicrafts; so we can say that since this school was established, all the village children are being educated. Villagers who know Chinese character are only 19% of the total adult population. Most women did not go to private schools in the past, so most of them are illiterate. If we omit the women from the number of adults the literate men are 40% of their total.

The principal crop is rice. It produces about 707 piculs a year. The production has been much increased since we made the agricultural improvements. The principal fruit trees are the lungan and the olive. The income from them is about $ 1.500 a year. Most farmers raise swine and fowl, an average for each family, of one swine and four fowls.

The average area of land cultivated by one family is 4 to 6 mows, about one acre. The least extent of land to be cultivated by one family is only 2

mows, the biggest 17 mows

As for the economic condition of this village, the total income from agricultural management of 34 families, of which we made investigation, is $ 5. 701. $\frac{00}{}$ a year, $ 167. $\frac{66}{}$ for one family a year and $ 14. $\frac{00}{}$ a month. With this income to keep alive five persons life is very hard indeed. There is other income which does not come from the agricultural management, of which we did not make investigation, but the amount from it is very small. In the total amount of income from agricultural management stated above, 46% is from crops, 26% is from fruit trees, and 12% is from domestic animals. From these figures it is seen that in this village the crops are the most important product. A good harvest means easier living.

On the side of expenditures, the total amount of expenditure for 34 families is $ 12. 580. $\frac{70}{}$ a year, per one family $ 370. $\frac{02}{}$; per month it amounts $ 30. $\frac{83}{}$. Summarizing all expenditure, the expenditure for agriculture amounts to $ 65. $\frac{39}{}$ per family, or 17. 9 %, and the rest 72. 1 % or $ 304. $\frac{63}{}$ per family is for living expenses. Farmers get their food and fuel from their agricultural products; so in this investigation, we divided the expenditure into self produced values and that for what is bought from outside. In the total expenditure, 52% — or $ 6.559. $\frac{00}{}$ is self produced values, and the rest, 48% is for what is bought from outside; the expenditure for seed and food being mostly self produced values.

For each family, income is $ 167. $\frac{66}{}$ and expenditures is $ 370. $\frac{02}{}$ on the average, as is stated above; so the expenditure exceeds the income by more than $ 200. $\frac{00}{}$. We know that on the side of income we did not include income other items than from the agricultural products, as the receipt from labour, etc. In these the cost of labour is mostly met by their own work; so we did not

count it on the side of expenditure too. The amount of the rest which we did not calculate is very small. On the side of expenditure, we knew that 52 % of the total is from self produced values. This amounts to $ 193. ^{50} per family; so if we omitted this amount from the total expenditure, or added it into the total income, we are able to make both sides very nearly balance. Nevertheless, this explanation has no very sound basis, but we know from these figures that the living of these villagers is very hard, that their income can only supply the cost of living day by day. This does not give any economic solution of their difficult problem of living conditions.

This figures are complete only for the year 1931, during which our agricultural improvements were still progressing. We are deeply ashamed of our little accomplishment and at the same time sincerely hope to make further advance. On the problem of the economic conditions we want to do more detail study in the near future.

The actual investigation reported here was made by Mr. K. P. Low. In the arrangement of data, the writer was assisted by Mr. W.I. Chang. To both the writer wishes to express his hearty thanks.

柑橘肥料試驗(豫報)

