指標作物監測空氣測染試驗[1]

謝 慶 芳[2]

摘 要

本試驗之目的是要研究利用各種對烟害較爲敏感而有典型症狀之植物以偵測烟害之可行性。由於空氣污染物之種類很多，而適合於各種污染物之指標作物種類也不相同，本試驗主要選擇落花生、唐菖蒲、玉米等三種做爲指標作物以供偵測最普遍發生之兩種空氣污染物，氟化物和二氧化硫，水稻因爲是本地區之主要作物，而玫瑰是耐烟性較強之作物，所以也同時調查以供參考。

全部試驗計於花壇、和美、伸港、大肚、龍井等鄉鎮設置五個監測站每站均按距離污染源之遠近各設置兩個監測點。花壇監測站是以監測磚廠廢氣爲目的，和美、伸港、大肚、龍井等監測站則主要爲偵測興建中之臺中火力發電廠廢氣爲主。所有作物均按各地之栽培時期，分別於第一期作和第二期作種植以供調查研究。作物種植後即開始定期前往調查作物之症狀及生育情況，並採樣以供分析植物體之全氮，可溶性硫酸態硫與氟、鐵、錳、鋅、銅、鎳、鉻等。主要試驗結果摘要如下：

1. 根據試驗作物之葉片症狀及生長調查資料顯示，火力發電廠監測區尚未發現有明顯之空氣污染物爲害，植物體分析結果也證明沒有任何明顯之空氣污染物累積現象。
2. 磚廠監測區則有明顯之空氣污染物爲害，植物體中之一些污染物濃度也較正常地區爲高。主要污染物爲氟化氫，其濃度在5－15 ppb之間，可使許多作物產生明顯之可視性傷害，葉片氟素濃度也顯著提高；其次爲二氧化硫，其濃度在10－50 ppb之間，對一般作物尚不致於造成明顯之可視性傷害，但葉片之硫酸態硫則有較正常地區爲高之傾向；此外葉片之錳鎳含量也較正常地區爲高。
3. 唐菖蒲、落花生爲監測氟害之二種最理想之指標作物。二氧化硫則尚待發展更爲敏感性之指標作物才能達到良好之監測效果。
4. 利用指標作物監測空氣污染是一種經濟有效而簡便之方法。
5. 但葉片分析也是偵測氟化物污染非常可靠而有效之方法。

前 言

一般比較正式之空氣污染偵測方法是採用儀器直接測定空氣中污染物之種類和濃度或者採取受害植物體之樣品以化驗方法測定植物體中污染物之濃度。由於儀器測定法所需要之儀器設備相當昂貴並需要訓練有素之人員才能操作使用，所以只有一部分機關團體有能力使用，無法應用於全面性之偵測。植物體之化驗測定方法也需要有一般化驗設備與人員之機關

[1] 臺中區農業改良場研究報告第 0144 號。

[2] 臺中區農業改良場副研究員。

團體才能辦理。

指標作物之監測是利用對空氣污染特別敏感而有典型症狀之作物以偵測空氣污染之方法[6]。雖然它是定性的而不是定量的方法，無法測得個別之污染物濃度，但是它不要使用任何儀器，任何人均可實行。主要步驟是準備種子和栽培用之土地或植缽，種植完畢之後按照一般方法灌水、施肥、噴藥管理，並隨時觀察其產生症狀之程度，即可概略知道烟害之強弱情形。

由於空氣污染物之種類很多，而適合於各種污染物之指標作物種類也不相同。本試驗是以氟化物和二氧化硫等二種爲害最爲普遍之氣體爲目標選擇各種可能做爲指標作物者栽培於區內各監測站，以觀察各種作物之反應，以便選出最理想之指標作物。

氟害之發生機構，根據以往之報告[1,2,3,6,7,10]，植物葉面因雨或內部分泌而有水滴的時候，氟化氫即溶解於水滴中直接傷害葉部表面，但主要是從葉片氣孔吸收之後穿過柔細胞間隙到了導管，禾本科植物則除了氣孔之外更可由葉緣之水孔吸收後穿過被覆組織及副導管到了導管，在導管內遇到膠體狀之矽酸即與之發生反應而隨蒸散流到達葉緣和葉尖爲害，使其變黃枯死。一般好矽植物如水稻和小麥等所吸收之氟是與矽結合之後產生較難溶性之氟化矽，而好鈣植物如大豆、油菜所吸收之氟是與鈣結合之後產生難溶性之氟化鈣而存在於受害部位[3]。

二氧化硫爲害之發生機構，米丸氏[5]認爲進入植物體內之二氧化硫首先溶解於水中變成亞硫酸，然後與炭素同化作用初期產物之醛類或者體內有機酸分解產生之醛類結合而生成有毒性之α-hydroxy-sulfonic acid：

$$SO_2 \xrightarrow{H_2O} H_2SO_3 \xrightarrow{RCHO} R-CH\begin{matrix}OH\\SO_3H\end{matrix}$$

sulfur dioxide　　sulfurous acid　　α-hydroxysulfonic acid

米丸氏更以0.03%之亞硫酸與甲醛液等量混合後將大豆和菜豆植株浸在裏面19小時，發現單獨處理者未發生被害症狀而混合處理者則產生褐色斑點。另於暗室以50 ppm甲醛與25 ppm之二氧化硫照次序接觸裸麥30分鐘也有同樣之現象。此一α-hydroxysulfonic acid之鹽類有妨碍植物體內酵素氧化之作用。Zelitch氏[13]更進一步證明α-hydroxysulfonates主要抑制甘醇酸(glycollic acid)和乳酸(lactic acid)之酵母氧化作用。

Thomas則主張硫酸學說[13]，認爲植物體內吸收之二氧化硫溶解於水中變成亞硫酸之後，除一部分變成α-hydroxysulfonic acid之外，大部分均在植物體內氧化成硫酸。至於二氧化硫引起之毒害症狀，根據以往許多學者之報告，主要在葉脈間產生黃化或枯死之大斑點或小斑點[1,2,3,6,11]。

