番禺縣土壤調查報告書

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番禺縣土壤調查報告書

廣東土壤調查所（原隸廣東建設廳農林局廿一年九月改隸國立中山大學農學院）

鄧植儀編

民國二十年九月

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導言

民國十九年秋，廣東建設廳農林局，農鑛部廣州農產物檢查所，及中山大學農科，以本省農林事業，積極建設，而土壤情形，多未明瞭，規劃改進農業，深感困難，特發起設立廣東土壤調查所，俾負責專司，爲有系統之研究，以作改良農業之張本，旋於十月一日成立本所，隸屬於建設廳農林局，而經費則由建設廳與農檢所撥給，（十二月農檢所歸併商品檢驗局後，則由商檢局繼續撥給。）而所址則假中大農科土壤研究室。當成立之始，儀器未備時，借助農科不少，迄二十年四月，始遷進農林局新址繼續辦公。

查本省地方遼濶，計陸地面積有六十四萬七千餘方里，區分九十四縣，而各

縣之農林與交通狀況殊不一致，爰擬定全省土壤調查計劃，及進行步驟，分別依次進行。計調查辦法分爲三種：（一）爲各縣之詳細調查，根據陸地測量局之五萬分一地圖進行，（二）爲各縣之單簡調查，根據陸地測量局之十萬分一地圖進行，（三）爲全省重要土壤系區之調查，以五十萬分一地圖辦理之。依照計劃之規定，第一年度進行番禺南海西縣之詳細調查，此番禺縣土壤調查之緣起也。至調查及研究所用方法，另有規定，詳廣東土壤調查暫行辦法之專刊中。

番禺縣之陸地面積，據陸地測量局之計算，有五千八百四十六方里，而人口之統計，據最近調查，約有八十一萬，其中農民約佔百分之五十四，伸計農民約有四十四萬。第縣內之地，屬山岡而尚未利用者約有五分之一，照此估計已耕之地約有二百五十萬畝，則每農民平均所耕地不過六畝。至每農戶之耕地最多者，大概在沙灣以南之沙田，（多屬蛋戶）平均四五口，約耕水稻田七八十畝。其餘東

北部山谷中之農戶，則多屬耕數畝耳。故非墾植山林，利用土地，難資補救增益也。

本縣屬之土壤調查，野外工作，自十九年十一月開始，主編者與全體技術人員共同出發，分兩隊進行，初從農業改良試驗區（沿中山公路兩旁）着手，已詳該區土壤報告中。次及沙灣司，由主編者與劉茂青，呂潤民，温大明，周燜輝，四君担任。次及菱塘司，由彭家元，劉茂青，呂潤民，温大明，周燜輝，五君担任。次及鹿步司，由彭家元，周燜輝，劉天樂三君担任。而慕德里司，由主編者及陸啓先，劉茂青，呂潤民，三君担任。共歷時約三閱月。至室內工作，機械分析與鑑定土類，則由主編者與劉茂青，呂潤民，温大明，周燜輝，四君辦理。而呂君則兼任製圖。化驗工作，則由彭家元，陸啓先，吳文利，劉天樂，四君分別担任。嗣吳君辭職，則改由陳宗虞君担任。計室內工作，約歷六閱月，所以若是遲

滯者，蓋因開辦伊始，人員之歷練未得馴熟，而設備未週。舛誤之處不鮮，益以爲求縝密起見，分析化驗，不厭求詳，故耗時尤多也。又查縣屬土地，位於東莞界內者尙有三小段，面積二十餘方里(約七萬四千公畝)，在麻涌之東，地名大步，大東向、小東向，及大亨，小亨，現以未便調查，擬於下年調查東莞縣時補行之。

此次調查經過，得番禺縣政府及各區鄉辦事處派警保護，極其週至，調查沙灣沙田時，幷得護沙隊借用輪船與保護，而地質構成，大致參考兩廣地質調查所最近及未發表之報告，室內工作，得中大農科助力甚多，均裨益於調查研究進行不少，深誌感謝者。

一、本縣概說

（1）位置及面積　番禺位於廣東之中南部，約自北緯二二度四六分至二三度三二分，東經約自一一三度九分至一一三度三七分，南北延長最長之線約有八四・五公里（伸約一四六・七華里或五二哩），東西最長之線約四四・七五公里（伸約七七・七華里或二八哩，）南北長而東西狹。南半部屬廣州三角洲之範圍，北部多山連亘於大陸也。北界從化花縣，東界增城東莞，南界中山及獅子洋（珠江出口之一），西界南海，東南界東莞，西南界順德。陸地面積統計（依陸地測量局）爲五八四六方里，（伸三一五六八四〇畝）即一九四〇・八七方公里或七四八・二九哩，幾佔全省面積百分之一。

（2）地勢　本縣地勢，自廣州市迤東沿廣九鐵路之北而漸高，山嶺綿亘於東北及

中部，山嶺之最高者爲附近增城界之帽峰山，其高度達五四一公尺。次爲毘連花縣之鋪排嶂，高達四四二公尺。再次爲沿沙和公路附近太和市之芋嶂，高四〇〇。五公尺。鳳凰山三八二公尺。廣州市北之白雲山高三六四公尺，摩星嶺三八二公尺。由此足見偏東之中北部地勢，自廣州市趨向東北而漸高也。至偏西之中北部，則地多平坦，而廣九鐵路以南，則漸次低下，迄於沙灣一帶幾及海平。雖然，自廣九路以南地勢漸低，但仍有岡陵起伏於低地之間，如星羅棋布。第除沙灣附近之大烏岡高二三二公尺，青羅嶂二〇三公尺，紅羅嶂，大鎮岡，蓮花山，飛鵝嶺等高一百餘公尺外，其餘多在一百公尺以下。自沙灣以下，一望沙洲，有二百餘方公里，爲本縣最大段之純粹河流冲積土也。其次則新造細墟之東以迄獅子洋亦有大段河流冲積土，面積約三十方公里。其餘錯雜於岡陵之間，多屬小段谷底冲積土，而整段大片河流冲

積土者甚少。至縣之北部山嶺間，谷底冲積較爲發達，佔最大面積者，在偏西之中北部流溪河及黃洞水之流域，面積約二百方公里。次在龍眼洞面積十餘方公里。

（3）地質　據兩廣地質調查所最近調查廣州市及其附近之地質報告，廣州最古之岩層有水口系及小坪系，大約成於下中生界至二疊紀。水口系中有紅色粘土岩，石英角礫岩，及礫岩，石英砂岩及灰色頁岩。而小坪系中有黑色頁岩與粘土及砂岩。而最新之岩層爲紅色岩系（Red—beds）大約屬白堊紀。其中有紅色砂岩下部之石英角礫岩、礫岩，粘土頁岩及沙巖。此外尙有火成巖，生於小坪後紀，及紅巖後紀，其中巖石可分爲流狀花岡巖，（Fluidalgranite）塊狀花岡巖，（Massive granite）石英斑巖，（Quartz Porphyry）偉晶花岡巖，（Pegmatite）及流紋巖。（Rhyolite）上述各系巖層，在番禺縣中均有發見，除水口

系露頭及發育較少外，餘均發見不鮮，縣之北部山嶺，多屬火成巖，間有水口系小坪系之巖石參雜其間，如白雲山之石英砂巖及灰色頁巖，百足嶺一帶之黑色頁巖與粘土砂巖是也。廣九鐵路以南，則紅色巖發育尤盛，幷混有火成巖與水口系及小坪系之巖石。大抵紅色巖系之風化似較透澈，整塊巖石之留存較少，而崇石峻嶺之峭壁尖峰，多屬石英砂巖或火成巖焉。

（4）河流及水利　縣內河流之大者爲珠江，其支流之大者爲流溪河，黃洞水，大陂河，車陂河，及沙河。珠江橫貫縣境中部，滙合北來諸水。南部低陷，三角洲本身，港汊錯縱，水利至溥。北部地勢高，水源多出山嶺間。然以山勢傾斜，溪流湍急，倘無相當設備，如水陂山塘以蓄水，則夏季受沖刷，而秋冬患旱荒。即就廣九鐵路之附近如茅岡吉山一帶之低地，與縣屬偏西之中北部低地亦然，則較高之山間谷地，更可想見矣。

(5)交通　本縣爲廣州市所在地，水陸交通賴有珠江，流溪河，黃洞水，廣九鐵路，粵漢鐵路，南岡至羅岡又有輕便鐵路。近年公路四闢，北部已成之公路，有番增博，沙和，南番花。南部藉珠江分汊水路運輸，原甚便利，近更倡辦公路，如沙灣至新造一帶已陸續着手。水陸運輸，堪稱便利，裨益農業之發展不鮮也。

(6)氣候　廣州附近氣候之記載，以現在中山大學之觀測所所記載者爲較完備，而歷時最久，蓋以其承前廣東農林試驗場與農業專門學校及廣東大學農科繼續辦理者也。該所地址在本縣屬內，其所記載，大致自可適用，爰節錄其自民元至十五年氣候平均概說於次；（詳該所十五年氣候彙編）

(甲)氣溫　平均最低在一月，爲攝氏九•〇六度，而最高在八月，爲二四•九五度，十五年之各月平均，爲二二•二度，故一年之中，除重要作物

外，可經營之冬期作物種類甚多．蓋以霜害甚少也，自民元至十五年之間，其絕對最低之溫度雖有至零度者，但爲時甚暫，即下霜之溫度，每年亦見數次，然不致有大碍於冬期作物者，以時期不久故也。

(乙)氣壓　十五年間各月平均，爲七六一．五公厘，除四月略與正常氣壓相當外，在正常氣壓上者，爲一二三十十一十二各月，而以一月爲最高，其數爲七六七公厘强。在正常氣壓下者，爲五六七八九各月，而以八月爲最低，其數爲七五五公厘强，考其逐月高低之變遷，大概與氣溫適成一反比例，惟其中氣壓低降氣溫高昇，倘各趨至極端時，往往釀成强暴風雨，最足爲農植物之害者，數見不鮮也。

(丙)濕度　十五年間各月平均百分率爲七七．七八，在七〇以下者祇十一月，在七〇以上者爲一二九十及十二等月，在八〇以上者爲三四五六七八

等月，且年中達至極濕之限者，十五年中佔有十年，此乃濱海氣候之特殊點，與農事最關切者也。

（丁）雨量　十五年來之總平均，爲一六五四．一公厘，其中各年總計最多者爲九年，其數達二千六百公厘以上，最少者爲五年，其數亦達一千公厘以上，雨量可謂不少，且雨量分布多在春夏秋季，而冬季亦常有，倘利用得法，旱魃不易爲虐也。

（戊）風向　大概每年四月至九月，天氣炎熱時，多在南至東象限內，而一二三十十一十二等月，天氣寒冷時，則多在北至東象限內，此其故，蓋因本縣濱海，熱季海風吹於陸，寒季陸風吹於海所致也，惟農家於此對起畦栽種之農作物，其畦行之方向，各因其時其地而注意審擇可也。

（己）風速　風之速力，各年各月平均，其數大都由一至二公尺有奇，而十五

年平均數爲一・九二公尺、寔不足以言風速之大，惟一年之中，往往有疾强烈暴等風，雖時間尙暫，次數非多，農人對於栽培作物，亦宜加意保護，庶免損失。

二、土壤

縣境內一切山岡之地，乃原生殘積土，屬於第一部紅土屬也。其色大抵自紫紅以至紅黃或黃白不等，間有黑色或黑棕色者，其紫紅之土，多屬紅色巖中之紅砂巖，或礫巖與紅粘土頁巖，或黑色頁巖與砂巖風化而成。而紅黃色者多自火成巖風化而成。黃白者多自石英砂巖與灰色頁巖風化而成。黑色與黑棕色者由黑色頁巖風化而成。表土之（A層）質地恒較亞表土或底土（B層）者粗。（參閱下列機械分析成分表）其風化進行，在地勢高者異常透澈，常達五公尺以上，蓋因氣候

溫暖而雨水充足所致也。在底土(B層)中常發見有輕養化鐵之結核，其大如豆以至鷄卵，或有過之，或形成帶狀，長至數公尺者常見，此於中山大學石牌第二農場之花岡巖土隨處均有發見，而尤以表土冲刷劇烈之處爲顯著，恒露出地面，或於新成公路切口見之。此冲刷之土，表土層(A層)缺乏不存，可云古生蛻化之土，大概因原有山林完全伐去，無法涵養水源所致也。而表土未受若何冲刷而傾斜稍緩之岡土，其垂直切面可保存完備。第表土層常不深，多在二十公分之下，間祇有數公分者，至亞表土與底土層不分明，而底巖或原始物質層(C層)則常在五公尺之下，雖間有在一公尺內外者，如石牌村東之紅巖土，或白雲山牛牯頭之液狀花岡巖土是也。

縣內所有低地，概屬冲積土，生成之年代較近，尚未進化至於完成。其中最大部分，係由珠江冲積，在縣之中部與南部、西北部沿流溪河黃洞水之兩岸，則

由該兩河水之沉澱物積成。但在西北部自太和市至進和市一帶，其地勢自中部山嶺之坡向西傾斜迄於流溪河至黃洞水之間，所成之冲積平原，廣袤約二百方公里，暫作爲谷底冲積土，蓋以其中岡陵隱伏，風化殘餘之土阜散布甚多，且冲積層淺，多在半公尺之內，大概屬於附近岡陵風化冲下之物質居多，然亦不免參有流溪河或黃洞水之沉澱物，蓋以山洪暴漲，該兩河水間亦氾入此部谷底冲積地也。本縣所有冲積土層不厚，年代不久。河流冲積，多在二公尺內外，而谷底冲積，則多在一公尺內。

縣內山岡之土，據調查所得，可分作四系，而冲積之土，可分作五系，此外尚有石質土，零星發見，面積無多。茲將各系土壤分別提綱條列，並詳論其特徵與土宜於次：

（1）廣州系　由紅色巖系之巖石風化定積而成。此系土以在廣州一帶發育最

盛，故以廣州名之。現發見之土可分爲三區；(1)砂質壤土(2)礫質壤土(3)中砂質土。以砂質壤土區爲最發達，其餘二區所佔面積不廣。合計所有面積約二四七三〇〇公畝，約當全縣陸地面積一·一七%。

(2)羅岡系　本系土壤由火成巖風化定積而成，其母巖多屬花岡巖，以羅岡一帶發育至盛，故以羅岡名之。現發見之土可分爲五區；(1)砂質壤土(2)粗砂質土(3)礫質壤土(4)細砂質土(5)中砂質土。以砂質壤土區分布最廣，粗砂質土與礫壤次之，細砂土與中砂土又次之。合計所佔面積約四六〇五六〇〇公畝，約當全縣陸地面積二三·七五%。

(3)鍾村系　本系土壤由水口系巖石風化定積而成，以在鍾村一帶發育最廣，故以鍾村名之。現發見之土可分爲兩區：(1)砂質壤土(2)礫質壤土。而以砂質壤土區分布較廣。兩區合計約有面積五八四四〇〇公畝，約當全縣陸地面積三

•〇一%。

（4）小坪系　本系土壤由小坪系巖石風化定積而成，初發見於小坪一帶，因襲用地質調查所用之巖系名而名之。現發見之土可分爲兩區；（1）粘質壤土（2）細砂質壤土。而以細砂質壤土所佔面積較廣。合計兩區土所有面積約九八五〇〇公畝，約當全縣陸地面積〇•五一%。

（5）珠江系　本系土壤由珠江及其重要支流冲積而成，爲河流冲積土也。初發見於珠江附近，因而名之。本系土壤現發見者可分爲八區；（1）壤土（2）埴質壤土（3）砂質壤土（4）粘質壤土（5）細砂質壤土（6）粗砂質土（7）礫質壤土（8）中砂質土。自（1）至（5）之五區分布甚多，其餘（6）至（8）三區之面積較少。合計全系面積約七七二六六〇〇公畝，約當全縣陸地面積三九•八一%。

（6）江村系　本系土壤發見於江村一帶谷底平原，故以江村名之。爲該部山

水冲下附近岡陵土壤物質，並間雜流溪河及黃洞水汎入之谷底沉澱物而成。其中土壤現發見者可分爲四區；(1)砂質壤土(2)細砂質壤土(3)粘質壤土(4)壤土。(1)(2)兩區分布較廣。四區合計面積約二八二三五〇〇公畝，約當全縣陸地面積一四·五五%。

(7)石牌系　本系土壤初發見於石牌附近之谷底地，因而名之。爲附近山岡冲刷下來之物質塡積谷底而成。其山岡之岩石，大都爲紅岩，石英砂岩，灰色頁岩，及花岡岩。發見之土現有三區；(1)細砂質壤土(2)砂質壤土(3)壤土。其中以(1)區分布較廣。面積約有三七四七〇〇公畝，約當全縣陸地面積一·九三%。

(8)龍眼洞系　本系土亦爲谷底冲積土，發見於火成岩山嶺之谷底，純由火成岩山岡冲下物質堆積而成。其火成岩多屬花岡岩，以龍眼洞一帶發育較盛，故名之。現發見之土壤可分爲兩區；(1)砂質壤土(2)粗砂質壤土。以砂質壤土爲最普

通。兩區土壤所有面積約二五一〇二〇〇公畝，約當全縣陸地面積二二。九四%。

（9）佛嶺系　本系土初發見於佛嶺市附近，因而名之。乃谷底冲積土，由小坪系之砂岩黑色頁岩岡陵冲下物質塡積而成。現發見者祇有細砂質壤土。面積約二一〇六〇〇公畝，約當全縣陸地面積一。〇八%。

此外尙有石質土，其巖石有屬水口系，小坪系，火成岩或紅巖者。合計面積約一五二六〇〇公畝，約當全縣陸地面積〇。七九%。

茲將各土區及石質土所有面積列表比較如下：

土區別	面積 公畝	佔全縣%
廣州砂質壤土	二三七六〇〇	一。二二

礫質壤土	七一〇〇	〇・〇四
中砂質土	二六〇〇	〇・〇一
羅岡砂質壤土	四五六五六〇〇	二三・五三
礫質壤土	一二一〇〇	〇・〇六
粗砂質土	九三〇〇	〇・〇五
細砂質壤土	三四〇〇	〇・〇二
中砂質土	一五二〇〇	〇・〇八
鍾村砂質壤土	五七八九〇〇	二・九八
礫質壤土	五五〇〇	〇・〇三

小坪細砂壤土	九〇九〇〇	〇・四七	
粘質壤土	七六〇〇	〇・〇四	
珠江壤土	二六九二二〇〇	二三・八七	
埴質壤土	三三〇五〇〇〇	一七・〇三	
粘質壤土	四七九四〇〇	二・四七	
砂質壤土	九〇四三〇〇	四・六六	
細砂質壤土	三八四〇〇〇	一・四六	
礫質壤土	五四〇〇	〇・〇三	
粗砂質土	五三六〇〇	〇・二八	

中砂質土	二七〇〇	〇・〇一	
江村砂質壤土	一四八九五〇〇	七・六七	
細砂質壤土	九〇〇一〇〇	四・六四	
粘質壤土	三六〇五〇〇	一・八六	
壤土	七三四〇〇	〇・三八	
石牌細砂質壤土	三六三二〇〇	一・八七	
砂質壤土	七五〇〇	〇・〇四	
壤土	四〇〇〇	〇・〇二	
龍眼洞砂質壤土	二三三一八〇〇	一二・〇二	

粗砂質土	一七八六〇〇	〇・九二	
佛嶺細砂壤土	二一〇六〇〇	一・〇八	
石質土	一五二六〇〇	〇・七九	

至各土區之特徵與農業概況分述如次：

（1）廣州砂質壤土　此土區由紅巖系之砂質頁巖或礫巖風化而成，分布甚廣。廣州市所在地大都屬此土區，雖其中沿江之土間有表土層爲珠江冲積，然亦甚薄。此外發見於石牌及沙灣司之大鳥岡，其色大都濕潤時爲紫紅，乾時則色澤略淡，或帶赭色。表土底土及原始物質（A. B. C. 三層）之土色大略相似，不易分別。但結構則有別，表土有團粒狀結構，底土則漸少團粒而趨於粘閉，此殆因滲漏而下之膠體物質也。表土（A 層）厚度自數公分以至二十公分不等，而底土則常深達