AN EXPERIMENT IN FERTILIZING ORANGE TREES

陳 振 鐸

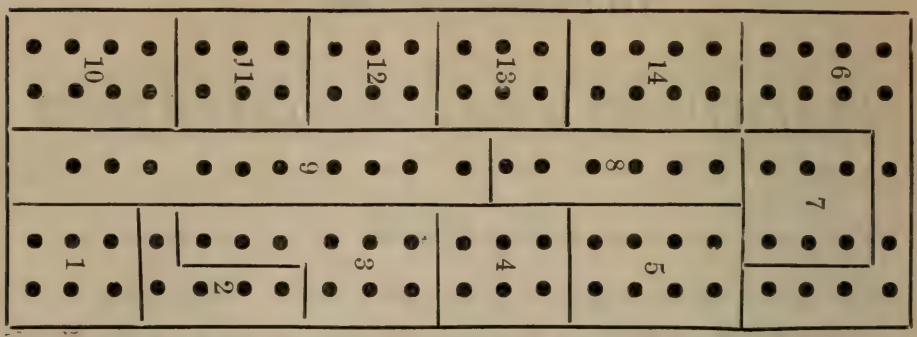
福州之柑橘，紅橘(Citrus Tangerina. Hort ex Tanaka.)之栽培，已由胡昌熾氏(金陵大學農林叢刊第二號)劉伯慶氏（福州農林學校農話第二卷第一期及第二期）詳細報告之，又著者關於本地柑橘栽培改良之意見亦曾在福州電氣公司農村電化部出版之農村電化部農業雜說第四號述之矣。本地柑橘之肥料試驗，從未舉行，故欲解決施肥問題時，可爲參考之用者，僅調查農家慣行施肥而研究之耳。

本試驗爲欲明瞭各種不同之肥料，施用于本地柑橘時，對於收量品質究有如何差異，以冀發現數字的根據而行之者，苟在此獲得柑橘栽培改良上緊要施肥問題之若干參考材料，則幸甚矣。

試 驗 設 計

(1) 試驗園：一 福州南郷螺洲廿五步之一柑橘園，作爲本試驗園，該園地勢平坦，爲沖積層壤土(Alluvial loamy soil)，肥沃中庸，排水佳良，果樹皆爲十五年生，生育平均，一園栽植一百零二株，本試驗之肥料區劃如第一圖所示，全園皆供肥料試驗之用。

第一圖　試驗園之配置



（2）施肥法及施肥用量：一　本試驗每樹施窒素，燐酸，加里各成分 280 grams，其肥料施用別表如第一表所示：

窒素質肥料爲硫酸亞，花生粕，人糞尿。燐酸質肥料爲過燐酸石灰，骨粉。鉀質肥料爲硫酸鉀，本試驗所用肥料，其成分如第二表：

第一表

番號	施肥料別	試驗株數	施肥株數	番號	施肥料別	試驗株數	施肥株數
1	硫酸鉀	6	6	8	硫酸鉀骨粉	6	6
2	硫酸鉀骨粉	5	5	9	人糞尿	6	10
3	花生粕半量	6	9	10	硫酸鉀半量	6	8
4	人糞尿骨粉	6	6	11	硫酸鉀貝粉	6	6
5	花生粕	6	8	12	硫酸鉀	6	6
6	花生粕	6	14	13	硫酸鉀追肥	6	6
7	無施肥	6	6	14	硫酸鉀	6	8

合　計　施肥株數 102株　試驗株數 84株

第二表

肥料名	N	P_2O_5	K_2O
硫酸銨	20 %		
花生粕	7.56	1.37 %	1.50%
骨粉	3.68	23.10	
過燐酸石灰		20.00	
人糞尿	0·85	0.26	0·21
硫酸鉀			0.49

(3) 管理：—試驗中所行之栽培管理如下；

二月中旬—剪定及施肥。　　三月中旬下旬—散布 Bordeau 藥劑各一次

四月上旬—散布石灰硫黃合劑　　七月中旬—追肥區(13區)施用追肥。

十二月下旬—中耕

除草—四月至九月每月一次

害虫驅除—四月至九月，每月每星期巡視一次並，驅除天牛。

(4) 收獲：——月上旬每樹收獲果實，依下列所述，將果實分爲大中小三級並秤量每樹各級果實之總量。

100 gr. 以上 大果　75 gr. 以上 中果　54 gr 以上 小果

45 gr. 以下 廢果

試驗成績

(一) 硫酸銨施用法試驗。

本地之施肥慣行，係二月果實收獲後卽施人糞尿，每樹約施窒素250gr. 左右。十一月中旬每株客土千斤餘。本地五六月間，爲霉雨期，故上季所施之肥料分，往往有若干流失，及至七月，果實肥大，此時如用速効肥料，須防雨天養分之流失，又果實利用必需養分，則其効果甚大，可確信也。照本地習慣罕施肥追，今若施用之，究有如何之結果乎。本試驗卽欲解決此問題