材料與方法

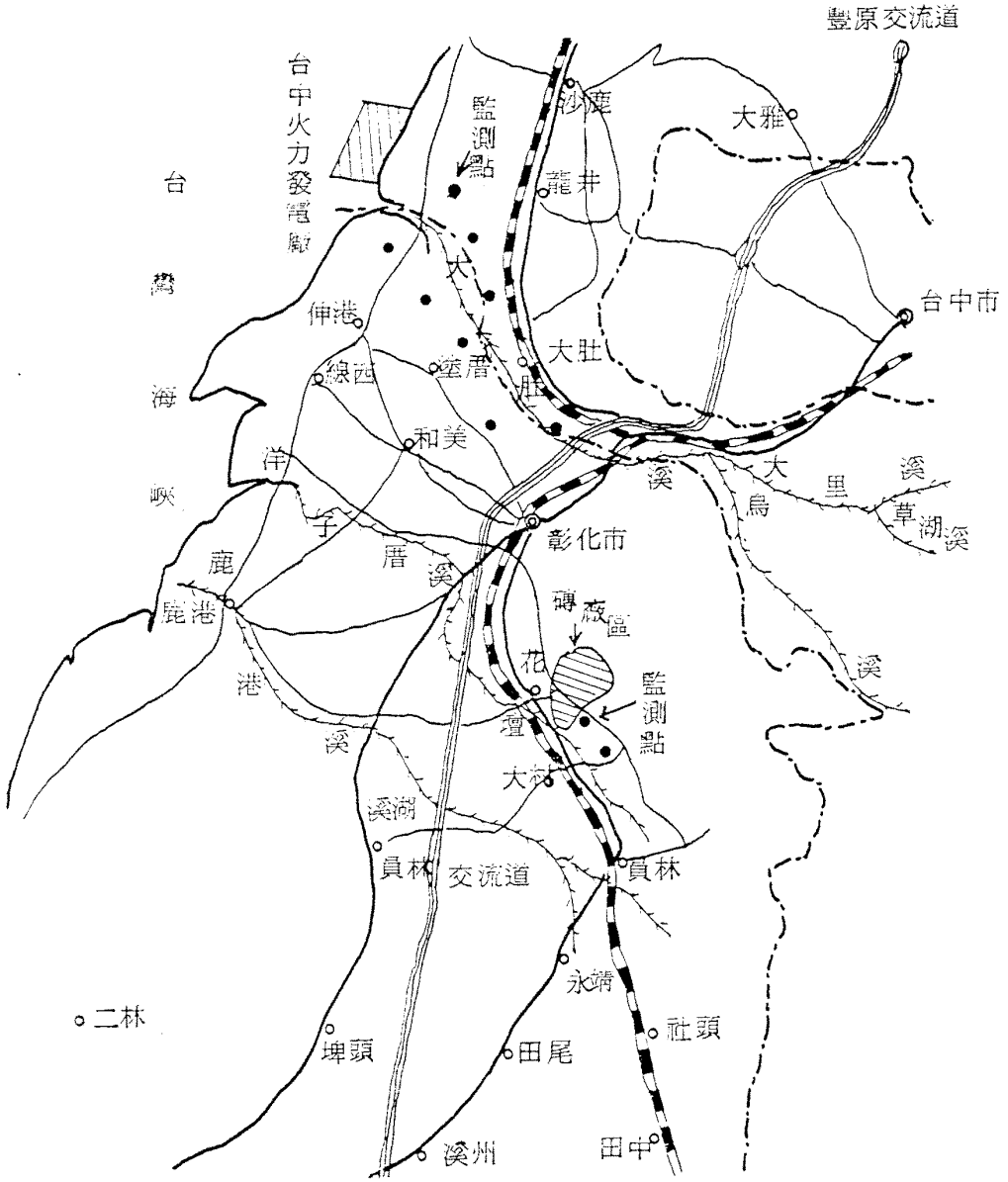
本試驗是從七十五年七月開始辦理至七十六年六月止，前後於七十五年二期作和七十六年一期各種植一次作物。全區計有五個監測站，分別設置於花壇、和美、伸港、大肚、龍井等五個鄉鎮。每一監測站各按距離污染源之近遠設有二個覽測點，花壇鄉二個監測點設於橋仔頭和三家春；和美鎮是設在地潭里和竹營里；伸港鄉設於全興村和汴頭村；大肚鄉設於成功村和追分村；龍井鄉則設於田水段和福麗段（圖1）。花壇監測站是以監測磚廠廢氣爲主；其他四個監測站則以監測興建中之臺中火力發電廠之廢氣爲目標。

本次所種植之主要指標作物爲唐菖蒲、落花生和玉米；水稻因爲是本地區之主要作物，而玫瑰因爲是耐烟性較強之植物，所以也同時調查以供參考。花壇鄉第一監測點附近並裝置有測定空氣中氟化氫和二氧化硫濃度之儀器各一部以供長期連續測定該二種氣體之濃度變化。

作物種植完畢之後即定期前往調查其生育情形和葉片產生之症狀，同時分爲初、中、後期採取植物體樣品以供測定植物體中之氮、硫、氟、鐵、錳、鋅、銅、鎳、鉻之含量。氮素是以硫酸和過氧化氫消化後以自動分析儀測得之全氮；硫是以0.01N鹽酸萃取後以Barium

chloraniate法測得可溶性硫酸態硫[9]；氟是以1N鹽酸萃取後以氟離子電極測定；鐵、錳、鋅、銅、鎳、鉻等都以1N鹽酸萃取後以原子吸光儀測定。

各監測點之土壤則於試驗後期全部採樣做全分析。交換性陽離子以醋酸銨萃取而微量元素則以1N鹽酸萃取後分別以火焰光度計和原子吸光儀測定。水溶性氟是以水土比1:1之方法萃取後以氟離子電極測定[8]。有效硫是以醋酸銨法萃取後以比色計測定[8]。



圖一　臺中區空氣污染指標作物監測站之分佈圖

Fig. 1　Distribution of the monitoring station of air pollution in Taichung District.