一二公尺下者。故原始物質或母巖（C層）除在露頭之石質土或公路鐵路切口外不常見。土面常散布有殘餘碎礫。此土之未墾植者，其表土結構似屬粘實，第一經墾植，則頗鬆軟而成團粒狀。但亞表土以至底土，其質地自砂壤以至壤不等，團粒漸次減少，成團塊狀，或至粘閉。以細土及粘土分子向下移運，故表土之通透性較底土爲佳。幸地勢罕有傾斜，地面排水尚佳，而冲刷亦不甚烈。地下水位常在二公尺以下，天然排水尚屬良好。至植物養分中之淡燐兩質爲量甚少，鉀量則屬中等，有機質量甚少，而酸性反應普通由中至强，倘須調和至於中性，每公畝之表土深二十公分須用石灰（炭酸鈣）自四十至六十公斤不等。

（2）廣州礫質壤土及（3）中砂質土　礫質壤土發見於沙灣附近之青羅幛，大概由紅巖中之頁巖與砂巖風化而成。土面多碎礫，地勢高而傾斜，冲刷甚劇，間有崩塌者。土色較砂質壤土尤濃，地多荒廢。表土頗實，有機質甚少，底土亦屬

礫壤。其他性質，則與砂質壤土相似。

中砂質土發見於廣州市東北之黃花岡，及石牌附近之葫蘆岡。面積不大，由紅巖中之砂巖頁巖風化而成。其底土爲砂壤或壤土。其特徵除表土砂質較高外，餘與砂質壤土相似，茲不贅。

茲將廣州系各區土壤之機械分析及重要化學成分節錄如下：

（甲）機械分析成分表（%）

樣本字號		番1001	番1002	番1005	番1
土層	表				
	亞表				
	底				
表					
亞表					
底					
表					
亞表及底					
A					
B					
C					

細砂	中砂	粗砂	細礫	礫	類別
17.70	9.12	6.49	5.57	12.58	砂質壤土
14.12	8.48	6.50	5.67	10.35	同上
8.07	6.04	6.89	5.27	8.38	同上
20.76	12.40	8.40	3.82	4.78	砂質壤土
15.60	10.04	6.61	3.67	4.54	同上
15.40	10.65	7.68	3.28	6.62	同上
6.10	3.62	4.70	7.85	37.15	礫質壤土
3.91	1.52	2.15	6.15	37.60	同上
24.19	12.56	9.07	8.06	9.66	中砂質土
14.00	10.51	6.82	6.10	18.08	砂質壤土
8.92	6.48	6.57	6.07	15.50	同上

極細砂	細土	粘土
20.90	16.30	10.80
18.90	23.18	12.25
15.90	28.76	18.95
17.95	19.55	12.40
16.02	23.35	18.70
13.25	27.40	15.70
7.78	19.10	12.15
6.48	19.52	12.15
18.72	12.05	5.17
20.30	15.10	9.37
14.95	25.02	16.46

表內所列之 1001 1002 1005 號爲普通代表樣本，而1號爲垂直切面樣本。普通代表樣本之表土深自〇至二〇公分，亞表土自二〇至五〇公分，底土自五〇公分至一公尺。垂直切面樣本採自葫蘆岡，A層自〇至二〇公分，B層自二〇至四〇，而C層則自四〇以下至一公尺，漸見原始物質及母岩，風化尙淺也。

由上表各樣本之分析成績觀之，細土及粘土份土層愈下而愈增，足以表示移

運之程度甚顯著也。

（乙）化學分析成分表

樣本字號	淡 %	燐 %	鉀 %	腐有機質 %
番1001（表）	.04	.034	1.11	.044
同（表亞）	.04	.010	1.21	.034
同（底）	.07	.008	1.28	.069
番1（A）	.086	.010	.56	.043
同（B）	.074	.038	.54	.033
同（C）	.077	.056	.55	.013

酸性反應	強				
每公畝石灰需要量（公斤）	61,3			39,38	

由上表成績觀之，各土區之淡燐與有機質均屬微少，若利用以經營農林，應注意培補之。查其原生植物，多屬淺根雜草、生長疎落而不暢茂。間有赤松生長，大概屬自然者多，而人工播種者少，生長均佳。砂壤及中砂土區之地勢不高，而傾斜不甚。易於經營。至礫壤區在青羅幛一帶，地勢既高，又復傾斜，除造松林外，不易作其他經營。植林則宜赤松或合歡竹柊樹等。若作果園，則宜多施淡燐有機質等肥。而果樹中，以根部强健能深入土層者爲宜，以其下層土較粘窒也。

（4）羅岡砂質壤土　本區土多由火成巖之花岡巖風化定積而成。發見之花岡

巖，有流狀與塊狀之別。其內容成分相差不遠，然前者結晶較後者小。所成之土，其中石英砂子，在流狀巖所成之土較細，此其辨別點也，本土區發育甚廣，北中南各部均有。其土色潤時多屬紅，俟乾則變紅黃，倘經墾植有年，則表土變棕黃以至灰黃色，以夾雜有機質也。本區土壤，風化極其透澈，冲刷所成土坑，每深達七八公尺，而坑底土層之風化程度，與表土相似。土面間留有風化殘餘之石塊或石壁，此又該土區地面之特殊點也。在未有墾植者，其表底兩土層之顏色殊不易別，第其結構，則表土，（A層）團粒甚富，深度常不過二十公分，至底土則略較密實，團粒狀之結構減少，深度自二三十公分以至數公尺不等，其質地自礫壤砂壤至壤不等。至原始物質之C層，則有母巖或石碎發見。其AB層之較淺者，於白雲山牛牯嶺一帶發見，切面頗佳。此區土壤，雖屬砂壤，其結構原應成團粒狀而鬆軟，但在未墾植之地，驟觀之，似極其硬實，尤以土面冲刷大者爲甚。第

一經耕耘，則易變鬆軟，通透性亦甚佳。地面多屬傾斜，排水嫌其過甚，地下水位常在五公尺以下，排水良好也。第以土屬砂壤，難涵養水源，故荒廢之土，初始墾植，以地面奔逸之水大，太陽熱烈時，常苦蒸發過甚，水分不足，此須特別注意者。至植物養分，淡燐之量不足，有機物亦缺乏，鉀量則自中以至中下，可無須特別注意者。酸性反應，自弱至中，若欲調和土酸至於中性，需要石灰（炭酸鈣）每公畝自二十至四十公斤不等。

（5）羅岡礫質壤土（6）粗砂質土（7）細砂質壤土（8）中砂質土　此礫質壤土發見於東北部附近增城界之桅杆庄一帶，其底土自礫壤至砂壤不等。

粗砂質土發見於縣之西北部附近鐘落潭之龍岡，其底土爲砂壤。

細砂質壤土發見於縣之東北部附近從化縣界之錦堂庄，其底土爲砂壤以至砂質粘土。

中砂質土發見於南部附近謝村之漢塘尾，其底土自砂壤以至中砂。所有此五區土，其性質大致與砂壤土相若，茲不分別詳贅。惟所含砂礫，除細砂質壤土外，均較砂壤爲高。保蓄水力較爲薄弱，故土力不及砂壤。但細砂壤土似略勝於砂壤，大概以其蓄水力較勝也。此區土現利用作果園栽植荔枝梅等。

茲擇錄各土區之機械分析及化學分析之重要成分列表於次以資比較：

（甲）機械分析成分表（%）

土層	樣本字號
A	番101
B	
C	
表亞表底	番1501
A	番103
B	
C	
A	番111
B	
C	
A	番110
B	
C	
A	番112
B	
C	
A	番104
B	
C	

細砂	中砂	粗砂	細礫	礫	類別
17.60	16.45	11.33	2.84	5 63	壤砂
16.88	15.70	10.35	2.34	6.60	土仝
15.30	15.08	11.33	4.24	3.66	土仝
10.66	10.20	11.45	9.31	12.92	壤砂
8.23	7.14	9.05	8.95	17.88	壤礫
7.85	7.47	10.12	12.05	10.25	壤砂
11.49	12.21	13.01	10.50	24.82	壤砂
10.20	10.20	12.45	14.02	27.20	壤礫
12.53	10.45	7.15	5.95	38.12	土仝
10.73	3.71	5.80	9.60	15.60	壤礫
18.75	4.45	5.32	4.88	7.10	壤砂
8.78	5.10	15.20	21.00	33.80	壤礫
16.00	7.63	18.71	24.68	4.26	砂粗
5.32	1.26	1.91	1.82	16.70	壤砂
9.88	4.80	6.95	16.01	31.80	土仝
18.80	2.83	3.99	1 85	2.81	壤砂細
25.00	3.75	2.56	1.77	1.12	土仝
33.50	2.35	1.26	.80	1.23	土粘質砂
28.50	19.05	6.75	3.44	11.60	土砂中
26.80	2.09	6.85	2.19	11.50	壤砂
23.11	19.61	7.88	3.18	14.38	土砂粗

粘土	細土	極細砂
16.20	20.15	9.15
23.30	18.50	7.08
26.40	16.15	7.15
13.40	26.00	5.95
15.85	25.40	6.33
16.90	29.97	5.82
7.24	15.39	5.34
7.10	13.40	5.15
9.18	16.55	9.10
26.60	21.00	8.45
27.90	20.36	11.30
6.00	5.78	5.30
3.76	11.50	13.90
37.00	23.80	13.10
14.00	9.10	14.30
23.90	27.40	18.50
33.15	18.65	15.60
43.70	15.50	12.33
4.34	12.30	12.51
6.78	14.20	10.35
10.20	9.90	9.85

表內之1501號爲普通代表樣本，其深度同前廣州系者。其餘各號爲垂直切面樣本，101 103 104 及110之A層自〇至二〇公分，B層自二〇至五〇公分，而C層自五〇以下至一公尺，111與112號之A層自〇自二〇公分，B層自二〇至八〇公分，C層則自八〇至一·五公尺。

101取自孖髻嶺。103取自崩岡 104 取自漢塘尾。110取自龍岡。111取自桅杆

庄。112取自錦堂庄。

由上表觀之，粘土細土由上層移運至下層，不若廣州砂質壤土之顯著，然仍屬不少。其中有細土粘土不獨不見其積聚增加於底土，反見其較表土少者，大概以底土以下仍易移運，或一公尺以下之土層，其積聚爲顯明，此則有待於將來研究者。

(乙)化學分析成分表

樣本字號	淡 %
番101(表)	.09
仝(表)亞	.09
同(底)	.09
番1501(表)	.06
同(表)亞	.03
同(底)	.02

每公畝石灰需要量（公斤）	酸性反應	有機質 %	鉀 %	燐 %
41.65	中	2.55	.78	.011
		1.33	.74	.007
		.087	.70	.014
39.38	中	1.11	.93	.037
		.68	.92	.013
		.42	1.14	.037

由上表觀之，植物養分之三要素，以淡燐二者爲最缺乏，而鉀量及有機質亦平庸。查其現在墾植者，多在液狀花岡岩所成之砂質壤土及細砂質土，所栽者多

屬橄欖甜竹荔枝之屬，所用肥料多屬人畜肥糞，亦適宜也，此系土壤，若用以種植，除上述各種外，赤松桉樹刀豆菠蘿等均宜，但須注意其地面冲刷爲要。

（9）鍾村砂質壤土（10）礫質壤土　本系之土，乃由水口系岩石風化定積而成，其中風化透澈者，即完成爲砂質壤土，而碎礫尙多者，則多屬礫質壤土。砂質壤土分布於縣之南部及西部，而礫質壤土則多在中部。土色黃白，間有巖石露頭，與石質土混合。其結構在表土層略有團粒，而底土則漸密窒。砂壤之底土，自砂壤以至礫壤壤土或粘土。至礫壤之底土，則屬礫壤。均以土力薄弱，雜草疎落，不便耕作。故多未利用以造林，而仍荒廢。惟地位常高而傾斜，天然排水良好，但嫌其地面水奔逸過甚耳。

茲將其機械分析及化學分析之重要成分列表比較如次；

（甲）機械分析成分表（%）

樣本字數	土層	類別	礫	細礫	粗砂
番	A	砂壤	12.40	2.27	8.21
	B	同上	6.35	2.57	9.40
209	C	砂質粘土	6.30	1.46	4.60
番	表	砂壤	25.70	5.10	5.05
2002	亞表及底	同上	22.10	6.10	7.70
番	A	砂壤	11.10	12.75	14.40
	B	礫壤	34.00	5.84	12.24
202	C	同上	26.95	8.60	11.30
番	表	礫壤	18.30	8.60	5.75
2001	亞表及底	同上	16.95	8.60	6.38

粘土	細土	極細砂	細砂	中砂
9.35	16.00	19.10	25.10	8.25
14.10	17.30	20.45	22.13	8.35
31.40	18.90	23.50	14.02	5.20
9.80	21.00	8.15	14.90	8.65
18.74	13.55	5.70	12.90	11.40
12.01	20.40	3.68	11.85	12.70
11.30	17.80	1.84	8.00	8.96
15.70	19.00	1.88	6.98	8.70
27.90	25.43	4.58	5.29	4.06
19.50	31.20	5.43	6.78	4.72

表內之2001及2002號爲普通代表樣本，其深度詳前。202與209號爲垂直切面樣本，202之A層自〇至一五公分，B層自一五至四〇公分，C層自四〇以下

至一公尺。其地點在中山大學第二農場。209之A層自〇至二〇公分，B層自二〇至八〇公分，C層自八〇以下至一•五公尺，其地點在菱塘司鍾村之北近禮村。

（乙）化學分析成分表

樣本字號	淡 %	燐 %	鉀 %
番209（A）	0.11	.018	.69
仝（B）	0.06	.022	.76
仝（C）	0.01	.016	1.07
番2002（表）	0.06	.020	.66
仝（亞表及底）	0.07	.018	.79
番202（A）	0.02	.005	.17
仝（B）	0.02	.005	.26
仝（C）	0.02	.012	.29
番2001（表）	0.01	.046	1.35
仝（亞表及底）	0.01	.043	1.52

有機質%	酸性反應	每公畝石灰需要量（公斤）
1.00	弱	26.25
.61		
.46		
.46	弱	28.13
.38		
.157	弱	35.
0.142		
0.86		
0.41	中	63.
0.33		

由上表觀之，淡燐均屬異常微少，而鉀量則各地相差甚大，自〇。一七以至一，五二，有機質甚少，腐有機質量亦甚少。酸性反應自弱至中，若欲調和土酸至於中性，需要石灰（炭酸鈣）每公畝自二十七至六十三公斤不等。在砂壤之區，若不過高而傾斜大者，可經營種竹及菠蘿，惟須補助淡燐及有機質肥。其地位高而傾斜大者，與礫壤之區，現祇宜植松放牧而已。

(11)小坪細砂質壤土及(12)粘質壤土　本系土壤，由小坪系之黑色頁岩粘土及砂岩等風化定積而成。發見於縣之中部及西部，面積不大。其粘土成分高者成粘質壤土，餘爲細砂質壤土。粘質壤土區發見於西部，而細砂質壤土在於中部。本系土濕潤時爲暗紫以至黑棕色。乾時則棕紅色，間有黑色者，然不多覩。風化亦頗透澈，其結構在表土略有團粒，而底土則多屬粘實，而成小塊狀，通透性弱。粘壤之底土亦屬粘壤。而細砂壤之底土，則屬細砂壤或粘壤。在中部之細砂壤土，地勢頗傾斜，而地位亦高，排水良好，又以細土粘土成分不弱，保水力尙强。至西部之粘壤，地面多有岡陵起伏性，略有傾斜，而排水亦佳。

茲將其機械分析與化學分析之重要成分列表比較如次；

(甲)機械分析成分表(%)

樣本字號	土層	類別	礫	細礫	粗砂
番	A	細砂壤	○	3.89	5.38
	B	同上	○	3.67	2.92
302	C	粘壤	○	6.90	5.55
番	A	粘壤	○	2.54	6.45
	B	同上	○	4.70	4.90
304	C	同上	○	9.60	7.80

粘土	細土	極細砂	細砂	中砂
21.90	29.00	19.00	18.05	3.56
20.50	31.80	29.60	10.20	1.88
25.20	41.00	12.90	6.20	2.31
33.60	31.80	14.05	9.10	2.60
89.40	33.70	11.68	4.23	1.43
26.60	30.40	15.00	8.10	2.50

表內之302與304號爲垂直切面樣本。302號採取自中部之百足嶺，其A層自〇至二〇公分，B層自二〇至八〇公分，而C層則自八〇至一。五公尺。304號

則採自望岡，其A層自〇至五〇公分，B層自五〇至一公尺，C層自一至一・五公尺。

（乙）化學分析成分表

樣本字號	淡 %	燐 %	鉀 %
番304（A）	0·09	.015	1.09
同（B）	0.06	.012	1.09
同（C）	0.06	.022	.65
番302（A）	0.10	.024	1·39
同（B）	0.09	.027	1.38
同（C）	0.04	.051	1.88

有機質%	酸性反應	每公畝石灰需要量（公斤）
1.01	中	43.68
.40		
.81		
.87	中	33.75
.45		
.21		

依據上表所列結果，此兩區土壤，質地細密，蓄水力强，造林及種果適宜。至經營普通農作則不合宜，以地位高而傾斜，耕作不易也。所含有機質及鉀尚屬中庸，而淡燐嫌其微少。倘利用以種植果木，施肥須注意淡燐及有機質爲要。至酸性反應，係屬中等，一般果木之種植，無調和酸性之必要。

（13）珠江壤土　本區爲珠江系重要土區之一，分布於西中南各部，而中部所

佔面積尤廣，其沖積土層厚度自數公分以至數公尺不等，而普通約在二公尺內外，乃新成土也。其亞表土及底土，自砂質壤土以至壤土粘土不等，但以壤土爲最普通，次爲砂壤與粘土，均不多見。珠江附近之龍水埗一帶，其底土屬粘土，所植荔枝橙等，均不及珠村獵德一帶，甚有不能生長者，大概因底土閉結所致。但自底土下約一公尺，則發見有砂質土層。查本區土之表土，其色自暗灰色以至灰黑，底土色澤常相似而較淡，在底土或一公尺下之土，間帶有棕白等色，大抵接近原始底岩風化土也。土之結構多屬團粒狀，耕作情形良好，除底土屬粘重之地帶外，排水不甚劣，然以地勢平坦，地下水位普通在一二公尺內，天然排水係屬中下。然多利用作水田，故亦適宜無碍。本區土壤，除沿鐵路兩旁數十尺範圍及道路水溝未有利用耕植外，餘幾盡墾作水田蔬圃果園。查土壤之植物養分，淡之量仍屬中下，其平均數不過爲千分之一強，燐之量則屬中上，平均約萬分之五，

鉀之量頗富，平均約百分之二強。至腐有機質量則屬中等，自百分之一至二·五不等。酸性反應自弱至中，若欲調和至於中性，每公畝需要石灰（炭酸鈣）自十七公斤至四十四公斤不等。

茲將土壤之機械分析及化學分析節錄於左表：

（甲）機械分析成分表（%）

樣本字數	土層	土類別
番 3502	表土	同上
	亞表土	同上
	底土	壤土
番 3505	表及亞表土	粘土

極細砂	細砂	中砂	粗砂	細礫	礫
12.20	13.55	6.09	3.48	2.13	1.78
11.50	13.00	6.22	3.80	2.38	2.40
8.58	14.05	6.33	4.30	2.25	2.23
12.22	18.10	7.75	5.30	3.48	2.43
10.68	3.20	1.45	1.32	1.04	○