而行之也。每樹之平均產量如下。

肥料別	大果重量 kg.	重量——標準偏差	對總量之百分率	中果重量 kg.	重量——標準偏差	對總量之百分率	小果重量 kg.	重量——標準偏差	對總量之百分率	總量	標準偏差
硫酸鋅區	1.940	0.909	13.56	9.06	2.19	63.98	3.18	1.64	18.22	14.4	3.34
硫酸鋅追肥區	2.880	1.38	17.84	10.63	2.05	64.37	2.88	1.48	17.84	16.2	3.10

卽以硫酸鋅作追肥用時，其總收量多，大果之重量對總重量之百分率大，少果量少，由此可知施用追肥，果實生產上之効果甚大。

(二) 燐酸質肥料試驗。

本地無過燐酸石灰，如欲施用之，須由外國輸入。骨粉角粉代過燐酸石灰時，究得如何之結果，爲欲明瞭此問題而行本試驗。

肥料別	大果重量 kg.	重量——標準偏差	對總量之百分率	中果重量 kg.	重量——標準偏差	對總量之百分率	小果重量 gk.	重量——標準偏差	對總量之百分率	總量	標準偏差
過燐酸石灰	2.16	1.28	10.98	13.5	1.86	68.60	4.26	3.06	21.65	19.7	1.64
骨粉	1.26	0.26	6.89	13.4	4.69	73.44	3.60	1.99	19.67	18.6	5.84
角粉	2.58	1.28	13.65	12.5	1.44	65.08	4.02	1.43	21.27	18.9	1.67

據試驗成績，知本地產之骨粉角粉可以代燐酸肥料之過燐酸石灰，並與過燐酸石灰得同樣之收量，惟大果之重量，有多少之差異，然小果之量兩者殆相同，至于中果，適與大果成相反之位，以補大果之差異，可知二者之收量上，無甚相異也。

(三) 人糞尿施用試驗。

螺洲之施肥慣行法，係僅施人糞尿，今若加骨粉硫酸鉀于人糞尿，以爲完全肥料施用時，于柑橘之收量品質，究有如何之差異，本試驗之目的，即欲明此問題而行之也。

肥料別	大果重量 kg.	重量—標準偏差	對總量之百分率	中果重量 kg.	重量—標準偏差	對總量之百分率	小果重量 kg.	重量—標準偏差	對總量之百分率	總量	標準偏差
人糞尿單用	1.56	0.96	6.60	16.0	4.93	67.77	6.00	2.76	25.15	23.7	3.04
人糞尿骨粉區	4.14	2.05	17.51	15.6	2.50	65.99	3.90	1.26	16.47	23.7	4.57

據試驗之結果，總收量並無差異，但大果之量以完全肥料最多，占總重量百分之十七，人糞尿單用區僅占百分之六。此種現象于柑橘之價格有異常之差異，本地大果每百斤之價平均爲十六元，中果八元，小果五元餘，故在收益上關係甚大。次就中果言之，兩區之量殆相同，在單用區，小果之量甚大，占總重量百分之二十五，完全區較小，僅百分之十六。又完全區因施用鉀質肥料，其味其美，品質上等，反之單用區，則品質惡劣，由是可知施與完全肥料，則收益上，品質上，大有改良。

本報告之 (2)，(3)，(5)，(6)，(7)，(10)，(11)， 區之調查成績，暫不發表，且待繼續試驗後再行報告。本柑橘試驗，係行完全栽培者，因本地特多瘡痂病(病原菌Sphaceloma Citri (Brios. et Farn.) T. Tanaka.)，故爲豫防計，舉行藥劑散布，今將本試驗果樹與附近柑橘園之不行藥劑散布者之每樹平均被害果實數比較之，則得下列之結果。

本試驗園藥劑散布樹　一樹平均病果數百分率　12%

附近農家柑橘園無散布樹　一樹平均病果數百分率　85%

即藥劑散布有不少之効果，尤以果實外觀美麗，品質上改良者特多。今將本試驗園十九年度收支揭之于後，以供參考之用。

支出				收入	
肥料費	$ 40.00	管理費	5.50		
藥劑費	10.00	驅除犬牛費	13.40		
剪定費	15.60	收獲費	35.00		
除草費	19.70	資本利息	50.00		
支出總計			189.20	總收量2080斤每百斤6元	$210.00
利益			20.80		