試驗結果與討論

從田間觀察和生育調查結果可以發現和美、伸港、大肚、龍井等監測站之所有作物之生長情形均正常（表3、15、25、27、37），葉片都未出現明顯症狀，只有七十五年二期作之水稻因受二次颱風（韋恩與艾貝）之影響而產量大幅減少（表1）。但花壇監測站（圖6）之所有作物都有明顯之氟害症狀，較老葉之葉緣和葉尖黃化枯死。唐菖蒲約於出土後10天，落花生和玉米約於種植後40天，水稻（臺中秈10號）約於移植後70天以後才出現明顯之症狀，玫瑰只有到冬季一部分老葉出現明顯之症狀，其中唐菖蒲（圖7）和落花生（圖8、9）因爲症狀出現較早，並且較爲典型而易於辨認，似乎可做爲理想之氟害指標作物；玉米之症狀則易與風害或一些病蟲害引起之症狀混淆不清，水稻和玫瑰之症狀則較輕而且出現太晚，均不適合於做爲指標作物。作物生長和產量方面，距離污染源較遠之監測點(2)，臺中秈10號稻穀產量七十五年二期作（表1）和七十六年一期作（表3）各爲每公頃6,900公斤和7,039公斤，落花生則各爲每公頃1,980公斤（表13）和2,574公斤（表15），均在正常產量範圍；但距離污染源較近之監測點(1)，臺中秈10號稻穀產量七十五年二期作和七十六年一期作各爲每公頃6,200公斤和,6420公斤較監測點(2)爲低；落花生則各爲每公頃1,620公斤和1,926公斤，很明顯地低於正常產量；唐菖蒲（表25、27）和玉米（表37）則不論距離污染源之遠近，生長或產量均明顯地降低，表示此二種作物對氟化物較爲敏感。如以二期作和一期作相比較，則四種作物（水稻、落花生、唐菖蒲和玉米）之生長或產量均以二期作較差，可能與二期作中後期開始吹北風，廢氣較易吹到監測點有關。

從各種作物不同部位和不同時期植物體之化驗結果，可以發現植物體之氮（表2、4、14、16、26、28、38）含量各監測站之間差異不大，但氟含量差異卻很大，和美、伸港、大肚、龍井等未出現氟害症狀之監測站植物體含氟量水稻約4－50 ppm（表2、6），落花生約7－35 ppm（表14、18）唐菖蒲約4－40 ppm（表26、30），玉米約7－60 ppm（表40），但有氟害症狀之花壇監測站植物體含氟量水稻約60－1100 ppm（表2、6），落花生約60－900 ppm（表14、18），唐菖蒲約50－140 ppm（表26、30），玉米約60－300ppm（表40）並且二期作都高於一期作，而一期作遠近二個監測點，本物體之含氟量差異不大，但二期作則以較近之一點植物體含氟量較高，可能與二期作中後期以後吹北風，廢氣較易吹到較近之監測點有關。此外並發現遭受氟化物污染之植物體中含氟量多數均以下葉較高，上葉次之，而以全株最低，表示葉片吸取之氟化物有累積現象。多數試驗作物植物體之可溶性硫酸態硫含量（表2、5、14、17、26、29、39）均以花壇磚廠區二個監測點較高，並以葉片含量較全株含量爲高，表示有許多硫是從空氣中吸收而來。

重金屬方面，所測定六個元素當中鐵、鋅、銅、鉻四種元素在植物體中之含量（表7、9、10、12、19、21、22、24、31、33、34、36、41、44、46），全區五個監測站10個監測點之間都沒有明顯之差異，而其含量都屬正常，但鎳（表11、23、35、45）和錳（表8、20、32、42）在花壇兩個監測點各種植物體中之含量卻明顯地高於其他所有監測點植物體中含量，可能與磚廠廢氣之污染有關。至於和美監測點(1)及(2)和大肚監測點(1)水稻植物體中錳之含量（表8）較正常量高的原因則甚難解釋。至於土壤化驗結果（表47）各監測點之間雖稍有不同，但都在正常範圍，未發現有明顯遭受重金屬或其他元素污染現象。

從花壇第一監測點附近裝設之儀器測得之資料可以發現該監測點附近空氣中全年之二氧化硫含量約在10－50 ppb之間，而氟化氫則在5－15 ppb之間（圖2、3、4、5）。由於田間各種作物之氟害症狀都很明顯，表示空氣中5－15 ppb之氟化氫已經可以使許多作物產生明顯之可視性傷害。另一方面各種試驗作物所顯示之二氧化硫症狀並不太明顯，表示空氣中10－50 ppb之二氧化硫濃度尚不致於使一般作物產生明顯之可視性傷害。茲將主要試驗成果摘述如下：

A.火力發電廠監測區尚未發現明顯之空氣污染物爲害：

(1)所有試驗作物之發育均正常，未出現明顯之烟害症狀。

(2)所有試驗作物植物體分析結果也顯示未遭受任何污染。

(3)除了75年76年二期作有部分監測點因颱風而受到影響之外，多數監測點之試驗作物生長均正常。

B.磚廠監測區有明顯之空氣污染物爲害：

(1)所有試驗作物均有明顯之氟害症狀，但以唐菖蒲、落花生之症狀出現較早並且較爲典型而易於辨認。至於二氧化硫症狀則極爲輕微，甚難辨認。

(2)所有試驗作物之氟化物含量都非常高，而以下葉最高，上葉次之，全株最低，表示氟化物主要從葉片吸收並有累積現象，兩期作之間則以二期作較一期作爲高，可能與生長中後期吹北風，磚廠廢氣直接吹向試驗田有關。

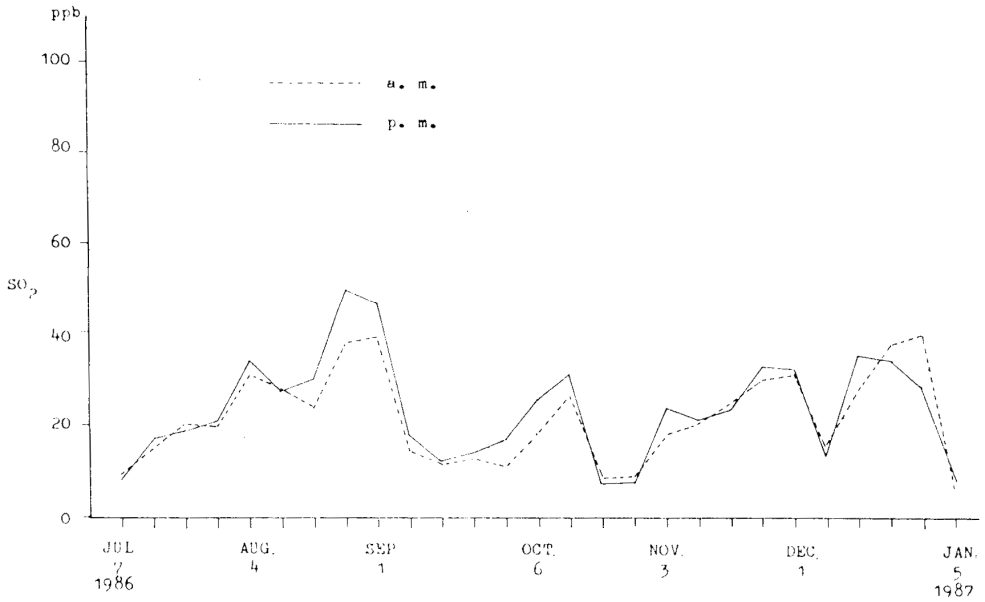
(3)多數試驗作物植物體中之可溶性硫酸態硫和錳、鎳含量都有較火力發電廠偵測區爲高之現象，並且葉部含量都有高於全株之傾向，表示本偵測區空氣中二氧化硫、錳、鎳之含量可能較一般地區爲高。