(乙)化學分析成分表

樣本字號	淡 %	燐 %	細土	粘土
番3502(表)	.11	.060	45.55	13.25
同(表亞)	.09	.060	44.80	15.90
同(底)	.04	.036	41.20	21.00
番3505(表)	.10	.032	33.43	17.40
同(表亞及底)	.05	.030	40.00	41.50

每公畝石灰需要量（公斤）	酸性反應	腐有機質%	鉀%
16.66	最弱	1.20	1.57
		1.02	1.49
		1.11	1.60
43.8	中	2.49	1.84
			1.25

由上表之機械及化學成分觀之，本區之土，堪稱肥沃，爲本系土等土區也。倘淡燐等質常有補充，水利管理得當，土力自無缺乏之虞。查縣內之農業，以在本土區內者爲最發達，水稻田所佔面積爲最多，次則爲蔬果。

(14)珠江埔質壤土及(15)粘質壤土　此兩土區發見於縣之南部，面積甚廣，地位甚低，排水不良，然多藥有基圍，墾作水田以種稻，間有種甘蔗與桔橙者。其土色灰黑，與壤土區者相似。然細土或粘土成分高，結構多屬粘閉而鮮團粒狀。耕作原不易，但以作水稻田則甚適宜。極南一部，間受鹹潮淹及者，幸已藥有基圍禦水，否則難於利用。埔壤與粘壤之性狀大略相似，不過在粘壤則粘土成分較高耳。埔壤之底土多屬埔壤，間有砂壤。至粘壤之底土則屬埔壤。此部分之沖積層較在中部之壤土區爲深，常在一公尺以外。厚度雖較大，但亦屬新成之土未進化完成者。

茲將其機械分析及化學分析成分節錄如次：

(甲)機械分析成分表(%)

樣本字號	土層	類別	礫	細礫	粗砂
番	表	埴壤	.42	4.60	4.17
	亞表	同上	5.35	2.82	3.12
3507	底	砂壤	1.34	4 95	16.70
番	表	埴壤	.05	.72	2.26
3508	亞表及底	同上	.54	.50	1.01
番	表	粘壤	◌	.34	.95
3519	亞表及底	埴壤	○	.09	.39

粘土	細土	極細砂	細砂	中砂
20.20	55.05	8.85	3.44	3.30
19.50	52.90	10.40	3.18	2.52
9.95	31.50	13.10	8.80	13.64
22.95	54.01	10.90	7.15	1.45
21.85	56.65	9.75	7.30	2.36
31.40	54.40	10.70	2.58	.41
26.90	59.00	10.20	2.97	.35

酸性反應	有機質 %	鉀 %	燐 %	淡 %	樣本字號
弱	.78	1.18	.039	0.20	番3507（表）
	.36	1.48	.036	0.15	仝（表亞）
	.13	1.06	.022	0.12	仝（底）
最弱	2.42	1.45	.054	0.10	番3508（表）
	2.48	1.58	.053	0.11	仝（表亞及底）
強	2.89	2.44	.069	0.16	番3519（表）
	2.23	2.43	.067	0.12	仝（表亞及底）

每公畝石灰需要量（公斤）	
	22.50
	12.31
	42.50

據上表分析結果，此兩區土，所含淡燐鉀及有機質量，係屬中等以至中上。而土酸自弱至強，差異頗大。此種土壤，現利用以種稻者多，淡燐及有機質肥，仍應施用，以增加土力，而垂久遠，不宜祇賴灌溉濁流中之固體及溶解質也。石灰需要量，差異既大，且關係於農民經濟不鮮，宜有專案之調查及研究，此則有待於將來辦理者。

（16）珠江砂質壤土（17）細砂壤土（18）礫質壤土　此砂質壤土，除縣之南部（沙灣司屬）外，其餘中西北各部沿河流域均有發見。其底土自礫壤以至砂壤細砂中砂粗砂不等。而其層次之厚薄亦不一，至爲複雜。大都利用作水稻田或蔬菜地。底土屬砂壤者，比較他者爲勝。蓋以滲漏較少也。

細砂壤土發見於縣之西部（慕德里司屬）流溪河黃洞水之下游，其底土自細砂壤以至砂壤或粘壤不等。其土力似較砂壤區土爲佳，大概以砂較細而底土較佳也。其利用亦多作水稻田。

礫質壤土發見於石牌（鹿步司屬）東附近程界東社一帶，面積無多，而土層不深。大概因附近紅岩岡陵冲刷下來之物之影响，故礫質成分頗高。其底土亦屬礫壤。現利用作水稻田及蔬菜地。

以上三區土壤，其色澤在濕潤時爲暗灰色，乾時則灰色。與壤土區之顏色相似。第間有因施肥關係，有機質成分高者，則色澤較黑。此三區土壤，以砂分高而粘質少，表土多有團粒狀結構，耕作較易也，第以地位常低，雖屬砂質，然排水狀況亦不佳良。至土力强度，三土區約略相似，但較壤土區爲遜耳。

茲選錄各土區之機械分析及化學分析成分列表比較如後：

（甲）機械分析成分表（%）

樣本字號	土層	類別	礫	細礫
番	表	砂壤	5.50	6.75
513	亞表及底	礫壤	13.75	17.60
番	表	細砂壤土	·92	.83
3522	亞表	全上	1.41	2.27
	底	砂質壤土	9.60	2.95
番	表	礫壤	31.00	3.13
3501	亞表	全上	30.30	1.77
	底	全上	32.30	1.94

粘土	細土	極細砂	細砂	中砂	粗砂
26.43	27.70	8.57	10.78	4.70	9.94
9.20	10.70	5.93	9.70	7.65	23.70
14.50	32.30	19.80	24.20	4.80	2.55
11.95	29.50	15.20	38.60	2.87	3.39
15.70	34.58	8.44	18.65	2.77	7.65
11.60	24.30	9.02	9.61	6.07	5.22
17.60	27.70	7.35	7.52	4.72	2.97
15.35	22.45	9.25	11.25	4.38	2.94

(乙)化學分析成分表

樣本字號	淡 %	燐 %	鉀 %	有機質 %
番513（表）	0.12	.033	.86	2.55
仝（亞表及底）	0.05	.009	.57	1.14
番3522（表）	0.10	.029	2.84	4.32
仝（亞表）	0.06	.028	2.81	1.47
仝（底）	0.05	.012	2.48	.32

酸性反應	每公畝石灰需要量（公斤）
中	33.68
弱	22.50

依上表分析結果推論，此砂壤及細砂壤土，所含有機質及鉀係屬中至中上等。而淡燐成分則甚微薄。施用肥料宜注意有效淡燐之補助，有機質次之。石灰施用量，宜分別酸性程度，及作物抵抗酸性之強弱而定之。

（19）珠江粗砂質土及（20）中砂質土　此兩土區所佔面積無多。粗砂質土發見於流溪河下游附近高塘，其底土亦屬粗砂或中砂。色灰白，保水力弱，而土力微薄，乃屬瘠土。幸附近河流，水利易得，間亦墾作水稻田或蔬菜地。然收穫甚劣，第以砂性大，耕作甚易。至中砂質土，則發見於沙灣村北青羅幛嶺下涌邊鄉。

其色灰，其底土屬壤土。其土力較勝於粗砂土，而略遜於砂壤區之土。利用作水稻田，水利亦頗佳。此兩區土地位低，地下水位距表土甚近，故土之本身排水雖易，然排水情形亦不良好。

茲將兩土區之機械分析及粗砂土之化學分析成分節錄如下表：

（甲）機械分析成分表（%）

樣本字號番	土層	類別	515番	503番
	表	粗砂質土		
	亞表	中砂質土		
	底	粗砂質土		
	表	中砂質土		
	亞表	壤土		
	底	同上		

極細砂	細砂	中砂	粗砂	細礫	礫
16.40	33.80	9.00	9.62	5.80	5.44
12.75	35.66	9.56	8.23	6.08	7.66
16.45	31.00	8.70	9.69	8.97	6.50
9.90	36 80	15.50	14.96	4.85	○
9.15	13.20	5.75	6.50	3.05	8.45
7.50	10.10	4.29	7.40	3.10	.77

(乙)化學分析成分表

樣本字號	淡 %	燐 %
番515(表)	0.05	0.45
同(表亞)	0.04	0.18
同(底)	0.15	0.17

細土	粘土
12.00	7.33
12.20	7.75
10.10	8.66
12.30	5.60
41.80	12.05
49.50	17.20

每公畝石灰需要量（公斤）	酸性反應	有機質 %	鉀 %
4.50	極弱	.71	2.65
		.36	2.81
		.27	2.77

依據上列粗砂土之分析結果，所含鉀量頗富，第燐則中等，而有機質及淡則甚微。施肥宜特別注意之。酸性尚弱，需要石灰甚微也

（21）江村砂質壤土（22）細砂質壤土（23）粘質壤土及（24）壤土　本系土壤位於

縣之西北部，成一大平原，其中發見之土可分爲四區；一爲砂質壤土，二爲細砂質壤土，三爲粘質壤土，四爲壤土。其厚度自數公分以至一公尺不等，其底岩頗複雜，有屬水口系者，有屬小坪系或火成岩者。地勢頗平坦，地位較附近之珠江系土略高，故其排水狀況。除粘質壤土區外略勝。砂質壤土之色，濕時暗灰，乾時則灰。在平原之東部者，其底土多爲砂壤土，在西部者間有粘壤或粘土，其色與表土相似，間帶有黃白或紅白色者，以近底岩故也，在東部之砂壤，以底土多屬砂壤，保水力弱，滲漏較易，秋冬兩季常患旱。故作水稻田者，每於晚造改種甘藷豆菽。至西部之砂壤土，以底土間有粘壤或粘土，堪以儲水，故多掘井以備灌溉之用。此種吊水桿杆，由江村至花縣界，沿廣花公路四望，儼若桅杆，幾疑爲舟楫叢集。本區土之表土頗富團粒狀結構，耕作容易，土力亦不弱，祇嫌水利不足，爲應設法改善者。其土多利用作水稻田，或種花生及雜糧。

細砂質壤土，發見於江村平原之中部。色澤潤時爲黑灰色以至黑色不等，（間有灰色者）大概受人工施肥影响所致，乾時則暗灰或灰色。其底土爲細砂質壤土或粘壤不等。底土及底土以下保蓄水力不弱，故掘井溉灌之法，較在砂質壤土區尤爲普遍。其表土之結構多作團粒狀，耕作容易，土力似勝於砂質壤土。此區土多利用作水稻田，或種花生甘藷。

粘質壤土發見於平原之北部。土色與上述之細砂壤土相似。其底土亦屬粘壤，排水不良，團粒狀之結構甚少，耕作不易，幸多利用作水稻田，故亦適宜而無碍，土力較勝於上述之砂質壤土。

壤土發見於平原之東北，面積不大。土色結構與上述細砂壤土相似。其底土亦屬壤土，其土力頗良好，多利用作水稻田。

茲將上列各區土壤之機械分析及化學分析成分節錄列表而比較之如次：

（甲）機械分析成分表（%）

樣本字號	土層	類別	礫	細礫
番	表	砂質壤土	3.33	6.66
	亞表	上同	2.77	5.20
4030	底	上同	4.04	4.20
番	表	砂質壤土	6.10	9.55
	亞表	上同	5.95	4.95
4034	底	土粘	2.02	3.56
番	表	細砂壤土	4.25	3.81
	亞表	上同	5.78	3.60
4035	底	粘質壤土	2.52	1.92
番	表	粘質壤土	2.80	2.80
	亞表	上同	3.60	3.90
4037	底	上同	3.84	4.40
番	表	土壤	2.30	2.40
4032	亞表及底	上同	1.92	2.02

粘土	細土	極細砂	細砂	中砂	粗砂
13.05	20.40	14.60	23.40	6.15	12.10
17.60	18.80	18.60	21.80	5.05	9.90
20.60	20.10	15.25	18.30	7.02	9.35
10.77	21.00	19.00	12.40	5.20	15.20
18.90	24.30	22.60	12.05	3.03	7.80
40.50	24.30	15.40	7.57	1.23	4.85
23.60	24.82	21.10	12.00	2.98	7.25
21.40	28.70	21.56	9.56	2.74	5.40
28.60	50.90	5.08	6.05	1.57	2.83
23.00	39.56	13.60	11.20	3.05	4.00
36.50	32.77	10.23	5.95	3.00	4.25
24.10	32.40	10.65	6.47	2.32	5.88
20.00	39.20	18.00	9.45	2.45	5.75
20.80	39.60	19.90	8.20	2.66	4.73

（乙）化學分析成分表

樣本字號	淡 %	燐 %	鉀 %	有機質 %
4030番（表）	0.28	.019	1.39	3.60
同（表亞）	0.26	.013	1.21	.82
同（底）	0.27	.016	1.37	1.08
4034番（表）	0.10	.021	.44	1.50
同（表亞）	0.03	.015	.53	.66
同（底）	0.04	.011	.96	.16
4035番（表）	0.12	.031	.83	1.85
同（表亞）	0.05	.021	.70	.78
同（底）	0.04	.009	.94	.09
4037番（表）	0.14	.034	.96	1.56
同（表亞）	0.09	.031	1.06	1.24
同（底）	0.06	.026	.96	1.20
4032番（表）	0.09	.016	1.61	2.07
同（底及表亞）	0.08	.030	1.53	1.35

酸性反應	每公畝石灰需要量（公斤）
中	37.90
弱	22.50
弱	7.60
弱	7.50
弱	21.30

依上列分析結果比較，四區土壤所含重要物質成分相差不遠。概括論之，有機質及鉀之數量係屬中至中上。而淡燐成分甚低。此部耕地施肥，應特別注重淡燐肥之補助。酸性自弱至中，需要石灰尚不多也。

（25）石牌細砂質壤土　本區土發見於廣州市之東部與西部，及縣之中部（菱塘司屬）與南部（沙灣司屬）爲谷底沖積土。地勢平坦，由附近岡陵土面沖下物質積聚而成。其沖積土層較珠江沖積之厚度爲薄，約一公尺內外，而普通五十公分下，發見谷底原有岩之定積土層，以其色澤結構均不同也。本區土之色，濕潤時

自灰黃以至暗紅，乾時則色澤略淡。底土自細砂壤以至壤或砂壤，色帶紅黃或紅白。表土之色，大概與墾植年代之遠近有關，有機質量增加之影响也。其結構疏密適中，團粒易成。地勢常較附近之珠江壤土略高，故天然排水較好。地下水位普通常深在二公尺之下，其土力較遜於珠江壤土。現多利用作水稻田甜竹園或蔬圃。收成除甜竹外似不及在珠江壤土經營者。

茲將機械分析及化學分析成分節錄列表而比較之如次：

（甲）機械分析成分表（%）

樣本字號	番	番	番
土層	表	601	602	4001
	亞表			
	底			
	表			
	亞表			
	底			
	表			
	亞表			
	底			

細砂	中砂	粗砂	細礫	礫	類別
14.20	5.98	3.58	1.94	11.30	細砂壤土
15.41	6.00	3.70	3.90	1.41	同上
15.60	12.20	3.03	.21	2.10	同上
14.82	3.50	3.48	4.17	2.66	細砂壤土
16.30	14.60	11.85	7.84	3.81	同上
17.20	8.66	2.92	1.72	6.60	壤土
15.30	7.55	4.95	2.41	3.81	細砂壤土
13.90	7.90	5.28	2.83	3.05	同上
14.70	6.75	2.94	2.64	3.84	同上

（乙）化學分析成分表

樣本字號	氮 %
番601（表）	0.85
仝（表亞）	0.81
仝（底）	0.34
番400（表）	1.25
仝（表亞）	0.74
仝（底）	0.56

極細砂	細土	粘土
25.00	30.00	8.20
25.20	35.35	9.25
16.90	33.20	16.00
17.10	34.30	9.55
5.72	33.30	6.62
3.88	38.60	19.40
26.70	32.80	6.05
28.10	32.30	6.70
27.20	29.30	9.75

每公畝石灰需要量（公斤）	酸性反應	有機質%	鉀%	燐%
17.50	弱	.68	.43	0.32
		.43	.53	0.38
		.27	1.59	0.40
33.32	弱	.85	.42	0.48
		.69	.47	0.40
		.54	.44	0.31

由上表觀之燐鉀之成分係屬中等，而淡與有機質則微薄，至酸性則不強。在一般作物之施肥宜注意淡與有機質之補助，而燐鉀次之，石灰則非甚需要也。

(26)石牌砂質壤土及(27)壤土　此砂質壤土區發見於縣之中部南村附近（菱塘司屬）其色暗灰。底土爲砂壤，色灰間帶有紅白色，以近底岩故也。表土結構多團粒狀，耕作容易，排水中庸，其土力與細砂壤土相伯仲。

壤土區發見於市橋附近沙墟之處，色暗灰，底土屬砂壤或礫壤。其結構及其他特徵與細砂質壤土相似。此兩區土沖積層厚度約在一公尺內，

茲將其機械分析成分列表於後以資比較；

機械分析成分表(%)

樣本字號		番	番	
土層	表			
	亞表及底	4015		608
	表			
	亞表			
	底			

類別	礫	細礫	粗砂	中砂	細砂
砂壤土	4.68	5.56	13.14	6.54	11.52
同上	5.02	6.45	16.20	7.00	13.40
壤土	○	11.73	11.45	6.26	6.40
砂壤土	16.95	16.00	12.81	6.15	5.14
礫壤土	23.90	25.20	1.72	7.86	3.26

極細砂	細土	粘土
8.55	36.40	13.10
10.00	30.30	9.85
7.18	37.80	19.00
4.35	22.38	15.38
1.46	15.33	6.18

(28)龍眼洞砂質壤土及(29)粗砂質土　本系之砂質壤土區所佔面積甚廣，凡純粹火成岩山岡之谷地幾盡屬之，故其分布在南中北各部均有。其土之色澤濕潤時自暗灰以至灰棕色，乾時則變灰或淡棕色。間有黑色之土發見在岑村附近，及中山大學第二農場，與縣之東北烏坭逕(河棠下附近)然面積不大，大抵由遠年水松或他種植物就地積聚腐化所致也。其底土多屬砂質壤土，其結構多團粒狀，耕

作容易。惟保水力弱而患旱，倘能貯蓄山水以資灌溉，則此土亦屬中上土也，其地位雖在谷底，然地勢高，地下水位常在二公尺以外，故天然排水情形尙佳。山洪有法疏洩，不易爲患也。此土大概有機質量極微薄，而石英砂子常粗，有機質之養化消失極易，是應注意者。其利用多作水稻田及蔬菜地。

粗砂質土發見於廣州市東，沙河至太和市公路之北，面積不大。其表土色自灰白以至灰黃，乾時則色澤略淡。底土色則自灰黃以至紅黃，蓋以近底岩也。其底土爲砂質壤土。本土區以粗砂成分高，而粗砂多屬石英，故土力遠不若砂質壤土區。所幸底土係屬砂壤，故亦利用以作水稻田及蔬菜地。其結構則在表土嫌其疏散，但亞表土底土係屬砂壤，足以補救多少

上述兩土區之冲積土層厚薄不一，大概自數公分以至一公尺，而以半公尺內外爲最普通。

茲將其機械分析及化學分析成分節錄列表而比較之如次：

（甲）機械分析成分表（%）

樣本字號	土層	類別	礫	細礫
4011番	表	砂質壤土	2.54	5.16
	亞表	全上	4.20	4.72
	底	全上	2.20	5.43
4017番	表	砂壤	3.44	7.94
	亞表	全上	3.25	7.96
	底	全上	2.31	5.30
4022番	表	粗砂質土	5.14	2.80
	亞表	砂壤	3.15	9.40
	底	全上	5.20	7.60