本試驗園未行試驗前及試驗後之收量及每百斤果實價格之比較如下所示。

		產額 斤	每擔價格	總額
改良前	18年	1900	$ 3.20	$ 60.80
改良後	19年	3500	6.00	210.00
差額		16.00	2.80	149.20

因改良之故，肥料及藥劑剪定等費約支90元，但猶有50餘元之利益，試驗當年，因隔年結果，果實特別增收，但因改良之增收如又不可不認識也。本試驗宜長期行之，雖猶未得確定之結果，然施肥管理等，以本試驗之方法而行改良，則于農家之獲益定非淺鮮也。

雜　　錄

MICELLANEOUS

MISCELLANEOUS

(一) 電力灌溉事業

福州電氣公司實行電力灌溉始于民國十五年，茲將十五年至二十年間電力灌溉所用抽水機按設場所及其馬力數列表如下：

年度	抽水機按設場所及馬力數	抽水機個數	總馬力數
1926	下濂 40 H.P. 鼓山 7.5 H.P. 洪山橋 60 H.P.	3	107.5
1927	鼓山 7 5 H.P.	1	7.5
1928	科貢 5 20 25 H.P. 王莊 3 H.P. 鼓山 7.5 H.P. 下道 2 H.P.	6	62.5
1929	科貢 5 20 25 H.P. 下道 2 H.P. 王莊 1 H.P. 鼓山 3 H.P.	6	56.
1930	科貢 5 20 25 H.P. 下道 2 H.P. 鴨母洲 3H.P. 鼓山 3 H.P.	6	58.
1931	科貢 5 5 20 25 1 H.P. 下道 1 H.P. 萬壽橋 2 H.P.		
	鼓山 3 H.P. 螺洲 1 1 H.P. 洋下 3 H.P. 潘敦 3 H.P.	12	70.

民國十九，二十年兩年間，其所按設抽水機場所及總馬力數，較十八年均有增多。又自二十年脫離從來試驗推行期後，凡按設與農人作爲水田灌溉之用者均爲營業性質，故收機械償却金及電費等，以維持本事業例如按設於螺洲二處，潘敦下洲等均如是。又爲一般農人猶未充分了解電力抽水機之利點，故以刊行物如"電力灌溉"（農村電化部農業雜說第三號）及其他小篇出版物，頒布鄉間以冀普及。

二十年度電力抽水機之成績可爲令人滿足，例如螺洲鄉，該鄉本爲產桔之區，自按設抽水機以來，農人以夏期所用足踏車(本地原用灌溉器具)抽水勞力，可移作桔橘害虫驅除及桔園除草，水田耕作等之用，加之水稻因得其用水合理的調節，收量增加，以其所獲利益，除補充電力抽水機之費用外，尚有餘裕，且於農民本身之保健上，兒童勤學上，所得利益，尤非淺鮮，現全鄉農民對電力抽水機，已有殊大信用矣。

至於他處，因暫無顯著副業，作爲補助所剩勞力之用，故其効果之大，

無如螺洲者，但深信電力抽水機在本地頗有實行之可能，蓋此對于今日農村生產之發達組織之改良上，所施利益，殊非淺也。

(二) 出版物

爲普及農事改良問題及紹介農村電化部所辦事業起見，特編印各種雜說，茲將民國十九年四月至廿一年四月兩年間所發行之印刷物列之如下。計有農村電化部報告一册，農業雜說四集，講演集四篇，其他一種，均作爲分送交換國內外農業機關，公共事業機關及私人熱心於斯業者之用。