(4)試驗區空氣中全年之氟化氫含量變化約在5－15 ppb之間，已經使試驗作物產生明顯之可視性傷害，二氧化硫濃度約在10－50 ppb之間，對試驗作物造成之可視性傷害極爲輕微而難於辨認。

(5)作物生長與產量，一期作除了敏感性之作物和唐菖蒲、落花生、玉米等明顯地受到影響之外，其他作物都大致正常，但二期作則不少作物都有明顯受害或減產現象。

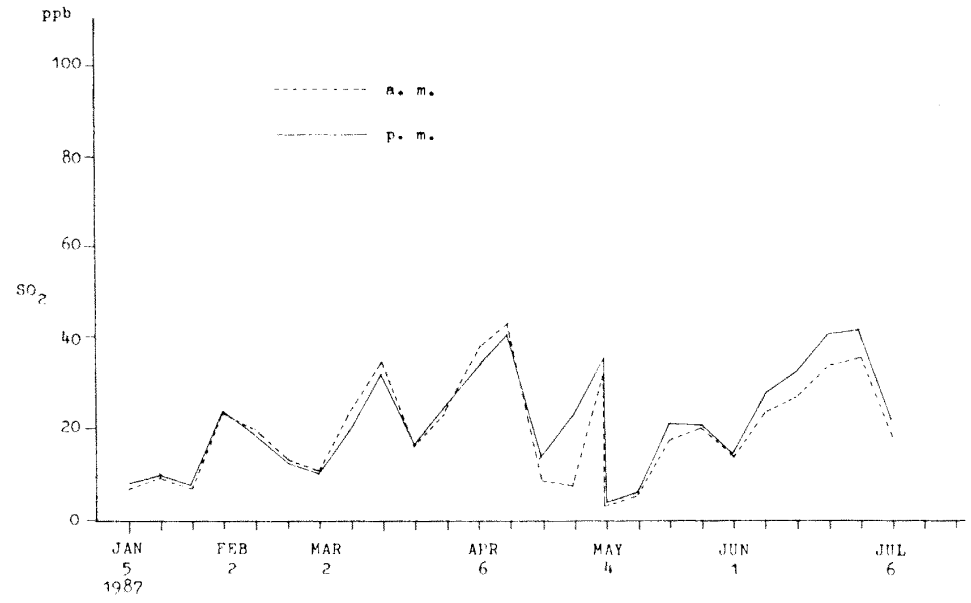
根據上述結果可以做成下面幾點結論：

1. 利用指標作物監測空氣污染是一種經濟有效而簡便之方法，但葉片分析也是偵測氟化物污染非常有效之方法。
2. 唐菖蒲、落花生爲監測氟害之二種最理想之指標作物。二氧化硫則尚待發展更爲敏感性之指標作物才能達到良好之監測效果。
3. 磚廠監測區爲害作物之主要空氣污染物爲氟化氫，其濃度在5－15 ppb之間可使許多作物產生明顯之可視性傷害，葉片氟素濃度也顯著提高。其次爲二氧化硫，其濃度在10－50 ppb之間對一般作物尚不致於造成明顯之可視性傷害，但葉片之硫酸態硫仍有較高之傾向。此外葉片之錳和鎳也較正常地區爲高。
4. 火力發電廠監測區尚未出現明顯之空氣污染物影響作物之生長。



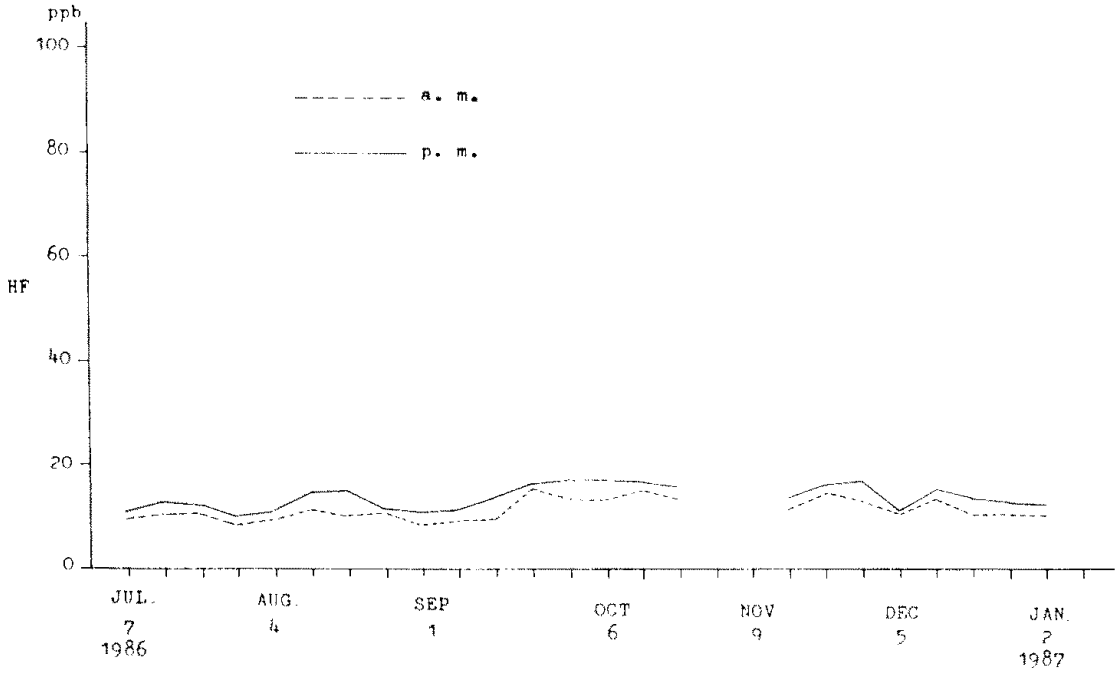
圖二　1986 年 7～12 月花壇監測站附近空氣中之二氧化硫濃度

Fig. 2.　Sulfur dioxide in the brickfactory area ta Huatan during July to December, 1986.