粘土	細土	極細砂	細砂	中砂	粗砂
13.60	83.10	15.40	18.30	7.70	14.15
14.10	21.08	16.20	20.46	7.15	11.10
16.20	24.54	20.90	16.32	4.73	9.06
17.10	19.24	8.00	18.10	11.40	15.30
27.15	21.99	7.41	11.73	6.21	13.36
30.80	21.50	8.60	15.00	5.65	11.30
7.64	11.85	6.90	20.10	11.80	33.10
16.50	16.30	7.40	18.80	10.50	18.50
17.90	15.75	10.30	19.10	9.42	14.50

(乙)化學分析成分表

樣本字號	淡 %	燐 %	鉀 %	有機質 %
番4011(表)	0.12	0.49	1.11	1.72
仝(表亞)	0.07	0.42	1.06	.33
同(底)	0.05	0.25	1.21	.82
番4017(表)	0.09	0.02	2.40	.83
同(表亞)	0.07	0.16	2.46	.86
同(底)	0.06	0.16	2.19	.72
番4022(表)	0.09	0.22	2.71	.74
同(表亞)	0.08	0.21	2.53	1.61
同(底)	0.07	0.23	2.58	.59

酸性反應	每公畝石灰需要量(公斤)
弱	21.63
弱	18.80
極弱	1.88

據土列化驗結果，兩區土壤所含重要養分相差不遠。大概鉀量豐富有機質平庸，燐質自中至中下等，淡亦微薄。施肥宜注重淡燐之補助及增加有機質，如種植綠肥等以增長土力，改良土性爲要，此兩區土酸性尙弱，需要石灰量不大。

(30)佛嶺細砂質壤土　本土區發見於佛嶺市一帶山谷間，爲附近小坪系岩石之岡陵土面冲下物質塡積而成。其厚度在一公尺之內。地勢平坦，地位略高於附近西部之珠江沖積土。然以其底土屬粘質壤土，排水情形仍不良好。其土色自灰棕色以至暗棕色，乾時則色澤略淡，結構則表土多有團粒狀，而底土則粘閉，耕

作尙容易。土力中等。與石牌系之細砂壤土相似。多利用作水稻田或桃園，收穫頗佳。

茲將機械分析及化學分析成分節錄如下表；

（甲）機械分析成分表%

樣本字號番	土層	類別	礫	細礫
2501	表	細砂壤	○	2.19
	亞表	仝上	○	2.76
	底	粘壤	○	2.50

（乙）化學分析成分表

樣本字號番	淡%	燐%	鉀%
2501（表）	0.09	0.23	.86
同（亞表）	0.07	0.22	.89
同（底）	0.07	0.16	.93

粘土	細土	極細砂	細砂	中砂	粗砂
20.50	30.80	19.50	16.30	5.52	5.39
21.50	31.00	20.00	14.32	2.98	6.44
30.80	26.00	16.60	13.10	4.35	6.23

每公畝石灰需要量（公斤）	酸性反應	有機質%
21.00	弱	1.75
		.73
		.97

由上化驗結果推論，此兩區土所含淡燐成分微少，鉀與有機質量中等。施肥宜注重淡燐之補助，而有機質及鉀肥亦宜有相當之增加。土之酸性微弱，施用石灰非重要也。

石質土

廣州羅岡鍾村小坪各系之土區內均有石質土發見，雜有各該系土之原始母岩風化未盡之石塊。然石塊間之土壤，在廣州羅岡系土區內者多屬砂壤，在鍾村系土區內者多屬礫壤，在小坪系內者多屬細砂壤，其特徵與相當之土區相似。在廣州系內者，間有利用造松林，如附近茅岡之長魚頭嶺一帶是也。在羅岡系內者，多利用以造松林雜木及栽植荔枝欖等，如龍眼洞羅岡洞一帶常見，至在小坪及鍾村系內者，尙鮮利用，此種石質土，地勢雖多屬甚傾斜，然能善用之以放牧造林，亦可有相當收益也。

三、農業生產概況及前途希望

(甲)農業生產概況　本縣之農業生產，以利用河流冲積及谷底冲積之土地達最高程度，而山岡之地次之，查冲積低地之荒廢者甚少，沿廣九鐵路北附近車陂河上游馬鞍岡赤岡之間有地約一方公里(約千畝)大約以水利缺乏而致荒廢。縣之西部附近小梁山(佛嶺系土)亦有地約一方公里，亦因水利問題而荒廢。其餘南部在沙灣村之西南滘湄沙有地約二方公里(約三千畝)近年來因盜賊猖獗，難於耕作收穫而致荒廢。其餘山谷零星荒地，因排水不良者間有之，然面積不大，於此不贅。至山岡之土荒廢者多，除石質土外，估計廣州系約有三分之二，鍾村系土約有十分之九，小坪系土約有五分之四，羅岡系土約有三分之二，照此推算山岡之地荒廢者約佔三分之二。

查河流冲積與谷底冲積之地，利用以生產水稻者約有十分之八，而經營蔬菜甘薯豆菽雜糧者約佔十分之二。其原因固關乎水利，而糧食問題，乃一般農家視爲重要者也。所施肥料，大概以麪糞爲主，然亦間有用舶來之化學肥，以硫酸鐵爲最普通。第沙灣附近之沙田，則鮮有用化學肥者，大概以粘性過重，而土酸亦不弱所致。此則有待於將來專事研究者。又查沙灣沙田極南一部附近萬頃沙之地，亦畧受鹹潮限制生產較低，此應與附近東莞中山各縣之鹹潮田作一問題而研究改良者也。昔年沙灣沙田曾多利用以種甘蔗，獲利頗厚，但近年來以沙匪常有出沒，蔗林妨碍保護，種蔗面積大爲減少。現有改種柑橙者，然收穫不佳，大概以粘性太重，而地下水位距表土太近，排水不良所致。沙灣所有沙田，已築基圍者約有十分之八九。而新造細墟東之沙田，則築基圍者尚少，不過約佔十之一而已，至谷底冲積之土，土力本遜於河流冲積，而水利亦不如，故農作宜因地之利而

經營之。自不失爲中上土也。

山岡之土，現利用者多作果林松林竹林之屬，收入亦不菲。查山岡地之利用，以東北部爲多，而中部與南部較少，多屬童山濯濯，青草不留，以村落多而燃料缺乏也。果木之普通者，以荔枝龍眼梅欖菠蘿爲最大宗。其餘桔橙檸檬楊桃亦不少，大都種於低地之冲積土。

茲將各種重要作物及林木分別約述之如左；

(1)水稻　全縣冲積之土約佔陸地面積百分之七十，其中種水稻者約佔十分之八。多在縣之南部，(即沙田)其餘則在縣之西部(即江村平原)及中部之山谷間。南部水利至溥，西部次之，而山谷間又次之，沙田中有基圍者施肥較多，收穫量每畝平均約五六百斤，可種二造。去年豐收，查收穫之高者，在黃埔附近之圍田，數達一千一二百斤，惜面積不大耳。無基圍者時患水浸，多不

施肥，每年祇種一造，每畝收穫量至多不過三石。平均估計每畝水稻田每年收穫約四百斤，每年稻之收穫約在五六百萬担以上。足供全縣人口一年半之食而有餘。

（2）陸稻　市橋鍾村大龍一帶畧有種植，生產之量不多。

（3）甘薯　全屬除沙田各鄉，均有栽種爲副粮食品，而以羅岡龍眼洞鐘落潭太和市新造沙灣鍾村大龍蔡邊各鄉種植最多。尤以新造甘薯之鬆爽香甜爲著名。市橋鍾村蔡邊大龍各鄉每年於八九月間種植，明年一二月收穫，每畝中等產量約有一千五百餘斤，用製薯乾運省銷售。

（4）花生　種植於龍歸市太和市中和市鐘落潭進和市一帶最多。而羅岡暹岡亦畧有種植，每畝收穫量約五六石，搾油爲食用，而花生粕用作肥田料，豆糠可飼家畜。

(5)黃豆　龍眼洞南岡大石各鄉均有種植，大約用製豆腐腐乳之用。

(6)蘿蔔　各鄉均有種植爲蔬菜用，而以新造南村深井坑頭石樓市橋一帶生產最多，均用乾晒入埕，運省銷售。

(7)椰菜　花地河南一帶均有栽種，而以石牌洗村寺貝村沙河出產最多，每年運外洋銷售約四五十萬元。

(8)其他蔬菜　如苦瓜絲瓜節瓜冬瓜白瓜豆角薑等多在沿鉄路及公路之冲積土栽植，每年產量估計在二百萬元以上。

(9)燈草　爲大石鄉民專種之業，一年收穫二次，每畝一千五百餘斤，乾晒去皮，運銷於省佛。

(10)荔枝　全屬各鄉均有種植，而以南岡羅岡魚珠黃埔大塘土華大石何村新造市橋石基進和市各鄉生產最多，除在岡地外，冲積土及其基圍上均有栽植，種

類以糯米糍桂味爲多其餘黑葉淮枝三月紅又次之，年計出產約四五百萬元。

(11)龍眼　以大塘小洲土華新橋各鄉出產爲多，每年約數十萬元。

(12)柑橙　以珠村上堂吉山棠下羅岡南岡各鄉種植最多，年約三百餘萬元。而鶴嶺洪村各處亦漸有種植。

(13)檸檬　凡種柑橙之園邊均栽種之，產量不大。

(14)梅　以羅岡南岡一帶出產較多，而進和市九佛墟一帶亦有種植。多用製青梅糖紫蘇糖礶頭。

(15)桃　慕德里司之佛嶺市石馬官橋鶴邊一帶農民多植桃樹。每畝產量約在三十担左右，種植地面約三百畝，年計價值約在一二十萬元間。

(16)楊桃　專產於花地芳村一帶。每年於八九月大旺收穫，年產約十餘萬元。

(17)柿　柿有方柿及鷄心柿兩種，產於進和市鐘落潭九佛墟一帶者爲方柿。產於

岑村陳田江夏各鄉者爲鷄心柿。產量不甚大。

(18)杧果　下茅望岡鶴邊一帶均有種植，產量不多，而以下茅之蘭花杧爲最著名。

(19)柚　在花地大石石壁大洲一帶岑有種植，產量不多。

(20)欖　有烏白二種，全屬除南部沙田外，各鄉均有種植，而以南岡羅岡常平社謝村漢塘尾李人洞各鄉生產最多。烏欖用實生種，白欖亦多用實生種，或用烏欖種植三四年後之樹本約四五尺高，於一二月間截去尾段，簽接白欖樹枝約四五寸生長而成。此等枝術以羅岡人爲最精巧，全屬生產亦多。

(21)茶　坑頭鍾村左邊龍尾一帶山岡坡地均有種植大茶，產量不多，且每斤價值約有一毫左右，於農民無甚裨益。

(22)菠蘿　常平社牛鼻頭聯安社各處岑有種植，而以羅岡南岡一帶生產較多。近

年來中山大學農科第二農場利用開闢羅岡砂質壤土，以種菠蘿，面積百餘畝，成績亦頗佳云。

(23)番石榴　植果樹之地多兼種番石榴，或於田基圳邊種植之，以河南大塘一帶生產者味最香甜可口，惜價值低下，無甚裨益農民耳。

(24)甜竹　甜竹之筍，可作食用，或藏之於罐，販出外洋。此種甜竹，多在廣州砂壤及羅岡砂壤區內，而地勢較低平者種植適宜。每畝收入不菲，惜種植面積尚不多耳。

(25)松林　利用山岡土以植松林者，多在中部及北部之羅岡砂壤土區，約有六十萬公畝。而農林局廣州市政府及中山大學農場模範林場，近年來在石牌及白雲山一帶造林亦及十萬公畝。倘能保護週到，則廣州柴薪問題，得助不少。

(乙)農林前途之希望　本縣地處温帶，雨量充足，交通便利，水利堪稱溥及，土地大都肥沃，天然環境甚佳，所缺者人事未有盡耳。就利用土地以生產而言之，山岡之土尚可墾植者約佔全縣面積六分之一以上，伸算不下三百萬公畝，(約五十萬畝)倘能分別利用以造林種果，年可增加生產逾千萬元。沙田低地之未築基圍，早造受水浸而收穫減少者，亦不下四十萬公畝，(約七萬畝)倘能築圍禦潦，則年可增收一百餘萬元。西部之江村平原，與中北各部之谷底地，秋冬或早春患旱荒者不下八十萬公畝，(約一十五萬畝)倘能設置水塘，蓄水禦旱，則稻之生產，每年可增加二三百萬元。又稻米爲生產之大宗，而每畝平均產量殊屬太低，饒有改良增加之餘地，倘能於育種研究，分別土宜，育成佳種，則平均產量增加百分之三四十不難，而年入可增加三四千萬元矣。此外重要作物，蔬果種類之改良，土地適宜之利用，農民經濟之改善，均有待於政府之提倡指導與輔助，而

農民之合作能力，亦應注意者。以上數端，僅就調查所知，附陳管見，竊以爲倘能提綱挈要，積極改善，則全縣農業之發展，未可限量者也。

附錄

度衡里畝比對表

1公尺=3市尺=3.125部尺=2.672廣尺(排錢尺)=3.281英尺

1公斤=2市斤=1.676庫斤=1.663廣東斤=2.225英磅

1公里=2市里=1.736部里=0.621英里

1公畝=0.15市畝=0.163部畝=0.119廣畝(排錢尺)=0.0243英畝

Report on
The Soil Survey of Pan-Yu District, Kwangtung. China,

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SOIL SURVEY OF PAN-YU DISTRICT

KWANGTUNG, CHINA.

BY

T. Y. TANG

INTRODUCTION

The Soil Survey was established in October, 1930 under the Bureau of Agriculture and Forestry, Department of Reconstruction, Kwangtung Provincial Government with the aim of studying the soil in the province systematically for the improvement of the agricultural industry. Besides provincial appropiation, the survey is subsidised by the former Canton Agricultural Products Inspection Bureau, later reorganized into the Bureau of Inspection and Testing of Commercial Commodities of the Ministry of Industry, Central Government. The work is carried on in cooperation with the College of Agriculture and the Geological Survey of Kwangtung and Kwangsi of the Sun Yatsen University. Since the area of this province is so great, and agricultural conditions and communication facilities vary greatly from place to place, it is necessary to divide the work into several steps in order to meet the requirements of the situation. The procedure is divided into three stages as follows: (1) Detail soil survey, (2) Preliminary survey or soil reconsonnance, and (3) Rough survey of important soil series and types of the province. The

detail survey is conducted for those districts in which agricultural industry is well developed and communication facilities are adequate, using 1:50,000 map as a base. The preliminary survey is designed for districts where agricultural industry is not so well developed and communication facilitiess are poor, using 1:100,000 map as a base. The survey of important soil series and types will be conducted with the object of helping the future survey of different districts and obtaining rough data on main soil group conditions of the province, using 1:500,000 map as a base. The plan for the first year is to carry out the detail survey of the Pan Yu and Nam Hai Districts. The field work of Pan Yu District was started last November and lasted three months. It was conducted by two parties formed of the whole technical staff of the organization. The laboratory work lasted for about five months. The methods of survey and laboratory investigations were published in a special issue of the Division.

GENERAL DESCRIPTION OF THE AREA.

Location: Pan Yu District is situated in the south central part of Kwangtung Province, between 22° 46' to 23° 32' N. lat. and 113° 9' to 113° 37' E. long. It is one of the most important and prosperous district of the province agriculturally speaking. Canton City, the capitol of the province, is located partly in this district.

The district comprises an area of 1940.87 square kilometers (or 749 square miles approximately). and has a population of about 810,000, of which 54 per cent are farmers. It is considered to be a densely populated area, and agriculture is comparatively well developed on account of good facilities for communication and transportation.

Topography: North of the Canton-Kowloon Railway, the land gradually rises towards the north-east with hills and mountains attaining a height of over 500 meters. The highest

peaks are Mao-fung-shan (帽峯山), 541 meters, in the north-east; Pu-pai-chang, (鋪排嶂). 442 meters, in the north; and Pe-yun-shan or White Cloud Mountain (白雲山), 364 meters, north-east of Canton City. South of Canton-Kowloon Railway, the elevation gradually diminishes towards the south to nearly sea level, although there are hills, mostly below 100 meters, scattered in the delta plain. This southern portion of the district is a part of the Canton Delta. In the western part along the Canton–Hankow Railway, the land is rather flat, being mostly of alluvial deposit or valley bottom deposits in nature.

Geology: According to a recent report on the geology of Canton and its vicinity, by the Geological Survey of Kwangtung and Kwangsi Provinces, the oldest formation of the area begins with the Permian consisting of two series of rocks namely (1) Shuikou Series (水口系) and (2) Shiuping Series (小坪系). The Shuikow Series is made up of red clay, shale, quartzite breccia, quartzite sandstone with gray shale. The Shiuping Series is made up of black shale, clays and sandstone. The younger formation regarded as cretaceous is the so-called Red Bed Series which is made up of basal red beds chiefly quartzite breccia, conglomerate, clay shale and sandstone. In between the old and young formations and following the younger formation there are two periods of igneous intrusions, chiefly of fluidal and massive granities with some dykes of quartz, quartz porphyry, pegmatite and rhyolite.

The northern section of the district, especially the central and northeastern parts are mostly of granite formations with some outcropping of Shuikow and Shiuping formations, while in the south, besides the granite and Shiuping Series, Red Beds are better preserved, forming rolling hills. Rocks of all formations in general are deeply weathered, except in some parts, the quartzite and granite are discovered in the higher

elevations forming the peak of some mountains, or lying on the slope partly weathered.

Water Courses and their Utilization:— The Chukiang or Pearl River, flowing through the central part of the district, is considered to be the most important water course to which all streams in the northern section are either directly or indirectly connected. It spreads out into many trunks below the City of Canton, and flows out into South Sea through Boca Tigris. Among the important contributaries of Chukiang in the district, two may be mentioned: namely Liu-chi Stream (**流溪河**) and Huang-tung Stream (**黃洞水**). These two streams coming from the north and from the northeast respectively are navigable within the district. Pearl River and all its contributaries are highly utilized for irrigation and transportion.

Roads Transportation:— Besides Canton-Kowloon and Canton-Hankow Railways and Lo-kang Light Track, there are many highways or motor roads recently built for transportation. The agricultural industries may be further developed and improved by modern conveniences.

Climatic Conditions:— According to a summarized report for a period of 15 years (1916-1930) from the Weather Division of the College of Agriculture, Sun Yatsen University, Canton, the average temperature is 22.2° C. for the period; the lowest temperature always occurred in the month of January, the average minimum being 9.06° C.: the highest temperature occurred in the month of August, the average maximum being 24,95° C. Temperature as low as freezing point seldom obtains, and frost may come several times in a year, but the period is short. Winter crops are scarcely damaged by frost.

On account of the bordering sea coast, the humidity is generally high from March to August, being above 80 per cent, while the remainder of the year ranges generally above 70 per

cent.

The annual precipitation ranges between 1100 to 2600 mm., the average is a little over 1600 mm. Precipitation mostly occurs from February to September. More than half of the annual precipitation falls in the summer months.

The atmospheric pressure ranges between 755-767 mm, and the average mean is 761 mm. The lowest pressure is always observed in August and typhons generally occur in that month. The destructive effect of typhon is very fierce for crops; losses amounting to millions of dollars in crops are not inrefquent.

GENERAL DESCRIPTION OF SOILS

All hilly and mountainous soils are of primary and residual in nature, and belongs to Lateritic Soils. The colors of soils vary from purple red to reddish yellow or yellowish white. In addition, there are some black or dark brown soils. The purple red soils are mostly formed from the weathering of red beds, those of reddish yellow from igneous rocks, those of yellowish white from quartzitic and clay shales, while those of black or dark brown from black shale, which may contain some coal or coal-like materials.