出版物書名		出版年月	出版部數	殘部有無
福州電氣公司農村電化部報告第一號		19.4 初版	500	無
福州氣電公司農村電化部農業雜說第一號	外洋猪種飼養繁殖方法 猪堆料之製造及施用方法	20.11再版	1500	
福州電氣公司農村電化部農業雜說第二號	養鷄大意	20.11再版	1500	有
福州電氣公司農村電化部農業雜說第三號	電力灌溉	20.11再版	1500	有
福州電氣公司農村電化部農業雜說第四號	福州柑橘改良上之意見	20.12初版	300	無
福州電氣公司農村電化部講演集第一號	人果爲何而生	20.11三版	1500	有
福州電氣公司農村電化部講演集第二號	改善農業之要素 福州在農業上之地位	20.11再版	1500	有
福州電氣公司農村電化部講演集第三號	日本農業發達情況及農村電化	20.11再版	1500	有
福州電氣公司農村電化部講演集第四號	閩侯科貢鄉農村改良過去進行之成績及將來之計劃	20.11再版	1500	有
福州電氣公司農村電化部敬告農人書		20.11初版	500	有

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電力抽水機及誘蛾燈

Electric Irrigation Pump and Light Trap

(三) 科貢鄉村教育事業

民國二十年間所行科貢鄉農事調查報告及農事改良大意，已以英文登載本册第二篇"An Agricultural Survey of KeKung Village." 篇中。至其過去所行事業大畧已述明於農村電化部講演集第四篇閩侯科貢鄉農村改良過去之成績中，茲惟就民國二十年間農村電化部所補助該鄉農村小學概況，作一簡畧報告。

(1) 學生籍貫

鄉名	科貢	高沙	下坑	西邊	橫頭街	洪塘	懷安	計
學生人數	25	17	8	6	4	2	1	63

(2) 學生年齡

年齡	7	8	9	10	11	12	13	14	15	16	17	計
學生人數	3	3	5	13	11	3	10	4	5	1	2	63

(3) 學生家長之職業

職業	農業	工業	商業	學界	計
人數	33	21	6	3	63

(4) 學生一覽

姓名	年齡	性別	住址	姓名	年齡	性別	住址	姓名	年齡	性別	住址
王利棟	15	男	科貢	鄭可潤	11	男	西邊	林葵花	15	女	科貢
林大祥	14	男	橫頭街	郭逸民	10	男	科貢	謝長炳	11	男	下坑
郭齊凱	14	男	科貢	林長波	11	男	科貢	張朝桂	11	男	懷安
周金木	15	男	下坑	張祥金	13	男	西邊	高清開	10	男	高沙
鄭大鐘	13	男	西邊	阮朝人	10	男	下坑	高玉心	9	男	高沙
阮朝冰	13	男	下坑	王家禧	11	男	高沙	高炎官	10	男	高沙
王德勛	13	男	橫頭街	高永保	13	男	高沙	郭永年	9	女	科貢
陳利旺	13	男	西邊	黃長仁	10	男	下坑	郭啓耕	7	男	科貢
林恭友	15	男	洪塘	林長用	13	男	科貢	郭財神	8	男	科貢
張仁祥	17	男	橫頭街	林長柱	11	男	科貢	王家駐	9	男	高沙
高玉華	17	女	科貢	高清官	13	男	高沙	周金柱	10	男	下坑
郭齊南	11	男	科貢	郭齊鏗	11	男	科貢	王天賜	8	男	高沙
林振湘	14	男	科貢	林燊友	12	男	洪塘	高鍾藥	10	男	高沙
林蘭花	16	女	科貢	郭齊華	14	男	科貢	吳芝榮		男	高沙
鄭可釵	12	男	西邊	高清仁	10	男	高沙	邱家品	7	男	梅花樓
王家禮	15	男	高沙	高金菊	13	女	高沙	郭齊連	7	男	科貢
王燮官	11	男	科貢	郭齊仁	10	男	科貢	郭齊先	8	男	科貢
王璞玉	13	女	高沙	郭杏玉	8	女	科貢	高孔仁	10	男	橫頭街
林長森	10	男	科貢	郭桂仙	10	女	科貞	郭希覺	9	男	西邊
王家才	11	男	高沙	郭淑貞	10	女	科貢	謝長樹	7	男	下坑
高永春	10	男	高沙	謝貞卿	12	男	下坑	郭泰齊	9	男	科貢

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