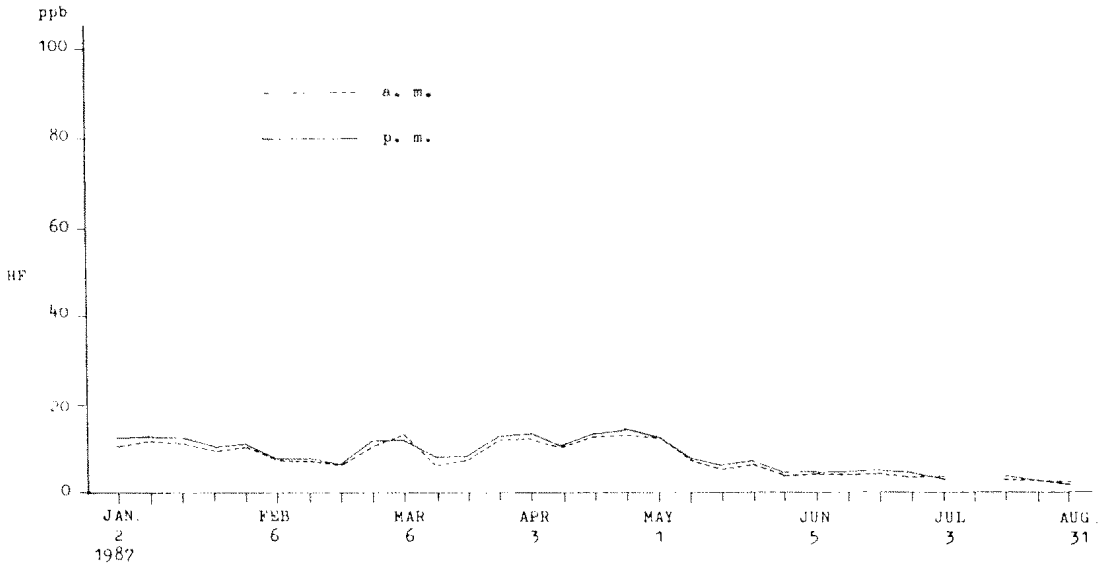
圖三　1987 年 1～6 月花壇監測站附近空氣中之二氧化硫濃度

Fig. 3.　Sulfur dioxide in the brickfactory area at Huatan during January to June, 1987.



圖四　1986 年 7～12 月花壇監測站空氣中之氟化氫濃度

Fig. 4.　Hydrogen fluoride gas in the brickfactory area at Huatan during July to December, 1986.



圖五　1987 年 1～6 月花壇監測站附近空氣中之氟化氫濃度

Fig. 5.　Hydrogen fluoride gas in the brickfactory area at Huatan during January to June, 1987.

圖六　花壇監測站指標作物落花生（左和下）首唐菖蒲（右中）生長情形，其中可以看到所有唐莫蒲都有明顯之葉尖枯死症。

Fig. 6. The growth of indicator plants, peanut (left and lower) and gladiolus (right center) at Huatan Monitoring Statin. Among them, gladiolus plants are showing serious tiphurn.

圖七　花壇監測站指標作物唐菖蒲出現典型之氟害症狀而葉尖枯死情形

Fig. 7. Gladiolus, an indicator plant at Huatan Monitoring station, showing typical symptom of tipburn on the leaves due to fluoride toxicity.

圖八　花壇監測站指標作物落花生出現典型之氟害症狀而葉尖或葉緣枯死症狀

Fig. 8.　Peanut, an indicator plant at Huatan Monitoring Station, showing typical symptom of edge and tipburn on the leaves due to fluoride toxicity.

圖九　花壇監測站落花生全株遭受氟害之症狀

Fig. 9.　Fluoride toxicity symptoms of the peanut plant at Huatan Monitoring Statin.

表一　指標作物監測站之水稻生育調查（75 年 2 期）

Table 1. The growth and yield of rice at monitoring plots (2nd crop, 1986)

Places	Crops	Plant height cm	No. of panicle /hill	No. of grain/ panicle	Filled grain %	1000 grain wt., g	Grain yield kg/ha	Straw yield kg/ha
Huatan (1)[1]	Taichung Sen 10	102.1	17.5	124	86	25.0	6,200	6,098
(2)	Taichung Sen 10	105.4	19.7	127	88	25.1	6,900	6,635
Homei (1)	Tainung 67[2]	86.5	17.6	42	43	22.6	3,400	5,313
(2)	Tainung 67	104.0	18.2	85	87	24.4	6,046	5,986
Shenkang (1)	Tainung 67[2]	84.2	15.6	34	49	22.7	2,980	4,027
(2)	Tainung 67[2]	85.6	15.5	58	68	23.9	4,850	5,574
Tatu (1)	Tainung 67[2]	88.6	24.7	52	64	23.6	4,760	5,409
(2)	Tainung 67	92.6	20.3	81	86	24.2	6,235	6,173

[1] (1) and (2) respectively representing the two monitoring plots at each station, one of them closer and another more separated from the source of air pollution.

[2] The grain yields of this crop were greatly decreased due to typhoon.

表二　指標作物監測站水稻植物體之氮硫氟含量（75 年 2 期）

Table 2. Nitrogen, sulfur, and fluorine contents in rice plant at monitoring plots at haversting stage (2nd crop, 1986)

Places	Crops	Nitrogen, %			Sulfur, %			Fluorine, ppm		
		UL	LL	WP	UL	LL	WP	UL	LL	WP
Huatan (1)[1]	Taichung Sen 10	3.84	2.98		0.13	0.35		1,056	1,129	
(2)	Taichung Sen 10	3.26	2.37		0.32	0.54		500	393	
Homei (1)	Tainung 67	1.67	1.41	0.70	0.05	0.12	0.19	6	5	4
(2)	Tainung 67	1.77	1.33	0.62	0.06	0.13	0.21	6	6	4
Shenkang (1)	Tainung 67	1.82	1.91	0.84	0.20	0.26	0.28	10	11	5
(2)	Tainung 67	1.67	1.41	0.81	0.18	0.20	0.29	9	9	7
Tatu (1)	Tainung 67	1.27	1.49	0.69	0.21	0.17	0.29	12	17	13
(2)	Tainung 67	1.43	1.02	0.54	0.14	0.24	0.17	19	18	9