On account of thorough weathering and severe erosion, or human activities, it is very difficult to find primary soils with normal profile that is well preserved. The surface soil is generally coarser than the subsoil. The weathering in most places goes as deep as below five meters, on account of heavy rain fall and warm climatic conditions. The natural drainage of the residual soil is generally very good. In the subsoil or B horizon one often finds accumulation of iron and aluminum oxides occurring in spots or streaks. Induration of these oxides are generally exposed in badly eroded soils; for example, the granitic soils in the College Farm of the College of Agriculture, Sun Yatsen University, near Shih-pai.

(石牌) These indurations from streaks varying in dimensions up to several meters long; once broken it forms nuts varying from the size of a pea to as big as an egg. These badly eroded soils may be regarded as aged (or degenerated) soils. Bad erosion is caused mainly by deforestation and heavy precipitation.

The well developed soils in this region generally has a surface soil, A horizon, not over 20 cm. in depth, while sub-soil or B horizon is generally very thick, and C horizon the parent material or rocks often appearing below five meter; but in some places the C horizon comes within one meter, for instance, the soil from red bed near Shih-pai and that from granite in Pe-yun-shan or White Cloud Mountain near Niu-ku-tou (牛牯頭)

All the low land soils in this region are of secondary and alluvial nature. They are comparatively young in formation and have not developed a perfect prefile. They occur mostly in the Canton Delta portion, in the western part of the district and in the valleys. The drainage in the Canton Delta is generally poor, and if not properly protected by dykes, flood may often happen. The drainage of the valley bottom soil is better. The river deposit is generally deeper than those in the valley bottom. The former usually has a depth of two meters, while the latter often less than one meter. But depth varies from a few centimeters upwards.

All soils so far mapped in this destrict may be grouped and classified as follows:

(1) Canton Series—This series of soil is derived from weathering of red beds. It is well developed around Canton, hence it is so named. Three types of soils are found, namely: sandy loam, gravelly loam, and medium sandy soil. Among them the sandy loam is the most extensive type while the other two types occur in comparative smaller areas. These three types occupy an area of 247,300 ares or 1.27 per cent of the

total land area of the district.

(2) Lokang Series—This series of soils is derived from igneous rocks. It is well developed around Lokang (羅岡), in the central eastern part of the district, so the series is named after the place. Soils so far found may be classified into five types, namely: sandy loam, coarse sandy soil, gravelly loam, fine sandy soil, and medium sandy soil. Among these, the sandy loam is the most extensive type. This series of oils occupies an area of 4,605,600 ares or 23.75 per cent of sthe total land area of the district.

(3) Chungtsun Series—This series of soils is derived from rocks of Shuikou formation. It is well developed near Chungtsun (鍾村) in the south western part of the district; so it is named. Two types of soils are found, namely: sandy loam and gravelly loam. The sandy loam is more extensive and better developed. This series of soils occupies an area of 584,400 ares or 3.01 per cent of the total land area of the district.

(4) Shiuping Series—This series of soils is derived from the rocks of Shiuping formation; so it is named. Two types of soils are distinguished, namely: fine sandy loam and clay loam. They comprise a comparatively small area amounting to 98,500 ares or 0.51 per cent of the total land area of the district.

(5) Chukiang or Pearl River Series—This series of soils, generally recognized to be very important agriculturally, is derived from alluvial deposits of Chukiang and its tributaries. It was first observed along the Chukiang; so it is named. There are eight types of soils so far distinguished, namely: loam, silt loam, sandy loam, clay loam, fine sandy loam, coarse sandy soil, gravelly loam, and medium sandy soil. The first five types occupy large areas. This series of soils comprises an area of 7,726,600 ares or 39.81 per cent of the total land area of the district.

(6) Kiangtsun Series—This series of soils is derived mainly from materials washed down from hills and mountains near-by by surface run-off and partly mingled with the subsidence from the flood of Liu-chi Stream or Huang-tung Stream. This series of soils is found around Kiangtsun (江村), a station on the Canton-Hankow Railway, hence it is named. Four types of soils are found, namely: sandy loam, fine sandy loam, clay loam, and loam. The first two types occupy a comparative large area. This series of soils occupies an area of 2,823,500 ares or 14.55 per cent of the total land area of the district.

(7) Shihpai Series—This series of soils was first observed near the Shihpai (or Shekpai) Station of the Canton-Kowloon Railway about 5 kilometer east of Canton City; so it is named. It is a valley bottom soil and the soil material is derived from the neighboring hills mostly or red beds, quartzites, gray shale, and granites. Three types of soils have so far been distinguished, namely: fine sandy loam, sandy loam, and loam. Of these three types the fine sandy loam is the most extensive. This series of soils occupies an area of 374, 700 ares or 1.93 per cent of the total land area of the district.

(8) Lungyen-tung Series—This series is also of valley bottom soils, and the washing down materials are entirely derived form hills and mountains of igneous rock chiefly granites. It is well developed within the valley of Lungyen-tung (龍眼洞): so it is named. Two types of soils are distinguished so far, namely: the sandy loam and coarse sandy soil. The former type is more extensive. This series of soils occupies an area of 2,510,200 ares or 12.94 per cent of the total land area of the district.

(9) Fuling Series—This series is also of valley bottom soil. derived from materials washed down from the neighboring hills of Shiuping formation. Only one type of soil, fine sandy

loam, has been observed so far. It occupies an area of 210,600 ares or 1.08 per cent of the total land area of the district.

In addition to the above, stony land in which there are rocks of Shuikou or Shiuping formation, red beds, or igneous in nature occurs. This stony area amounts to 152,600 ares or 0.79 per cent of the total land area of the district.

The different soil types and their areas may be tabulated as follows:

Table 1

Name of soil type	Area in ares	Percentage of total land area of district
Canton sandy loam	237,600	1.22
Canton gravelly loam	7,100	.04
Canton medium sandy soil	2,600	.01
Lokang sandy loam	4,565,600	23.53
Lokang gravelly loam	12,100	.06
Lokang coarse sandy soil	9,300	.05
Lokang fine sandy loam	3,400	.02
Lokang medium sandy soil	15,200	.08
Chungtsun sandy loam	578,900	2.98
Chungtsun gravelly loam	5,900	.03
Shiuping fine sandy loam	90,900	.47
Shiuping clay loam	7,600	.04
Chukiang loam	2,692,200	13.87
Chukiang silt loam	3,305,000	17.03
Chukiang clay loam	479,400	2.47
Chukiang sandy loam	904,300	4.66
Chukiang fine sandy loam	284,000	1.46
Chukiang gravelly loam	5,400	.03
Chukiang coarse sandy soil	53,600	.28
Chukiang medium sandy soil	2,700	.01
Kiangtsun sandy loam	1,489,500	7.67
Kiangtsun fine sandy loam	900,100	4.64

Kiangtsun clay loam	360,500	1.86
Kiangtsun loam	73,400	.38
Shihpai fine sandy loam	363,200	1.87
Shihpai sandy loam	7,500	,04
Shihpai loam	4,000	.02
Lungyen-tung sandy loam	2,331,800	12.02
Lungyen-tung coarse sandy soil	178,600	.92
Fuling fine sandy loam	210,600	1.08

DESCRIPTION OF DIFFERENT SOIL TYPES

The characteristics of the different types of soils and their general agricultural conditions are described below:

(1) Canton sandy loam—This type of soil is derived from weathering of sandstone shale or conglomerate of the red bed formations, and is distributed around Canton. In fact, Canton City partly rests upon this type of soil. In addition, it occurs at Shihpai and Ta-wu-kang (大烏岡) near Shawan (沙灣). The color is purple red when moisten and changes to a lighter color upon drying. The color of the surface soil subsoil and the parent material (A,B,C horizons) is very similar through out, and is very difficult to distinguish. However, the structure of different stratum is different. The surface soil has a somewhat granular structure, while in the subsoil the granular texture becomes less pronounced and has a tendency of becoming puddled. This is due perhaps to the concentration of leached down colloidal materials. The surface soil, or A horizon, varies in depth from a few centimeters to 20 centimeters and the depth of subsoil or B horizon generally reaches one or more meters below. For this reason, the parent material or C horizon is seldom exposed except near the out-cropping of the stony land, in the deep cut of motor highway or railway. The surface of the land is generally covered with some fragments or gravels of the parent rocks. In the

virgin condition, the structure of the surface soil seems to be compact, but after cultivation, it becomes quite porous and has a good granular structure. But the texture of the subsurface soil and subsoil is generally from sandy loam to loam, the granular structure becomes less and may even becomes puddled. This is due to the translocation of fine particles of silt and clay. Therefore the permeability of the surface soil is always better than the sub-stratum. It is fortunately, however, that the land has gentle slope and the surface drainage is generally good. Erosion is not excessive. The water table is generally two meters or more below the surface. The nitrogen, phosphorus, and organic matter contents are low, while the amount of potassium is fair. The soil has acid reaction, and the lime requirement varies from 40 to 60 kilograms per are.

(2) Canton gravelly loam and (3) medium sandy soil—Gravelly loam is discovered in Tsing-lo-chang (青羅嶂) near Sha-wan (沙灣). It is formed mostly from the weathering of shale and sandstone of red beds. The surface soil is generally covered with fragments or debritus of rocks. The topography of the land is rather steep, and erosion is very great, the land is almost entirely barren. The color of the soil is deep purple red and the organic content is very low. The subsoil is also of gravelly loam in nature, while the other characteristics are similar to those of sandy loam of this series.

The medium sandy soil is observed in Huang-hua-kang (黃花岡) north east of Canton City and Hu-lu-kang (葫蘆岡) near Shih-pai, and the area is not large. This type of soil is also formed mostly from the sandstone and shale of the red beds. The subsoil is of sandy loam to loam. Its characteristics are similar to those of sandy loam except the percentage of sands is higher in the surface soil.

The mechanical analyses (table 2A) of these three types of soils show that the silt and clay contents increase down-

wards from surface to subsoil. This obviously means the translocation of fine particles from A to B horizons.

The chemical analyses (Table 2B) show that these soils are poor in nitrogen, potassium, and organic matter. Should this land be utilized in the future, proper management for increasing these constituents deserves special attention. The natural growth of plants on this land is generally a thin cover of weeds or grasses, and the growth is poor. In some spots there are native pines which grow well. The surface slope of the sandy loam and medium sandy soil area is generally very gentle and the land could be easily utilized for agricultural purposes. But the topography of gravelly loam area is generally steep, and the land is only good for reforestation. Native pine, eucalyptus, and various species of leguminous trees may be selected for reforestation. The sandy loam and medium sandy soil areas may be used for orchards to some extent, and attention must be called to the restoration of adequate amount of nitrogen, potassium, and organic matter. Fruit trees having strong root system are preferable.

Table 2A. Machanical analyses of Canton sandy loam, gravelly loam, and medium sandy soil.

Sample number	Soil class	Gravel	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
P. 1001 surface	Sandy loam	12,58	5,57	6,49	9,12	17,70	20,90	16,30	10,80
P. 1001 subsurface	Sandy loam	10,35	5,67	6,50	8,48	14,12	18,90	23,18	12,25
P. 1001 subsoil	Sandy loam	8,38	5,27	6,89	6,04	8,07	15,90	28,76	18,95
P. 1002 surface	Sandy loam	4,78	3,82	8,40	12,40	20,76	17,95	19,55	12,40
P. 1002 Subsurface	Sandy loam	4,54	3,67	6,61	10,04	15,60	16,02	23,35	18,70
P. 1002 subsoil	Sandy loam	6,62	3,28	7,68	10,65	15,40	13,25	27,40	15,70
P. 1005 surface	Gravelly loam	37,15	7,85	4,70	3,62	6,10	7,78	19,10	12,15
P. 1005 subsoil	Gravelly loam	37,60	6,15	2,15	1,52	3,94	6,48	19,52	21,15
P. 1 A	Medium sandy soil	9,66	8,06	9,07	12,56	24,19	18,72	12,05	5,17
P. 1 B	Sandy load	18,08	6,10	6,82	10,51	14,00	20,30	15,10	9,37
P. 1 C	Sandy loam	15,50	6,07	6,57	6,48	8.92	14,95	25,02	16,46

Note— Soil samples given in this table and all other tables are either general representative samples or soils profile samples: the latter are numbered from 1 to 1000 while the former from 1001 up. For the general representative sample, the surface soil is taken from 0 to 20 cm., the subsurface soil from 20 to 50 cm., and the subsoil from 50 to 100 cm. For the soil profile sample, the depth is taken according the actual thickness of the different horizons. In this table, No. P. 1 is taken at Huang-hua-kang (黃花岡). Horizon A is taken from 0–20 cm., horizon B from 20–40 cm., and horizon C from 40 cm. down to about one and one-half meter. The parent material and mother rock are observed in the horizon C. It is not much weathered.

Table 2B. Chemical analyses of Canton Sandy loam and medium sandy soil.

Sample number	Nitrogen per cent	Phosphorus per cent	Potassium per cent	Humus per cent	Acidty	Lime requirement, kilograms per are
P. 1001 surface	.04	.034	1.11	.044	strong	61.30
P. 1001 subsurface	.04	.010	1.21	.034		
P. 1001 subsoil	.07	.008	1.28	.069		
P. 1A	.086	.010	.56	.43	medium	39.39
P. 1B	.074	.038	.54	.33		
P. 1C	.077	.056	.55	.13		

(4) Lokang sandy loam—This type of soil is formed from weathering of igneous rock mostly of granite. Two forms of granites are observed, one is fluidal and the other is massive. The former has smaller crystalline structure than the latter, and soils derived from the latter has larger angular quartz sand. This soil is extensively and well developed in the central and northern part of the district. The color of soil is red when moisten but changes to reddish yellow upon drying. After long period of cultivation it changes to yellowish brown color, or grayish yellow on account of the addition of organic matter. This soil is well weathered, and erosion in some places has gone very far forming gullies seven or eight meters in depth. The degree of weathering in the lower stratum of the gully is about the same as in the surface soil. In some parts of this area there are large blocks of granites left from weathering. This may be considered as

one of the characterics of this land feature.

In the uncultivated or virgin soil, the color of the surface and the subsoil is very similar and not easy to distinguish; but the structure of the surface soil or A horizon is mostly granular and the depth generally does not exceed 20 cm. The subsoil is more compact and has less granular structure, and its depth varies from 20 cm. up to several meters. The subsoil is from gravelly loam to sandy loam or loam. The parent material or C. horizon generally has fragments of the mother rocks. A good sample for A and B horizons is observed at Niu-ku-tou (牛牯頭) of Pe-ycun-shan (or White Cloud Mountain).

This soil is of sandy loam in nature, it is easily pulverized, but the appearance of the surface of uncultivated or virgin land seems hard, especially when there is heavy erosion. However, once cultivated, it becomes pulverized and the permeability is good. The surface of the land has more or less slope and the drainage is generally more than necessary. The water table is usually 5 meters below the surface. As this soil is sandy, the water holding capacity is very limited. For this reason, before begining fertilizing such land, the surface run-off and excess evaporation under sunshine are important problems deserving consideration. The soil is generally poor in nitrogen, phosphorus and organic matter and fair in potassium contents. According to the Emerson acidity test the soil acidity is from weak to medium. According to the Veitch method, the lime requirement is from 20—40 kilograms of calcium carbonate per are.

(5) Lokang gravelly loam, (6) coarse sandy soil, (7)fine sandy loam, and (8) medium sandy soil—The gravelly loam is discovered at Wei-kan-chang (桅杆庄) in the north-eastern part near Tseng-cheng District (增城縣) and its subsoil is of gravelly loam to sandy loam. The coarse sandy soil is observed at Lung-kang (龍岡) in the north western part near Chung-lo-tan (鐘落潭) and its subsoil is sandy loam. The fine sandy loam is observed at Chin-tang-chuang (錦棠庄) and its subsoil varies from fine sandy loam to sandy clay. The medium sandy soil is discovered at Han-tang-vei (漢塘尾) near Sieh-tsun (謝村) in the southern part of the district, and its subsoil varies from sandy loam to medium sandy soil. The characteristics of these five types are more or less similar to that of sandy loam, with the exception of the fine sandy loam, the content of sand and gravel is higher than in the sandy loam and its water holding capacity is lower. The fertility in general is not as good as that of sandy loam. But the fertility of the fine sand yloam is about the same as the sandy loam and is utilized mostly for the growing of lichee, plums, etc.

The mechanical nanlyses of these soils show that the silt and clay also have some degree of translocation from the surface stratum to the lower stratum but it seems that the degree has not gone as far as that in the Canton series. In some case the concentration of fine materials in the subsoil is not obvious. This may be due to the further translocation to the stratum below and ought to be investigated in the future.

The chemical analyses of these soils show that they are very poor in nitrogen and phosphorus and fair in potassium and organic matter content. At present, the soils cultivated are mostly sandy loam and fine Sandy loam derived from the weathering of fluidal granites. The crops grown are mostly native olive, sweet bamboo, and lichee. The fertilizers used generally are human and cattle manure. Besides the above, such plants as native pine, eucalyptus, broad beans, and pineapple are probably suitable for

this series of soils, but attention should be called to the prevention of surface erosion.

Table 3A. Mechanical analyses of Lokang sandy loam, gravelly loam, coarse sandy soil, fine sandy loam, and medium sandy soil.

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	silt %	Clay %
P. 101 A	Sandy loam	5.63	2.84	11.33	16.45	17.60	9.15	20.15	16.20
P.101B	Sandy loam	6.60	2.36	10.35	15.70	16.88	7.08	18.50	23.30
P.101C	Sandy loam	3.66	4.24	11.33	15.08	15.30	7.15	16.15	26.40
P.1501 surface	Sandy loam	12.92	9.31	11.45	10.20	10.66	5.95	26.00	13.40
P.1501 subsurface	Gravelly loam	17.88	8.95	9.05	7.14	8.23	6.33	25.40	15.85
P.1501 subsoil	Sandy loam	10.25	12.05	10.12	7.47	7.85	5.82	29.97	16.90
P.103A	Sandy loam	24.82	10.50	13.01	12.21	11.49	5.34	15.39	7.24
P.103B	Gravelly loam	27.20	14.02	12.45	10.20	10.20	5.15	13.40	7.10
P.103C	Gravelly loam	38.12	5.95	7.15	10.45	12.53	9.10	16.55	9.18

P. 111A	Gravelly loam	15.60	9.60	5.80	3.71	10.73	8.45	21.00	26.60
P. 111B	Sandy loam	7.10	4.88	5.32	4.45	18.75	11.30	20.36	27.90
P. 111C	Gravelly loam	33.80	21.00	15.20	5.10	8.78	5.30	5.78	6.00
P. 110A	Coarse sandy soil	4.26	24.68	18.71	7.63	16-00	13.90	11.50	3.76
P. 110B	Sandy loam	16.70	1.82	1.91	1.26	5.32	13.10	23.80	37.00
P. 110C	Sandy loam	31.80	16.01	6.95	4.80	9.88	14.30	9.10	14.00
P. 112A	Fine sandy loam	2.81	1.85	3.99	2.83	18.80	18.50	27.40	23.90
P. 112B	Fine sandy loam	1.12	1.77	2.56	2.75	25.00	15.60	18.65	33.15
P. 112C	Sandy Clay	1.23	.80	1.26	2.35	23.50	12.32	15.50	43.70
P. 104A	Medium sandy soil	11.60	3.44	6.75	19.05	28.50	12.51	12.30	4.34
P. 104B	Sandy load	11.50	2.19	6.85	2.09	26.80	10.35	14.20	6.78
P. 104C	Coarse sandy soil	14.38	3.18	7.88	19.61	23.11	9.85	9.90	10.20

Note—In this table, No. P.1501 is a general representative sample, while the others are soil profile samples. P.101 is taken at Ma-chi-ling(孖髻嶺), horizon A O—20 cm., horizon B 20—50 cm., and horizon C 50—100 cm. P.103 is taken at Peng-kang (崩崗),horizon A O-20 cm., horizon B 20—50 cm., and horizon C 50—100 cm. P. 104 is taken at Han-tang-vei (漢塘尾), horizon A O - 20 cm., horizon B 20—50 cm., and horizon C 50-100 cm., P111 is taken at Lung-kang (龍崗), horizon A O—20 cm., horizon B 20—50 cm., and horizon C 50—100 cm. P. 111 is taken at Waikan-chuang (桅杆庄), horizon A O—20 cm., horizon B 20—80 cm., and horizon C 80—150 cm. P. 112 is taken at Chin-tang-chuang (錦塘庄), horizon A O—20 cm.. horizon B 20—80 cm., and horizon C 80—150 cm.

Table 3B. Chemical analyses of Lokang sandy loam

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement, kilograms per are
P. 101A	.09	.011	.78	2.55	Medium	41.65
P. 101B	.09	.007	.74	1.33		
P. 101C	.09	.014	.70	.87		
P. 1501 surface	.06	.037	.93	1.11	Medium	39.38
P. 1501 subsurface	.03	.013	.92	.68		
P. 1501 subsoil	.02	.037	1,14	.42		

(9) Chungtsun sanhy loam and (10) gravelly loam—This series of soils is derived from the weathering of rocks of Shuikou formation (水口系). When the soil is better or more thoroughly weathered, it forms sandy loam' if not so thorough, gravelly loam. Even in the sandy loam, the surface soil still retains a certain amount of gravel. The sandy loam is mostly distributed in the southern and western part of the district and the gravelly loam in the central portion. The color of these soils is yellowish white. In some places there is an outcrop of rocks and stony land. The surface soil has a somewhat granular structure while the subsoil is compact. The subsoil of sandy loam varies from sandy loam to gravelly loam, loam or clay loam; while that of gravelly loam is the same as its surface soil. The fertility is poor and the surface generally has a steep slope. Only thin covering of weeds is present and practically

none of such land is utilized for agricultural and forestry purposes. Under these conditions, the drainage is good, but surface run-off is rather excessive.

The chemical analyses of these soils show that their nitrogen and phosphorus contents are exceedingly low and potasssum content varies greatly, from .11% to 1.52%. The organic matter content is also low. The acidity is from weak to medium and the lime requirement is from 35-65 kilograms per are. In the sandy loam area, if the surface is not steep, it may he utilized for growing bamboo and pineapple; but proper amount of nitrogen, phosphorus, and organic matter fertilizers should be added to restore and maintain the fertility. In areas where the surface slope is steep or in gravelly loam soil, the land may be used only for growing of native pine or for grazing.

Table 4A Mechanical analyses of Chungtsun sandy loam and gravelly loam,

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay %
P. 204A	Sandy loam	12.40	2.27	8.21	8.25	25.10	19.10	16.00	9.35
P. 204B	Sandy loam	6.35	2.57	9.40	8.35	22.13	20.45	17.30	14.10
P. 204C	Sandy clay	6.30	1.46	4.60	5.20	14.02	23.50	18.90	31.40
P. 2002 surface	Sandy loam	25.70	5.10	5.05	8.65	14.90	8.15	21.09	9.80
P. 2002 subsurface & Subsoil	Sandy loam	22.10	6.10	7.70	11.40	12.90	5.70	13.55	18.74
P. 202A	Gravelly loam	1.10	12.75	14.40	12.70	11.85	3.68	20.40	12.01
P. 202B	Gravelly loam	34.00	5.84	12.24	8.96	8.00	1.84	17.80	11.30
P. 202C	Gravelly loam	26.95	8.60	11.30	8.70	6.98	1.88	19.00	15.70
P. 2001 Surface	Gravelly loam	18.30	8.60	5.75	4.06	5.29	4.58	25.43	27.90
P. 2001 subsurface & subsoil	Gravelly loam	16.95	8.60	6.38	4.72	6.78	5.43	31.20	19.50

Table 4B Chemical analyses of Chungtsun sandy loam and gravelly loam,

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement, kilograms per are
P. 209A	0.11	.018	.69	1.00	weak	26.25
P. 209B	0.06	.022	.76	.61		26.13
P. 209C	0.01	.016	1.07	.46		28.13
P. 2002 surface	0.06	.020	.66	.46	weak	
P. 2002 subsurface and subsoil	0.07	.018	.79	.38		
P. 202A	.02	.005	.17	.16	weak	35.00
P. 202B	.02	.005	.26	.14		
P. 202C	.02	.012	.29	.86		
P. 2001 Surface	.01	.046	1.35	.41	medium	63.00
P. 2001 subsurface and subsoil	.01	.043	1.52	.33		

Note—In the above tables, P.2002 and P.2001 are general representative samples, while P.202 and P.209 are soil profile samples. P.202 is taken at the College Farm of Sun Yatsen University, horizon A 0–15 cm., horizon B 15–40 cm., and horizon C 40–100 cm. P, 209 is taken at north of Chungtsun near Li-tsun (禮村), horizon A 0–20 cm., horizon B 20–80 cm., and horizon C. 80–150 cm.

(11) Shiuping fine sandy loam and (12) clay loam—This series of soils is formed from weathering of rocks of Shiuping

formation and is distributed in the central and western part of the district. They occupy a comparatively smali area. The clay loam is distributed in the west, while the fine sandy loam in the central portion of the district.

The color of soils varies from dark purple to black brown-when wet and turns to brownish red when dried. In few spots, it acquires a black color, but the area is very small. The weathering is generally thorough. The surface soil has little granular structure while the subsoil is lumpy, heavy, and impervious. The subsoil of clay loam is the same as its surface soil in texture. while the subsoil of fine sandy loam is from fine sandy loam to clay loam. But the drainage is good on account of the hilly nature of the land. The fine sandy loam soil usually has asteep slope. Itsdrainage is good, and it has a good water holding capacity.

Mechanical analyses of these soils show that they have a fine texture, so their water holding capacity is high. They are adaptable to reforestration and some fruit growing. But they are not suitable for general farming on account of steep land surface and high elevation. Chemical analyses of these soils show that their potassium and organic matter contents are fair, but their nitrogen and phosphorus contents are rather deficient. If utilized for fruit growing, these soils should be properly fertilized with nitrogen, phosphorus, and organic matter. The soil acidity is only medium, lime application for fruit growing is not necessary.

Table 5A. Mechanical analyses of Shiuping fine sandy loam and clay loam.

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Fine silt %	Clay %
P. 302A	Fine sandy loam	0	3.89	5.38	3.56	18.05	19.00	29.00	21.90
P. 302B	Fine sandy loam	0	3.67	2.92	1.88	10.20	29.60	31.80	20.50
P. 302C	Clay loam	0	6.90	5.55	2.31	6-20	12.90	41.00	25.20
P. 304A	Clay loam	0	2.54	6.45	2.60	9.10	14.50	31.80	33.60
P. 304B	Clay loam	0	4.70	4.90	1.43	4.23	11.68	33.70	39.40
P. 304C	Clay loam	0	9.60	7.80	2.50	8.10	15.00	30.40	26.60

Table 5B. Chemical analyses of Shiuping fine sandy loam and clay loam.

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement, kilograms per are
P. 302A	.10	.024	1.39	0.87	Medium	33.75
P. 302B	.09	.027	1.38	0.45		
P. 302C	.04	.051	1.88	0.21		
P. 304A	.09	.015	1.09	1.01	Medium	43.68
P. 304B	.06	.012	1.09	0.40		
P. 304C	.06	.022	0.65	0.81		

Note—In this table, both P. 302 are soil profile samples. P- 302 is taken at Pe-tsu-ling (百足嶺) in the central part of the district. The depth of horizon A is 0-20 cm. horizon B 20-80 cm., and horizon C 80-150 cm. P. 304 is taken at Wang-kang (望岡). The depth of horizon A is 0-50 cm, horizon B 50-100 cm., and horizon C 100-150 cm.

(3) Chukiang loam-This soil is one of the important types of the Chukiang series, and is distributed throughout the western, central, and southern parts of the district, reaching particularly extensively development in the central portion, The thinkness of this alluvium varies from a few centimeters to several meters, but generally within two meters The

subsurface and subsoil varies from sandy loam to loam or clay in texture, but loamy subsoil is more common than the others, At Lung-shui-poa (龍水埗) near Chu-tsun (珠村), the subsoil is of clay in texture and the lichee and orange do not grow so well as those in Lieh-te (獵德), In some spots these fruit trees cannot grow at all owning perhaps to the impermeability of the subsoil, But underneath this clay subsoil there is generally discovered a layer of sandy soil,

The surface loam soil is generally of dark gray color, and the subsoil is usually about the same or lighter. Since this is a recently formed soil, the profile is not well developed, Below one meter in depth, some brownish white spots, due to the admixture of the original residual soil of the bottom rocks, are often found,

The structure of this soil is mostly granular and has a good tilth. With the exception of those underlined with clay usbsoil, the drainage is generally not too bad. Since the topography of the land is low and flat and the water table generally comes within one or two meters of the surface, the natural draingage cannot be considered as good. This soil mostly utilized for rice culture for which it is highly suitable. Besides, it is utilized somewhat for truck and vegetable gardening.

The chemical analyses show that the plant nutritive constituents of this soil are fairly good. If properly supplied with nitrogen and phosphorus and better managed in regard to irrigation water, this may become the best soil of this series.

Table 6A Mechanical analyses of Chukiang loam.

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay %
P. 3502 surface	loam	1.78	2.13	3.48	6.09	13.55	12.20	45.55	13.25
P. 3502 subsurface	loam	2.40	2.38	3.80	6.22	13.00	11.50	44.80	15.90
P. 3520 subsoil	loam	2.23	2.25	4.30	6.33	14.05	8.58	41.20	21.00
P. 3505 surface	loam	2.43	3.48	5.30	7.75	18.10	12.22	33.43	17.40
P. 3505 subsurface-and subsoil	Clay	0.00	1.04	1.32	1.45	3.20	10.68	40.00	41.50

Table 6B. Chemical analyses of Chukiang loam.

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acitdity	Lime requirement, kilograms per are
P. 3502 surface	.11	.060	1.57	1.20	very weak	16.66
P. 3502 subsurface	.09	.060	1.49	1.02		
P. 3502 subsoil	.04	.036	1.60	1.11		
P. 3505 surface	.10	.032	1.84	2.49	medium	43.80
P. 3505 subsurface and subsoil	.05	.030	1.25			

(14) Chukiang silt loam and (15) clay loam - These two types of soils occur in the southern part of the district, occupying a large area. It is low and flat and the drainage is poor, However, it is improved by leveed drainage, so that it can be utilized profitably for the growing of rice, sugar cane, and even citrous fruits, The soil is also dark gray in color similar to the loam described above, but the silt and clay contents are high and the soil is easily puddhed on account of the lack of granular structure. This condition makes the soil suitable for water culture of rice, The extreme southern portion was periodically inundated by salt tide, but is now productive through the protection of dykes and levees, The physical properties of these two types of soils are very similar to each other except that the clay content in the clay loam is higher. The subsoil of the silt loam varies from silt loam to sandy loam or clay loam, but is mostly of silt loam, The subsoil of clay loam is of silt loam in texture. The alluvium of this

section is generally deeper than that in the central part and often exceeds one meter. The soil is still new and the soil profile has not yet fully developed,

The chemical analyses of these soils show that they contain a fairly good amount of nitrogen, phosphorus, potassium, and organic matter, and the acidity varies from weak to strong, These soils are mostly utilized for rice culture, They should be properly managed with constant supply of proper amount of nitrogen, phosphorus, and organic matter in order to maintain their permanent productivity- It is not wise to depend upon the fettilizing elements contained in the irrigation water alone- As the lime requirement varies greatly. the application of lime has a direct effect upon farmer's economy. It is necessary to make careful investigations on the problem of liming in this area in the near future.

Table 7A; Mechanical analyses of Chukiang silt loam and clay loam

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay %
P. 3507 surface	Silt loam	.42	4.60	4.17	3.30	3.44	8.85	55.05	20.20
P. 3507 subsurface	Silt loam	5.35	2.82	3.12	2.52	3.18	10.40	52.90	19.50
P. 3507 subsoil	Sandy loam	1.34	4.95	16.70	13.64	8.80	13.10	31.50	9.95
P.3508 surface	Silt loam	.05	.72	2.26	1.45	7.15	10.90	54.01	22.95
P. 3508 subsurface and subsoil	Silt loam	.54	.50	1.01	2.36	7.30	9.75	56.65	21.85
P.3519 surface	Clay loam	.00	.34	.95	.41	2.58	10.70	54.40	31.40
P. 3519 subsurface and subsoil	Silt loam	.00	.09	.39	.35	2.97	10.20	59.00	26.90

Table 7B. Chemical analyses of Chukiang silt loam and clay loam

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement, Kgs. per are
P. 3507 surface	.20	.039	1.18	0.78	weak	22.50
P. 3507 subsurface	.15	.036	1.48	0.36		
P. 3507 subsoil	.12	.022	1.06	0.13		
P. 3508 surface	.10	.054	1.45	2.42	very weak	12.31
P. 3508 subsurface and subsoil	.11	.053	1.58	2.48		
P. 3519 surface	.16	.069	2.44	2.89	strong	42.50
P. 3519 subsurface and subsoil	.12	.067	2.43	2.23		

(16) Chukiang sandy loam, (17) fine sandy loam, and (18) gravelly loam:— The sandy loam is discovered along the river and streams in the central, western and northern parts of the district, and its subsoil varies from sandy loam to fine sand, medium sand or coarse sand. The depth of the subsoil varies to a great extent. This type of soil is also mostly utilized for water rice growing or vegetable gardening. In areas with sandy loam subsoil, the fertility is comparatively better, perhaps due to low degree of leaching.

The fine sandy loam occurs along the lower part of the Liu-chi and Huang-tung Streams. Its subsoil varies from

fine sandy loam to sandy loam or clay loam, The fertility of this type of soil seems to be better than that of sandy loam. The reason for this may be attributed to its finer sand ingredient and its better subsoil. It is generally used for rice growing.

The gravelly loam is found near Cheng-chia-tung-sheh (程界東社) east of Shihpai, The area is very small, and its depth is not great. The gravel ingredients probably come from the neighboring hills of red bed formations. Its subsoil is also of gravelly loam in nature. It is utilized for rice growing and vegetable gardening.

The color of these three types of soils is of dark gray when wet, turning to gray upon drying, but in some places the color is darker owing to heavy application of organic fertilizers. These three types of soils, as a whole, contains a large amount of sand, having a granular structure and are easily cultivated. Although they are sandy in nature, the drainage is not good, because the topography of the land is flat and low. In fertility the three types are nearly identical and is inferior to that of the loam soil of this series.

The chemical analyses of these soils show that their organic matter and potassium contents occur in fair amount, but nitrogen and phosphorus contents are low. Application of available nitrogen and phosphorus fertilizers are comparatively important for these soils, while organic matter should be supplied from time to time in order to keep up a constant supply. Liming should be done according to actual needs of the crop condition.

Table 8A. Mechanical analyses of Chukiang sandy loam, fine sandy loam, and gravelly loam.

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay
P. 513 surface	Sandy loam	5.50	6.75	9.94	4.70	10.78	8.57	27.70	26.43
P. 513 subsurface and subsoil	Gravelly loam	13.75	17.60	23.70	7.65	9.70	5.93	10.70	9.20
P. 3522 surface	Fine sandy loam	.92	.83	2.55	4.80	24.20	19.80	32.30	14.50
P. 3522 subsurface	Fine sandy loam	1.41	2.27	3.39	2.87	28.60	15.20	29.50	11.95
P. 3522 subsoil	Sandy loam	9.60	2.95	7.65	2.77	18.65	8.44	34.58	15.70
P. 3501 surface	Gravelly loam	31.00	3.13	5.22	6.07	9.61	9.02	24.30	11.60
P. 3501 subsurface	Gravelly loam	30.30	1.77	2.97	4.72	7.52	7.35	27.70	17.60
P. 3501 subsoil	Gravelly loam	32.30	1.94	2.94	4.38	11.25	9.25	22.45	15.35

Table 8B. Chemical analyses of Chukiang sandy loam and fine sandy loam:

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement kilograms per are
P. 513 surface	.12	.033	0.86	2.55	medium	33.68
P. 513 subsurface and subsoil	.05	.009	0.57	1.14		
P. 3522 surf ace	.10	.029	2.84	4.32	weak	22.50
P. 3522 fubsurface	.06	.028	2.81	1.47		
P. 3522 subsoil	.05	.012	2.48	0.32		

(19) Chukiang coarse sandy soil and (20) medium sandy soil:- These two types of soils occupy comparatively small areas. The coarse sandy soil occurs along the lower part of Liu-chi Stream near Kao-tang (高塘). Its subsoil varies from coarse sandy soil to medium sandy soil. It is of grayish white color and has a low water holding capacity. The fertility is low and is condsidered to be a poor soil; but being near the stream, water is easily obtained and the land can be utilized for rice growing or vegetable gardening. Although the yield is not high, it has the advantage of easy cultivation on account of its sandy nature.

The medium sandy soil occurs at Chung-pien village (涌邊鄉). near the foot of Tsing-lo-chang (青羅嶂), north of Sha-wan (沙灣). The soil is of gray color and its subsoil is of loam in texture. Its fertility excells that of coarse sandy soil but is inferior to thaht of sandy loam of the same series. The

irrigation facility is good and the soil is utilized for rice crops. Although these two types of soils are sandy in nature, the drainage condition is not good because of their low situation.

The chemical analyses of these soils show that they contain a fairly good amount of potassium, and phosphorus, but their nitrogen and organic matter contents are poor. In fertilization, attention should be paid to these facts. Acidity of those soils is not high, so liming is not so vital.

Table 9A. Mechanical analyses of Chukiang coarse sandy soil and medium sandy soil.

Sample	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand	Fine sand	Very fine sand	Silt	Clay
P. 515 surface	Coarse sandy soil	5.44	5.80	9.62	9.00	33.80	16.40	12.00	7.33
P. 515 subsurface	Medium sandy soil	7.66	6.08	8.23	9.56	35.66	12.75	12.20	7.75
P. 515 subsoil	Coarse sandy soil	6.50	8.97	9.69	8.70	31.00	16.45	10.10	8.66
P. 503 surface	Medium sandy soil	0.00	4.85	14.96	15.50	36.80	9.90	12.30	5.60
P. 503 subsurface	Loam	8.45	3.05	6.50	5.75	13.20	9.15	41.80	12.05
P. 503 subsoil	Loam	.77	3.10	7.40	5.29	10,10	7.50	49.50	17.20

Table 9B. Chemical analyses of Chukiang coarse sandy soil.

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement, kilograms qer are
P.515 surface	.05	.045	2.65	.71	very weak	4.50
P.515 subsurface	.04	.018	2.81	.36		
P. 515 subsoil	.15	.017	2.77	.27		

(21) Kiangtsun sandy loam, (22) fine sandy loam, (23) clay loam, ad (24) loam; - This series of soils is distributed in the northwestern part of the district forming a great plain, and may be discriminated into four types, namely: sandy loam, fine sandy loam, clay loam, and loam. This alluvium varies in depth from a few centimeters to one meter. The nature of the bottom rocks waries considerably; some belong to Shuikou or Shiuping formations while others are igneous rocks. The land is comparatively flat. The elevation is higher than that of Chukiang series. Drainage condition is good with the exception of the clay loam area.

The sandy loam soil is of dark gray color when wet, gray when dry. In the eastern portion of the plain, the sandy loam soil usually has a subsoil of the same texture, while in the west, the subsoil varies from clay loam to clay. The color of the subsoil is similar to that of the surface layer, but it is often intermixed with yellowish white or reddish white, owning to contact with the bottom rock stratum. Due to the sandy loam nature of the

subsoil, the soil in the eastern portion of the plain has a low water holding capacity and often suffers from drought during autumn or winter dry season. For this reason, some rice fields are used for other crops in the second half of the year. In the western portion the soil is underlined with clay loam or clay and the underedrained water is held in the substratum. Therefore numerous wells are dug in the area for irrigation. When passing through this area, one may be surprised by the large number of masts and levers for handling water from wells. This soil is characterized by a richly granular structure and is susceptable to easy cultivation. The fertility is fair. The most urgent need of this area is a better irrigation system. This soil is principally utilized for rice, peaeut, and forage crops.