1 See table 1; UL-upper leaves; LL-lower leaves; WP-whole plant.

表三　指標作物監測站之水稻生育調查（76 年 1 期）

Table 3. The growth and yield of rcie at monitoring plots (1st crop, 1987)

Places	Crops	Plant height cm	No. of panicle per hill	No. of grain per panicle	Filled grain %	1000 grain wt., g	Grain yield kg/ha	Straw yield kg/ha
Huatan (1)[1]	Taichung Sen 10	94.3	26.8	76	88.8	25.0	6,420	6,618
(2)	Taichung Sen 10	102.1	20.8	110	88.1	25.2	7,039	6.539
Homei (1)	Tainung 67	105.1	25.6	74	92.3	24.7	6,700	7,412
(2)	Tainung 67	106.6	26.9	65	89.3	24.8	6,900	7,886
Shenkang (1)	Tainung 67	103.7	19.6	85	94.1	24.6	6,500	7,648
(2)	Tainung 67	100.6	23.6	67	90.4	24.5	6,700	8,681
Tatu (1)	Tainung 67	91.2	28.8	68	89.0	24.4	6,400	5,430
(2)	Tainung 67	100.0	29.8	84	90.4	24.2	7,300	6,820
Lungching (1)	Tainung 67							
(2)	Tainung 67	99.4	19.3	84.2	90.2	24.0	6,500	7,640

[1] See table 1.

表四　指標作物監測站水稻植物體之氮含量 (%)（76 年 1 期）

Table 4. Nitrogen contents in the different parts and different stages of rice plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	3.83	1.25	2.82	1.90	3.30	3.27	2.10	1.53	2.75	1.51	1.13	1.18
(2)	2.77	1.52	1.60	1.50	2.96	1.60	1.11	1.21	2.24	1.05	0.65	1.03
Homei (1)	2.70	2.26	2.39	1.06	2.82	1.61	2.09	0.61	2.43	1.38	1.30	0.61
(2)	4.35	2.39	2.01	1.74	3.98	2.19	1.25	0.95	2.34	1.99	0.63	0.73
Shenkang (1)	3.19	1.34	2.44	1.46	2.99	1.17	1.95	1.01	2.12	1.37	0.92	0.84
(2)	2.51	1.26	2.78	1.44	2.90	0.86	1.47	1.45	2.70	1.10	0.66	0.75
Tatu (1)	3.75	1.49	2.17	1.53	2.84	2.00	1.19	0.88	1.84	2.03	0.75	
(2)	2.97	1.37	1.26	1.45	3.23	1.81	1.35	0.86	3.29	1.82	0.65	
Lungching (1)												
(2)	2.52	1.27	0.32	1.11	2.39	2.37	2.19	0.81	1.67	2.66	0.61	

[1] See table 1.

表五　指標作物監測站水稻植物體之硫含量(%)（76 年 1 期）

Table 5. Sulfur contents in the different parts and different stages of rice plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	0.14	0.14	0.07	0.09	0.38	0.28	0.23	0.13	0.41	0.27	0.20	0.06
(2)	0.15	0.19	0.26	0.13	0.27	0.27	0.25	0.33	0.26	0.24	0.25	0.10
Homei (1)	0.10	0.09	0.08	0.08	0.11	0.12	0.18	0.07	0.16	0.25	0.18	0.14
(2)	0.07	0.16	0.28	0.10	0.08	0.17	0.11	0.23	0.15	0.30	0.19	0.14
Shenkang (1)	0.10	0.11	0.08	0.11	0.15	0.22	0.17	0.18	0.28	0.28	0.16	0.06
(2)	0.10	0.10	0.12	0.11	0.14	0.15	0.18	0.12	0.15	0.18	0.16	0.05
Tatu (1)	0.11	0.14	0.10	0.12	0.22	0.21	0.21	0.20	0.22	0.29	0.22	
(2)	0.06	0.08	0.08	0.09	0.18	0.11	0.13	0.13	0.30	0.13	0.14	
Lungching (1)												
(2)	0.08	0.21	0.17	0.14	0.15	0.21	0.24	0.16	0.20	0.24	0.23	

[1] See table 1.

表六　指標作物監測站水稻植物體之氟含量(ppm)（76 年 1 期）

Table 6. Fluorine contents in the different parts and different stages of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	815	168	138	675	2033	895	385	925	600	185	362	155
(2)	402	182	116	475	1463	515	242	625	262	157	66	135
Homei (1)	13	10	13	25	27	12	14	24	21	10	12	21
(2)	22	11	11	30	26	11	11	26	15	10	10	23
Shenkang (1)	23	20	18	38	30	21	20	38	18	21	16	29
(2)	23	13	14	39	26	18	15	32	18	12	13	25
Tatu (1)	26	22	9	27	29	16	15	24	26	14	8	
(2)	20	10	9	29	27	8		31	20	10	7	
Lungching (1)												
(2)	51	8	9	25	54	8	12	23	38	8	11	

[1] See table 1.

表七　指標作物監測站水稻植物體之鐵含量(ppm)（76 年 1 期）

Table 7. Iron contents in the different parts and different stages of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	370	140	295	241	600	340	28	785	410	180	300	241
(2)	255	195	275	265	780	425	435	315	450	295	285	430
Homei (1)	220	80	180	150	905	93	383	233	748	140	190	210
(2)	205	188	163	138	325	305	383	168	433	213	153	275
Shenkang (1)	260	108	208	395	380	478	263	308	445	253	148	243
(2)	228	135	253	198	533	330	288	228	650	130	258	185
Tatu (1)	200	660	195	198	633	193	291	180	373	70	336	
(2)	240	185	270	325	395	173	629	523	880	85	754	
Lungching (1)												
(2)	283	63	169	198	363	48	361	233	423	68	451	

[1] See table 1.