The fine sandy loam occupies the central part of the Kiang-tsun plain. The color of the surface soil ranges from dark gray to black, but in some places gray is dominant. This variation is perhaps due to the application of fertilizers. Upon drying, the soil changes to dark gray or gray. Its subsoil varies from fine sandy loam to clay loam and has a fairly good water holding capacity, in so much that well irrigation is extensively practised throughout this area. The surface soil is granular in structure and is easily handled in cultivation. The fertility seems better than that of sandy loam, and the land is mostly utilized for rice, peanut, and sweet potato growing.

The clay loam occurs in the northern part of the plain. The color of this soil is similar to that of the fine sandy loam. Its subsoil is of clay loam in texture and the natural drainage is poor. It is lacking in granular structure and should be carefully handled in cultivation. It is well adapted to and is utilized profitably for rice culture. Its fertility is better than that of fine sandy loam.

The loam soil occupies the north-eastern part of the plain. The color and structure of this type of soil are similar to that of the fine sandy loam. Its subsoil is also loam in texture. Being fairly fertile. it is devoted to rice growing.

A comparison of the results of the chemical analyses of these soils shows that the contents of the different constituents do not vary to a great extent. As a whole these four types of soils contain a fair amount of organic matter and potassiun, but nitrogen and phosphorus are deficient. Application of nitrogen and phosphorus fertilizers should be considered of primary importance. Soil acidity varies from weak to medium and the lime requirement is not great.

Table 10A. Mechanical analyses of Kiangtsun sandy loam, fine sandy loam, clay loam, and loam.

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay %
P. 4030 surface	Sandy loam	3.33	6.66	12.10	6.15	23.40	14.60	20.40	13.05
P. 4030 subsurface	Sandy loam	2.77	5.20	9.90	5.05	21.80	18.60	18.80	17.60
P. 4030 subsoil	Sandy loam	4.04	4.20	9.35	7.02	18.30	15.25	20.10	20.60
P. 4034 surface	Sandy loam	6.10	9.55	15.20	5.20	12.42	19.00	21.00	10.77
P. 4034 subsurface	Sandy loam	5.95	4.95	7.80	3.03	12.05	22.60	24.30	18.90
P. 4034 subsoil	Clay	2.02	3.56	4.85	1.23	7.57	15.40	24.30	40.50

P. 4035 surface	Fine snady loam	4.25	3.81	7.25	2.98	12.00	21.10	24.82	23.60
P. 4035 subsurface	Fine sandy loam	5.78	3.60	5.40	2.74	9.56	21.56	28.70	21.40
P. 4035 subsoil	Clay loam	2.52	1.92	2.83	1.57	6.05	5.08	50.90	28.60
P. 4037 surface	Clay loam	2.80	2.80	4.00	3.05	11.20	13.60	39.56	23.00
P. 4037 subsurface	Clay loam	3.60	3.90	4.25	3.00	5.95	10.23	32.77	36.50
P. 4037 subsoil	Clay loam	3.84	4.40	5.88	2.32	6.47	10.65	32.40	34.10
P. 4032 surface	Loam	2.30	2.40	5.75	2.45	9.45	18.00	39.20	20.00
P. 4032 subsurface & subsoil	Loam	1.92	2.02	4.73	2.66	8.20	19.90	39.60	20.80

Table 10B. Chemical analyses of Kiangtsun sandy loam, fine sandy loam clay loam, and loam.

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement, kilograms per are
P. 40 30 surface	.23	.019	1.39	3.60	Medium	37.90
P. 4030 subsurface	.26	.013	1.21	0.82		
P. 4030 sudsoil	.21	.016	1.37	1.08		
P. 4034 surface	.10	.021	0.44	1.50	weak	22.50
P. 4034 subsurface	.03	.015	0.53	0.66		
P. 4034 subsoil	.04	.011	0.96	0.16		
P.4035 surface	.12	.031	0.83	1.85	weak	7.60
P. 4035 subsurface	.05	.021	0.70	0.78		
P. 4035 subsoil	.04	.009	0.94	0.09		
P. 4037 surface	.14	.034	0.96	1.56	weak	7.50
P. 4037 subsurface	.09	.031	1.06	1.24		
P. 4037 subsoil	.06	.026	0.96	1.20		

P. 4032 surface	.09	.016	1.61	2.07	weak	21,30
P. 4032 subsur-face & subsoil	.08	.030	1.53	1.35		

(25) Shihpai fine sandy loam: - This type of soil occurs in the east and the west of Canton, as well as in the central and southern parts of the district. It is a valley bottom soil, formed from materials washed down from neighboring hills or uplands. The land is generally flat. The depth of this alluvium is less than that of the Chukiang series, varying from a few centimeters to one meter. Below half a meter in depth, bottom rock soil generally appears. This is easily distinguished by differences in color and structure. The soil color varies from grayish yellow to dark red, and becomes lighter when dry. Its subsoil varies from fine sandy loam to loam or sandy loam, and is generally of reddish yellow or reddish white color, The soil color is largely affected by cultivation and application of organic fertilizers. The structure of this soil is regarded as being good, and a granular texture can be easily induced, The land is generally of higher elevation than that of Chukiang loam near by, consequently the drainage condition is better. The water table generally lies below two meters. However, in respect to fertility, this type of soil is inferior to that of Chukiang loam. Farms in this region are devoted mostly to the culture of rice, sweet bamboo (for edible bamboo shoots), and vegetables.

The chemicals analyses of this soil show that its phosphorus and potassium contents are fair while its nitrogen and organic matter contents are rather low. The soil acidity is not high In managing this soil, enough nitrogen and organic fetilizer should be supplied to make up the deflciency, while the additon of

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Eine sand %	Very fine sand %	Silt %	Clay %
P. 601 surface	Fine sandy loam	11.30	1.94	3.58	5.98	14.20	25.00	30.80	8.20
P. 601 subsurface	Fine sandy loam	1.41	3.90	3.70	6.00	15.41	25.20	35.35	9.25
P. 601 subsoil	Fine sandy loam	2.10	0.21	3.03	12.20	15.60	16.90	33.20	16.00
P. 602 surface	Fine sandy loam	2.66	4.17	3.48	3.50	14.82	17.10	34.30	9.55

P. 602 subsurface	Fine sandy loam	3.81	7.84	11.85	14.60	16.30	5.72	33.30	6.62
P. 602 subsoil	Loam	6.60	1.72	2.92	8.66	17.20	3.88	38.60	19.40
P. 4001 surface	Fine sandy loam	3.81	2.41	4.95	17.58	25.30	28.80	32.80	6.05
P. 4001 subsurface	Fine sandy loam	3.05	2.83	5.28	7.90	13.90	28.10	32.30	6.70
P. 4001 subsoil	Fine sandy loam	3.84	2.84	2.94	6.75	14.70	27.20	29.30	9.75

phosphorus and potassium fertilizers is secondary. Application of lime in not very necessary for ordinary crops.

Table 11A. Mechanical analyses of Shehpai fine sandy loam

Table 11B. Chemical analyses of Shakpie fine sandy loam:

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime Requirement, Kgs per are
P. 601 surface	.085	.032	0.43	.68	weak	17.50
P. 601 subsurface	.081	.038	0.53	.43		
P. 601 subsoil	.034	.040	1.59	.27		
P. 4001 surface	.125	.048	0.42	.85	weak	33.32
P. 4001 subsurface	.074	.046	0.47	.69		
P. 4001 subsoil	.056	.031	0.44	.54		

(26) Shihpai sandy loam and (27) loam; — The sandy loam occurs near Nam-tsun (南村) in the central part of the district. It is dark gray in color and its subsoil is grayish sandy loam. In some places the color of the subsoil is reddish white due to the contact of soils of the bottom rocks. The structure is highly granulated, and it is essily cultivated. The drainage condition is fair and the soil fertility is about as good as that of the fine sandy loam described above,

The loam soil occurs around Sha-hsu(沙墟), near Shihchio (市橋), It is of dark gray color and its subsoil varies from sandy loam to gravelly loam, Its structure and other characteristics are very similar to those of fine sandy loam of this series, The depth of these two types of alluvium (Shihpai sandy loam and loam) is within one meter,

Table 12. Mechanical analyses of Shihpai sandy loam and loam

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt	Clay
P. 4015 Surface	Sandy loam	4.68	5.56	13.14	6.54	11.52	8.55	36.40	13.10
P. 4015 Subsur face & Subsoil	Sandy loam	5.02	6.45	16.20	7.00	13.40	10.00	30.30	9.85
P. 608 Surface	Loam	0.00	11.73	11.45	6.46	6.40	7.18	37.80	19.00
P. 608 Subsurface	Sandy loam	16.95	16.00	12.81	6.15	5.14	4.34	22.83	15.38
P. 608 Subsoil	Gravelly loam	23.90	25.20	17.21	7.86	3.26	1.46	15.33	6.18

(28) Lungyen-tung sandy loam and (29) coarse sandy soil :- The Lungyen-tung sandy loam occupies a large area. The soil in the valley bottom surrounded by hills or mountains of igneous formations is of this type. This soil is generally distributed throughout the southern, central, and northern parts of the district. The soil color varies from dark gray to grayish brown when wet, turning gray or light brown upon drying. Soil of blackish color is found in Chen-tsun (岑村), Sun Yatsen University Farm, and Black Mud Pass (里仇逕) near Ho-tang-hsia (河棠下) in the north-eastern corner of the district. This area, however, is not extensive. The origin of this black color is probably due to the accumulation of decomposed vegetable matter from the water pine and the like. The subsoil of this sandy loam is mostly of the same texture as the surface soil. The structure of this soil is largely granular and is aminable to cultivation. Its water holding capacity in low and is subject to drought during the dry season. If some measure for reserving water is installed, such as ponds to collect and store the upland surface run-off, irrigation facilities may attain a higher degree of effectiveness and the soil should become suitable for general crops. Although this is a valley bottom soil, the elevation is sufficiently high to bring the water table below two meters and the drainage condition is fairly good. This soil is generally poor in organic matter, as the quartz sand is coarse, and the organic matter decomposes readily. Hance the maintainnace of organic matter becomes an important problem. This soil is generally used for rice and vegetable growing.

The coarse sandy soil occurs along the northern section of Shahuo Motor Highway (沙和公路) in the east of Canton City. The soil color varies from grayish white to grayish yellow and it changes to lighter color when dry. The subsoil is of grayish yellow to reddish yellow on account of the proximity to the bottom rock soils. The subsoil is of sandy loam in texture. This

soil contains a high percentage of coarse sand, mostly quartz sand. Hence the fertility is not as good as that of sandy loam. Fortunately it has a sandy loam subsoil, and can be utilized for rice and vegetable crops profitably.

These two types of alluvial soils vary greatly in depth from a few centimeters to about a meter. The general depth is about half a meter.

The chemical analyses of these two types of soils show that the important constituents do not vary greatly. As a whole, they are rich in potassium; organic matter and phosphorus are fairly plentiful, but nitrogen is rather deficient. These soils should be properly fertilized with nitrogen and phosphorus, and green manure should be turned in once very few years in order to maintain the organic content. The soil acidity is weak, lime requirement is not great.

Table 13A. Mechanical analyses of Lungyen-tung sandy loam and coarse sandy soil

Sample number	Soil class %	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay %
P. 4011 surface	Sandy loam	2.54	5.15	14.15	7.70	18.40	15.40	23.10	13.60
P. 4011 subsurface	Sandy loam	4.20	4.72	11.10	7.15	20.46	16.20	21.02	14.10
P. 4011 subsoil	Sandy loam	2.20	5.43	9.60	4.73	16.32	20.90	24.54	16.20
P. 4017 surface	Sandy loam	3.44	7.94	15.30	11.40	18.10	8.00	19.24	17.10

P. 4017 subsurface	Sandy loam	3.25	7.96	13.36	6.21	11.73	7.41	21.99	27.15
P. 4017 subsoil	Sandy loam	2.31	5.30	11.30	5.65	15.00	8.60	21.50	30.80
P. 4022 surface	Coarse sandy soil	5.14	12.80	33.10	11.80	20.10	6.90	11.85	7.64
P. 4022 subsurface	Sandy loam	3.15	8.40	18.50	10.54	18.80	7.40	16.30	16.50
P. 4022 subsoil	Sandy loam	5.20	7.60	14.50	9.42	19.10	10.30	15.75	17.90

Table 13B. Chemical analyses of Lung-yen-tung sandy loam and coarse sandy soil.

Sample number	Nitrogen %	Phosphorus %	Potassium	Organic matter %	Acidity	Lime requirement, kilograms, per are
P. 4011 surface	.12	.049	1.11	1.72	weak	21.63
P. 4011 subsurface	.07	.042	1.06	0.33		
P. 4011 subsoil	.05	.025	1.21	0.82		
P. 4017 surface	.09	.022	2.40	0.83	weak	18.80
P. 4017 subsurface	.07	.016	2.46	0.86		
P. 4017 subsoil	.06	.016	2.19	0.72		
P. 4022 surface	.09	.022	2.71	0.74	very weak	1.88
P. 4022 subsurface	.08	.021	2.53	1.61		
P. 4022 subsoil	.07	.023	2.58	0.59		

(30) Fuling fine sandy loam: – This soil occurs in Fuling Market (佛嶺市) and its vicinity in the western part of the district. It is dispersed through the valleys as valley bottom soil, and is formed from the eroded debris of the neighboring uplands or hills of the Shiuping formation. The depth of this alluvium does not exceed one meter. The land is rather flat in contour, its elevation being a little higher than that of the

Chukiang alluvium near-by. It is underlaid with a clay loam subsoil and poor in natural drainage. The color of this type of soil varies from grayish brown to dark brown when wet, and changes to paler shades upon drying. The surface soil is somewhat granular in structure but the subsoil is easily puddled. However, cultivation is still not difficult. It has about the same fertility as the Shihpai fine sandy loam. The principal use to which this soil is put is for rice growing, and to some extent for peach orchards as well. The yield of the peach crop is considered fairly good.

The chemical analyses of this soil indicates a defeciency in nitrogen and phosphorus, and the presence of only fair quantities of potassium and organic matter. Application of fertilizers containing niutrogen and phosphorus is essential, while that containing potassium and organic matter also needed. Soil acidity is weak and lime application is of minor importance.

Table 14A. Mechanical analyses of Fuling fine sandy loam.

Sample number	Soil class	Gravel %	Fine gravel %	Coarse sand %	Medium sand %	Fine sand %	Very fine sand %	Silt %	Clay %
P. 2501 surface	Fine sandy loam	0	2.19	5.93	5.52	16.30	19.50	30.80	20.50
P. 2501 subsurface	Fine sandy loam	0	2.76	6.44	2.98	14.32	20.00	31.00	21.50
P. 2501 subsoil	Clay loam	0	2.50	6.23	4.35	13.10	16.60	26.00	30.80

Table 14B. Chemical analyses of Fuling fine sandy loam.

Sample number	Nitrogen %	Phosphorus %	Potassium %	Organic matter %	Acidity	Lime requirement Kgs. per are
P. 2501 surface	.09	.023	.86	1.75	weak	21.00
P. 2501 subsurface	.07	.022	.89	0.73		
P. 2501 subsoil	.07	.016	.93	0.97		

Stony Land: – There are stony lands occuring in the Canton, Lokang, Chungtsun, and Shiuping Series. The soil is frequently mingled up with fragmental stones or boulders of their respective mother rocks. In between the boulders or blocks of stones, soils of different textures occur. In the Canton and Lokang Series, soil is mostly of sandy loam; in the Chungtsun Series, it is mostly gravelly loam; and in the Shiuping Series it is mostly fine sandy loam. Their various characteristics are similar to their corresponding types. This land is utilized to some extent. In the area of the Canton Series, it is used to some degree for growing pine, as for instance, the Long Fish Head Hill (長魚頭嶺) near Mao-kang (芳岡). In Lokang series, stony land is used quite extensively to grow pine, lichee, native olive, and allied trees. This can be readily observed in the Lungyen-tung and Lokang Valleys; but in the area of the Chungtsun and Shiuping Series, stony land is seldom utilized. As a whole, the stony land has a steep slope. When properly managed, such lands can be profitably put to grazing, reforestration, and orchard purposes.

III. GENERAL CONDITIONS OF AGRICULTURAL PRODUCTIONS AND FUTURE PROSPECTS OF AGRICULTURE AND FORESTRY.

(A) General Conditions of Agricultural production :-

The alluvial soils in this district is extensively utilized for agricultural production while the upland and mountainous area are used only to a very limited extent. Although there are some alluvial land still lying idle on account of the problem of water supply or for other reasons, the area is almost neligible as it comprises only a few square kilometers in extent, The upland and mountainous areas are mostly laid idle and bare. It is estimated that about two-thirds of the Canton and Lokang Series, nine-tenths of the Chungtsun Series, and four fifths of the Shiuping Series have not been utilized. The above figures include about two-thirds of the hilly and mountainous area of the district.

About 80 per cent of the alluvial soils is used for rice crops, and about 20 per cent for greens, peas, peans, root crops, fruits, etc. Being the principal source of food, and irrigation being easily practicable in this locality, rice is grown most extensively. The most common fertilizers used are night soil, bean cakes, and cattle manure. In recent years, chemical fertilizers are being used in increasing quantities, especially sulphate of ammonia. In the large area of alluvial soil south of Sha-wan, farmers do not used chsmical fertilizers with profit. This may be due to the heavy nature and the acidity of the soil. This problem deserves a special investigation in the future. The southern portion of the great alluvium of Sha-wan is influenced by the salinity of the irrigated tide water and is capable of only a comparatively low yield. To make this land more productive for rice or other crops is certainly a very important problem for research, as large areas of land in neighboring districts are similar in nature. The alluvial

soil of Sha-wan plain has been proved to be good for sugar cane growing, but sugar cane is not yet extensively grown on account of many reasons,

The upland and mountainous areas are utilized to some extent for pine, bamboo, and fruit growing, They are better and more extensively developed in the north-eastern part of the district, The principal fruits grown are lichee, lungyen, plum, olive, and pinaapple. Orange, lemon, and other fruits are also grown, but not so much as in the low land.

(B) Future prospects in Agirculture abd Forestry:-

Being situated in the southern part of the temperate zone, this area receives an adequate amount of annual precipitation, has plenty of water resources, and a soil, as a whole, quite fertile for agriculture and afforestration. In addition, facilities for transportation and communication are rapidly being developed and improved, so that this district is likely to become an important agricultural and forestry center of the province. The uncultivated land amounting to about one-sixth of the total area of the district may be utilized in the not distant future. With the introduction of improvements along the lines of irrigation, plant breeding, fertilization, and the like, agricultural production is bound to be greatly increased.

Explanation of Plate I

圖(1) 廣州砂質壤土之一般地面情形地勢緩斜造林甚易施工此地爲廣州市政府林場在市東約8公里近年來開始造林

Fig. 1 This shows the general surface feature of the Canton sandy loam with gentle slopping surface easy for affor estation. This is a portion of the Minicipal Forest Station of Canton, about 8 kilometer east of the city.

圖(2) 廣州砂質壤土之垂直切面地面畧有碎礫表土層下粘性重而不易透水幷帶有白色斑點大概爲粘土分中之紅鐵養色被漂去所致其地點與圖(1)相同

Fig. 2 This shows the profile condition of the Canton sandy loam. The surface of the land contains some stone fragments or gravels. The sub-surface and sub-soil are generally clayey and imprevious with some white spots of clay probably due to the result of bleaching off of the red color of iron oxide.

圖 (1) Fig. 1

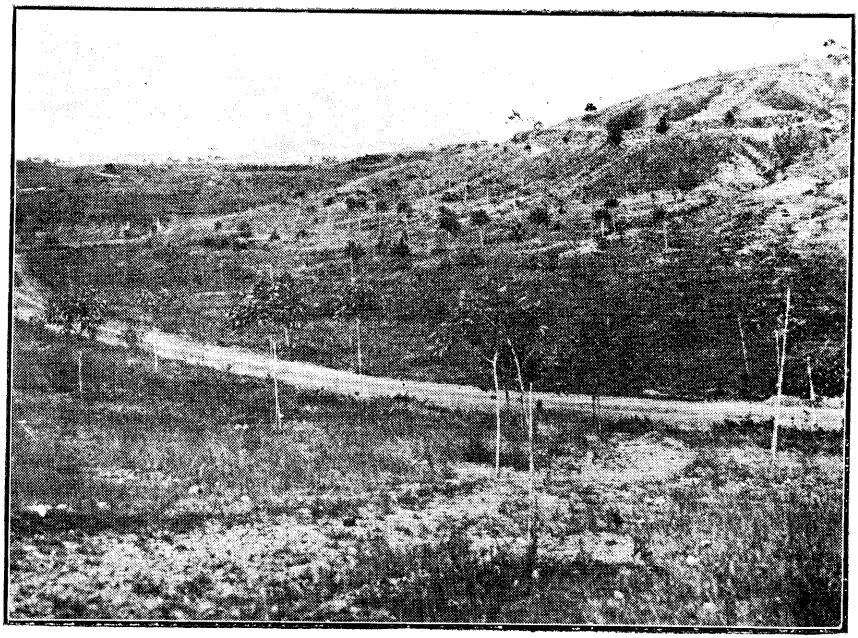
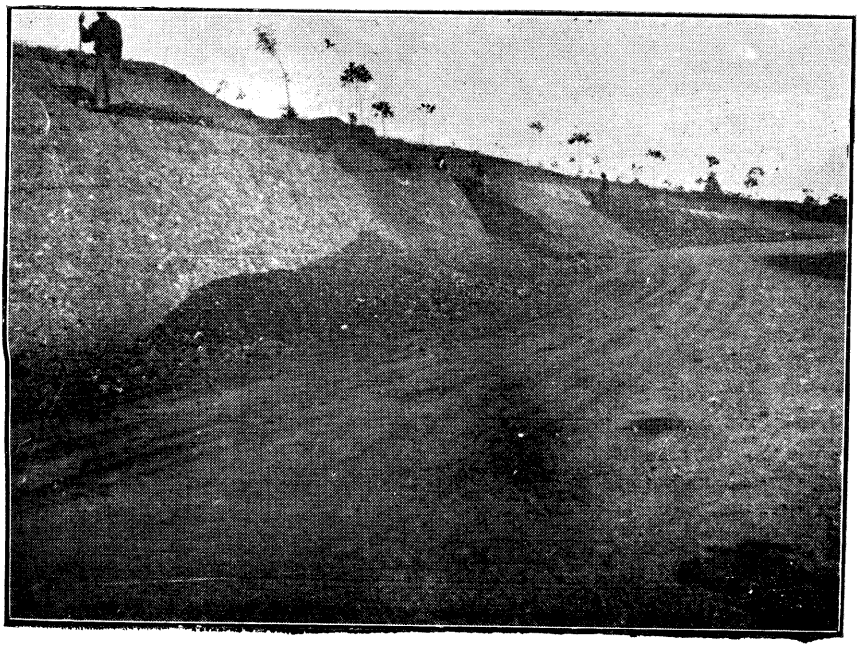


圖 (2) Fig. 2



Explanation of Plate II

圖(3) 羅岡砂質壤土之一般矮岡陵地面情形易於利用以作果園及林地此爲中山大學石牌農場之一部分前數年墾作果園及林地前面爲波蘿次爲荔枝遠處爲有加利林

Fig. 3 This shows the surface feature of low hills of Lokang sandy loam recently utilized for orchard and forest planting. This is a part of the Shih-pai Farm of the College of Agriculture, Sun Yatsen University. There are pine-apple plants in the front, lychee trees in the behind, and eucalyptus forest at a distance.

圖(4) 羅岡砂質壤土之冲刷崩塌情況及近年所造松林此地在沙灣村之東北角

Fig. 4 This shows erosion of Lokang sandy loam north east corner of Shawan and recent afforestation with native pine.

圖 (3) Fig. 3

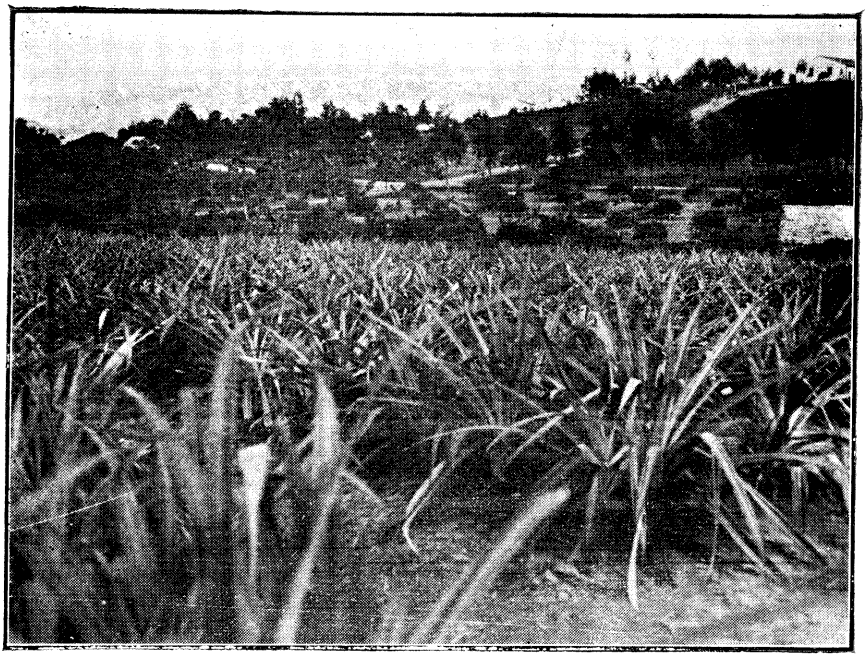
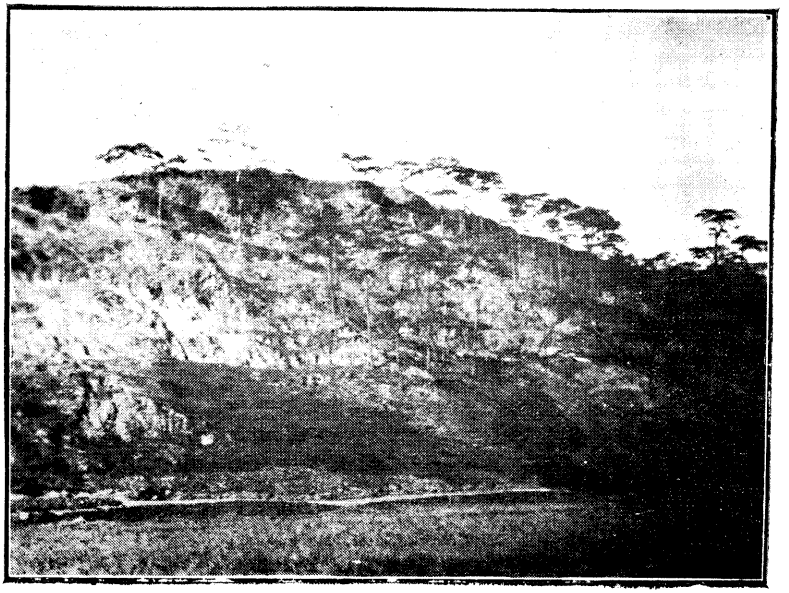


圖 (4) Fig. 4



Explanation of Plate III

圖(5) 此爲珠江冲積之河岸及江中沙洲乃珠江壤土利用以作稻田及於圍田之堤基種荔枝等果木此乃黃埔對岸在廣州市東約13公里

Fig. 5 This shows the river bank and delta deposits of Chukiang or Pearl River. It is a loam soil and utilized for rice culture. The embankment of the field is generally utilized for growing lychee or other fruits. This site is opposite to Huang-pao about 13 kilometers east of Canton.

圖(6) 此亦爲珠江壤土利用以種荔枝橙等果木生長頗茂盛其地點與圖(5)相近

Fig. 6 This is also of Chukiang loam showing the luxurient growth of lychee and other fruits. It is also near Huang-pao

圖 (5) Fig. 5

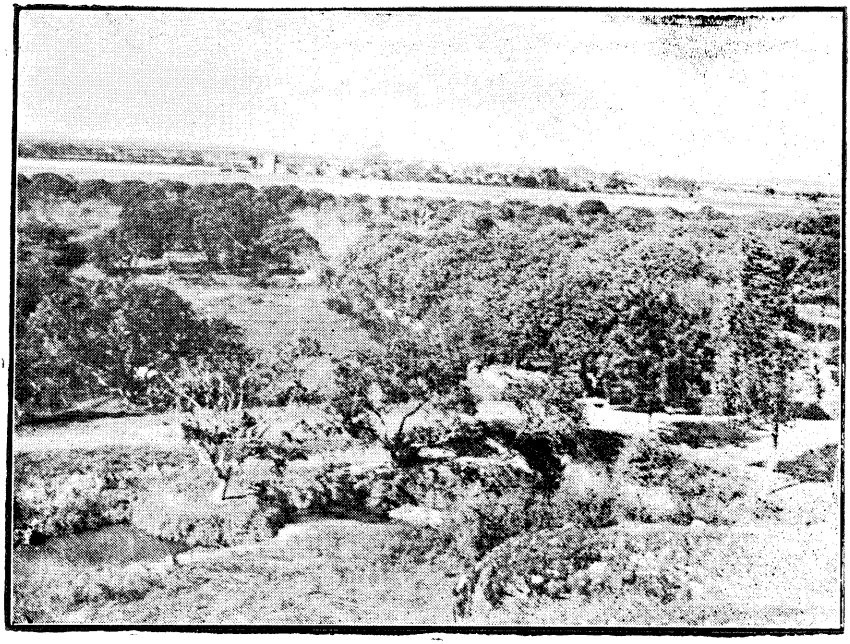
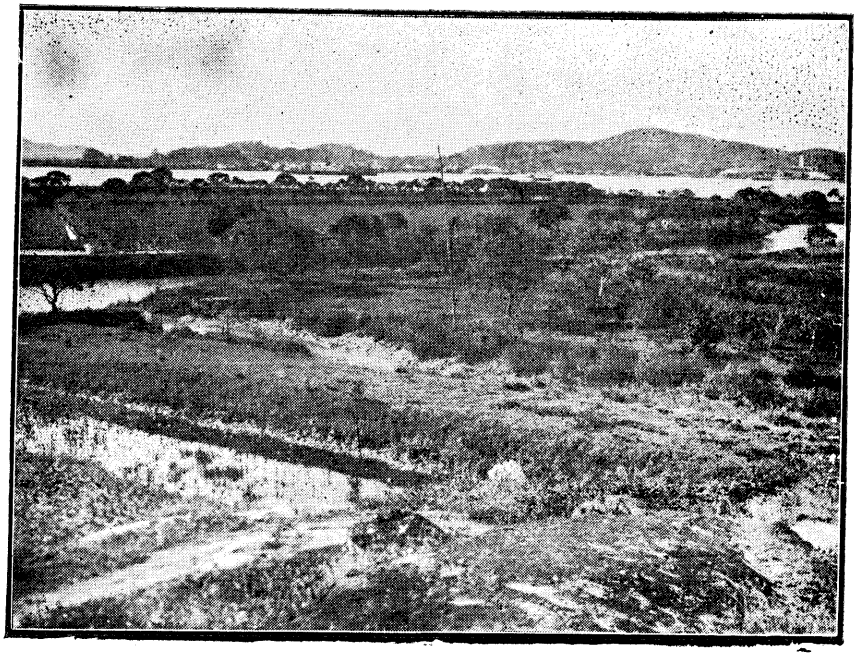


圖 (6) Fig. 6



Explanation of Plate IV

圖(7) 珠江壤土冬期作物種椰菜在廣州石牌村附近

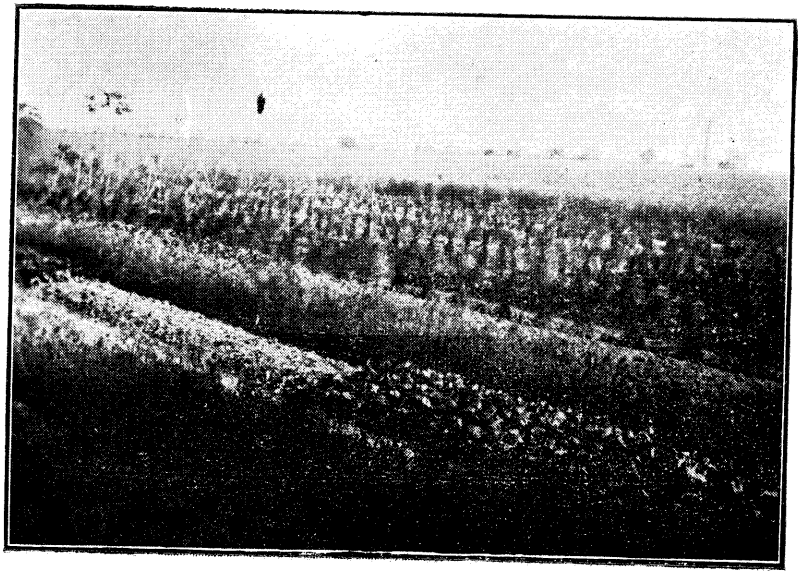
Fig. 7 Cabbage crop in winter after harvesting rice in Chu-Kiang loam near Shih-pai.

圖(8) 珠江壤土及埴質壤土水稻田(沙灣)秋收情況

Fig. 8 Harvesting of second crop of rice at Shawan in the Chukiang loam and silt loam soils.

圖 (7) Fig. 7

圖 (8) Fig. 8



Explanation of Plate VI

圖(9) 江村細砂壤土水稻田秋收後狀況

Fig. 9 Rice field, near Kiang-tsun Station, of Kiangtsun fine sandy loam after harvest in winter.

圖(10) 江村細砂壤土水稻田灌溉井及其吊水桔槔附近江村站

Fig. 10 Irrigation well with hauling lever in the Kiangtsun fine sandy loam rice field, near Kiang-tsun Station.

圖 (9) Fig. 9

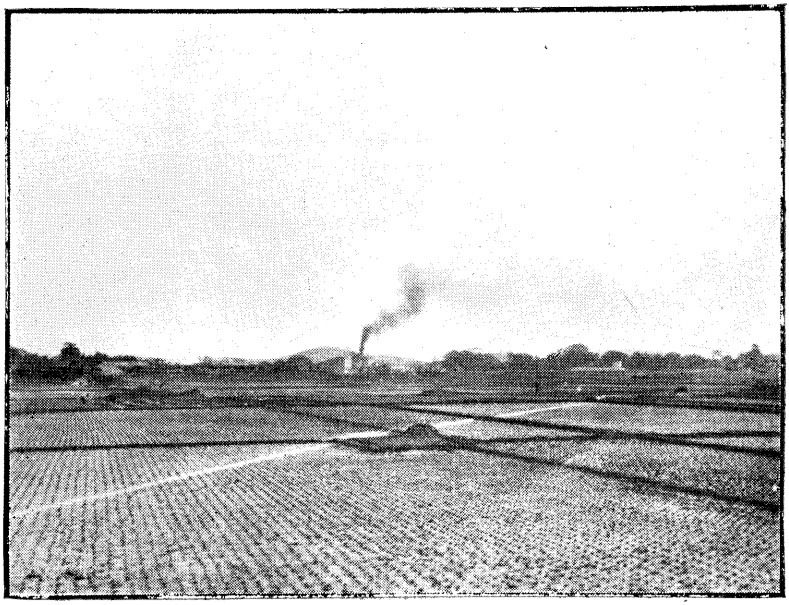
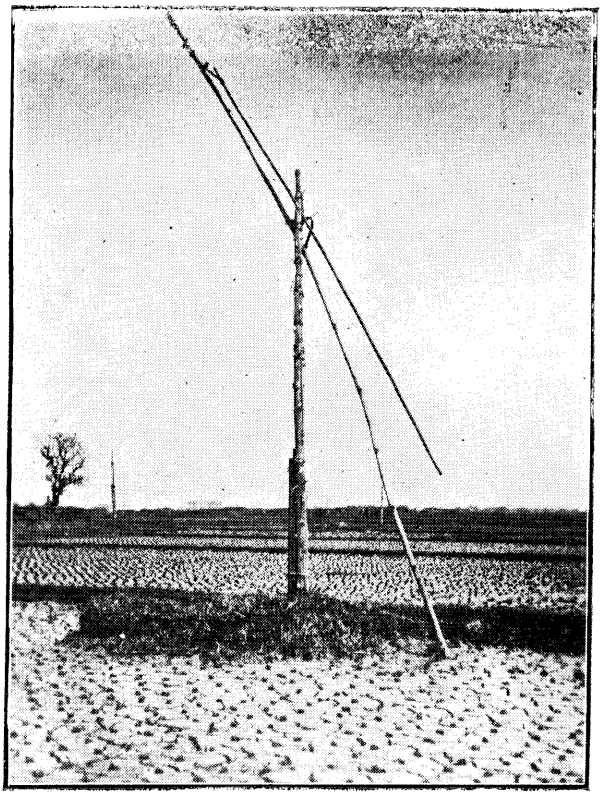


圖 (10) Fig. 10



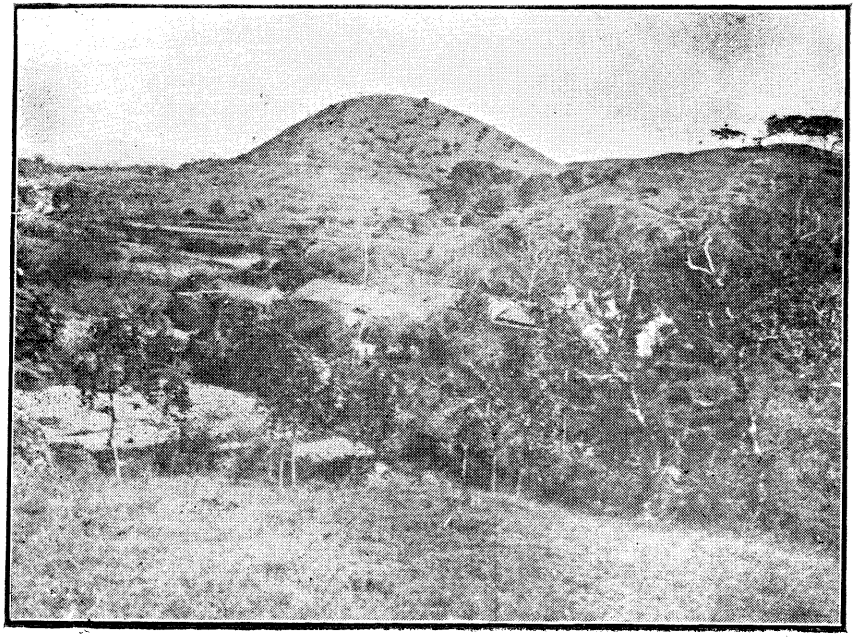
Explanation of Plate VI

圖(11) 此圖表示鍾村礫質壤土之岡陵地土壤之風化不甚透澈難於利用以造林但在岡脚斜坡及谷底則畧有利用此在廣州市東約16公里蟹山砲臺附近

Fig. 11 This hilly land of Chungtsun gravelly loam is generally not well weathered and is difficult to be utilized. This view is taken near Hai-shan Fort (蟹山) about 16 kilometers east of Canton.

圖 (11)

Fig. 11



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