表八　指標作物監測站水稻植物體之錳含量(ppm)（76 年 1 期）

Table 8. Manganese contents in the different parts and different stage of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	1220	1210	1440	103	1780	2970	2345	5100	1285	1460	1105	3750
(2)	450	530	950	4850	990	1010	885	4550	540	540	430	1380
Homei (1)	948	260	218	680	2578	1463	1360	1200	1250	858	360	1700
(2)	253	708	475	1450	350	545	1088	2000	288	998	465	2200
Shenkang (1)	388	390	158	600	498	205	343	518	308	55	160	210
(2)	200	125	213	155	295	313	325	260	370	113	203	128
Tatu (1)	850	120	840	1175	1838	48	1693	2650	145	105	915	
(2)	200	85	124	26	433	93	181	23	1068	143	141	
Lungching (1)												
(2)	168	120	311	24	540	115	714	25	290	65	508	

[1] See table 1.

表九　指標作物監測站水稻植物體之鋅含量(ppm)（76 年 1 期）

Table 9. Zinc contents in the different parts and different stages of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	20	15	25	44	25	25	30	50	25	25	45	52
(2)	15	10	20	46	25	15	20	46	20	15	25	52
Homei (1)	53	28	20	27	45	10	28	29	55	23	20	33
(2)	23	15	18	26	28	15	18	30	45	33	25	35
Shenkang (1)	30	10	18	25	23	10	18	27	25	15	18	26
(2)	15	10	20	29	15	10	20	27	25	8	25	26
Tatu (1)	30	50	18	40	33	73	21	25	25	38	28	
(2)	25	13	11	26	28	30	14	23	43	15	23	
Lungching (1)												
(2)	30	10	11	24	40	13	16	25	35	13	38	

[1] See table 1.

表十　指標作物監測站水稻植物體之銅含量(ppm)（76 年 1 期）

Table 10. Copper contents in the different parts and different stages of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	12	15	2	9	12	10	3	11	13	11	3	12
(2)	8	9	5	11	11	20	7	10	6	8	6	12
Homei (1)	11	5	9	6	12	5	9	7	11	4	9	6
(2)	10	9	7	10	12	5	6	9	8	8	7	7
Shenkang (1)	8	5	6	6	8	6	7	5	9	6	5	5
(2)	6	6	14	8	9	7	10	7	8	2	7	5
Tatu (1)	12	12	9	8	14	10	8	6	4	6	10	
(2)	8	7	6	5	8	8	5	5	16	6	5	
Lungching (1)												
(2)	7	4	9	6	9	7	6	5	7	3	12	

[1] See table 1.

表十一　指標作物監測站水稻植物體之鎳含量(ppm)（76 年 1 期）

Table 11. Nickel contents in the different parts and different stages of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	9	17	21	17	7	18	23	20	9	22	26	23
(2)	13	17	16	28	9	20	16	22	8	18	19	19
Homei (1)	8	10	7	12	6	12	7	12	9	9	6	8
(2)	10	11	10	8	10	14	7	10	10	12	11	9
Shenkang (1)	7	9	9	12	7	9	9	11	8	8	8	9
(2)	7	10	9	12	8	11	8	12	13	10	8	10
Tatu (1)	10	14	6	9	6	12	7	8	6	14	7	
(2)	7	12	8	12	8	13	6	12	9	11	7	
Lungching (1)												
(2)	8	12	8	10	7	13	7	9	10	12	9	

[1] See table 1.

表十二　指標作物監測站水稻植物體之鉻含量(ppm)（76 年 1 期）

Table 12. Chromium contents in the different parts and different stages of rice plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	8	17	18	15	16	16	16	19	16	14	17	19
(2)	15	13	20	14	17	17	19	16	16	18	19	15
Homei (1)	14	9	12	9	11	10	12	8	12	10	14	9
(2)	10	10	11	10	12	10	11	10	12	9	11	9
Shenkang (1)	25	9	13	12	12	11	12	12	10	12	11	15
(2)	13	11	13	11	14	11	12	10	12	11	11	9
Tatu (1)	16	11	7	10	11	10	7	9	9	11	7	
(2)	14	9	11	13	19	11	9	10	21	10	9	
Lungching (1)												
(2)	10	9	8	9	12	12	8	8	12	9	7	

[1] See table 1.

表十三　指標作物監測站之落花生和玫瑰生育調查（75 年 2 期）

Table 13. The growth and yield of peanut and rose at monitoring plots (2nd crop, 1986)

Place	Crops	Plant height cm	No. of pod per plant	Wt. of pod per plant, g	Shelld seed %	Pod yield kg/ha
Huatan (1)[1]	Peanut, Tainan 9	35	13.4	13.0	69.2	1,620
(2)	Peanut, Tainan 9	41	16.5	16.3	71.1	1,980
Huatan (1)	Rose	The rose plants gernerally grew normally until the winter season some old leaves showed edge and tip burn.				
(2)	Rose	The rose plants gernerally grew normally until the winter season some old leaves showed slighter edge and tip burn.				

[1] See table 1.

表十四　指標作物監測站落花生和玫瑰之氮硫氟含量（75 年 2 期）

Table 14. Nitrogen, sulfur, and fluorine contents in the plants of peanut and rose at monitoring plots (2nd crop, 1986)

Places	Crops	Nitrogen, %			Sulfur, %			Fluorine, ppm		
		UL	LL	WP	UL	LL	WP	UL	LL	WP
Huatan (1)[1]	Peanut, Tainan 9	1.33	2.53	2.33	0.25	0.68	0.24	892	702	441
(2)	Peanut, Tainan 9	1.38	2.38	2.03	0.27	0.38	0.49	365	247	160
Huatan (1)	Rose	2.17	1.78		0.16	0.82		192	513	
(2)	Rose	2.15	2.11		0.15	0.25		159	366	

1 See table 1; UL-upper leaves; LL-lower leaves; WP-whole plant.

表十五　指標作物監測站之落花生生育調查（76 年 1 期）

Table 15. The growth and yield of peanut at monitoring plots (1st crop, 1987)

Places	Crops	Plant height cm	No. of pod per plant	Wt. of pod per plant	Shelled seed %	Pod yield kg/ha
Huatan (1)[1]	Peanut Tainan 11	41.6	11.1	17.9	73.8	1,926
(2)	Peanut Tainan 11	55.5	15.5	21.7	74.8	2,574
Homei (1)	Peanut Tainan 11	49.3	16.3	24.9	72.5	3,210
(2)	Peanut Tainan 11	61.0	13.0	17.4	74.6	2,209
Shenkang (1)	Peanut Tainan 11	53.0	17.2	23.5	71.8	3,177
(2)	Peanut Tainan 11	58.1	14.9	20.2	70.4	2,258
Tatu (1)	Peanut Tainan 11	66.0	17.9	21.1	72.3	2,482
(2)	Peanut Tainan 11	55.8	13.3	16.7	73.2	2,200
Lungching (1)	Peanut Tainan 11	66.8	18.2	23.0	71.4	2,951
(2)	Peanut Tainan 11	50.6	14.2	18.8	72.0	2,307

[1] See table 1.

表十六　指標作物監測站落花生植物體之氮含量 (%)（76 年 1 期）

Talbe 16. Nitrogen contents in the different parts and different stages of peanut plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	2.86	2.15	2.99	3.04	2.29	2.35	2.86	2.23	3.03	2.32	2.76	2.13
(2)	3.31	1.37	1.88	2.28	3.01	1.90	2.47	1.70	2.81	1.71	3.17	1.48
Homei (1)	2.42	2.24	2.67	2.76	2.22	1.97	2.96	2.03	2.26	1.49	2.31	1.88
(2)	3.32	1.38	2.77	2.70	2.90	2.10	2.34	2.30	2.20	1.78	1.86	1.83
Shenkang (1)	2.25	1.14	3.52	2.46	3.36	1.44	3.12	1.82	2.93	1.27	1.72	1.74
(2)	2.89	1.63	3.94	2.88	2.47	0.82	2.64	2.22	2.95	2.51	2.45	2.06
Tatu (1)	3.04	1.34	3.41	2.89	2.11	2.68	1.88	2.17	2.29	2.17	2.14	1.95
(2)	2.22	1.11	0.57	2.77	2.35	1.79	1.43	2.11	2.16	1.84	1.48	1.66
Lungching (1)	2.49	2.21	0.99	2.51	3.01	1.54	1.58	2.15	2.67	1.29	1.42	1.53
(2)	3.01	3.52	0.66	2.80	2.88	3.52	0.85	1.80	3.31	2.27	1.45	1.99

[1] See table 1.

表十七　指標作物監測站落花生植物體之硫含量 (%)（76 年 1 期）

Talbe 17.　Sulfur contents in the different parts and different stages of peanut plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	0.29	0.23	0.23	0.52	0.29	0.29	0.23	0.33	0.86	0.31	0.26	0.53
(2)	0.22	0.14	0.25	0.31	0.29	0.27	0.12	0.21	0.39	0.30	0.22	0.22
Homei (1)	0.13	0.14	0.11	0.11	0.10	0.14	0.21	0.15	0.19	0.22	0.17	0.13
(2)	0.15	0.15	0.28	0.14	0.21	0.17	0.11	0.12	0.22	0.23	0.18	0.12
Shenkang (1)	0.14	0.16	0.32	0.35	0.20	0.19	0.26	0.44	0.31	0.23	0.36	0.35
(2)	0.15	0.12	0.13	0.16	0.17	0.18	0.19	0.17	0.24	0.17	0.16	0.23
Tatu (1)	0.18	0.13	0.11	0.10	0.18	0.16	0.15	0.15	0.31	0.20	0.18	0.16
(2)	0.15	0.22	0.15	0.11	0.21	0.20	0.20	0.20	0.27	0.26	0.20	0.30
Lungching (1)	0.16	0.12	0.16	0.12	0.20	0.22	0.16	0.20	0.26	0.19	0.25	0.23
(2)	0.38	0.21	0.16	0.12	0.38	0.43	0.29	0.25	0.37	0.39	0.24	0.19

[1] See table 1.

表十八　指標作物監測站落花生植物體之氟含量 (ppm)（76 年 1 期）

Talbe 18.　Fluorine contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	231	251	124	100	307	243	57	93	104	136	47	85
(2)	220	135	73	94	239	142	84	83	166	94	70	66
Homei (1)	26	13	13	26	21	16	13	23	20	15	13	22
(2)	25	13	11	25	36	10	10	21	27	10	10	21
Shenkang (1)	31	13	17	30	34	14	17	28	27	11	15	26
(2)	22	11	16	25	24	12	20	25	20	11	18	25
Tatu (1)	13	13	8	23	17	12	7	20	15	14	8	18
(2)	33	11	7	23	30	10	7	19	26	12	6	18
Lungching (1)	37	7	7	23	35	8	9	17	34	7	8	17
(2)		9	7	20		9	8	17		8	7	15

[1] See table 1.

表十九　指標作物監測站落花生植物體之鐵含量 (ppm)（76 年 1 期）

Talbe 19. Iron contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	200	175	145	1225	430	390	415	1290	270	260	295	610
(2)	115	135	85	73	440	295	345	139	195	160	215	535
Homei (1)	223	185	155	50	333	273	670	450	360	253	243	353
(2)	163	190	53	67	350	123	230	203	200	140	100	138
Shenkang (1)	148	55	105	50	403	275	238	248	208	340	140	175
(2)	128	70	135	133	533	335	123	365	223	115	248	275
Tatu (1)	248	145	70	533	413	135	290	323	428	145	281	173
(2)	138	138	106	118	280	145	374	383	320	183	184	253
Lungching (1)	170	63	70	47	343	158	285	108	173	155	236	100
(2)	325	140	138	43	358	95	430	160	480	208	288	120

[1] See table 1.

表二十　指標作物監測站落花生植物體之錳含量 (ppm)（76 年 1 期）

Talbe 20. Manganese contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	505	430	510	1090	445	400	470	910	350	325	255	635
(2)	465	515	485	875	320	565	685	1090	440	485	375	480
Homei (1)	210	78	108	41	218	83	213	153	68	70	190	31
(2)	133	500	118	223	190	36	218	275	63	25	85	155
Shenkang (1)	40	145	110	32	81	198	160	150	140	195	125	25
(2)	98	108	173	218	98	120	100	200	43	88	80	56
Tatu (1)	93	85	92	35	108	688	99	39	41	158	98	30
(2)	85	93	210	23	105	113	259	54	53	163	204	35
Lungching (1)	95	165	219	25	110	168	324	44	113	98	285	205
(2)	35	78	175	26	40	318	205	28	48	313	143	23

[1] See table 1.

表二十一　指標作物監測站落花生植物體之鋅含量 (ppm)（76 年 1 期）

Talbe 21. Zinc contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	55	20	45	59	50	20	55	65	50	35	40	52
(2)	55	55	50	68	70	85	140	85	35	50	70	58
Homei (1)	30	15	15	24	20	10	18	24	23	13	18	21
(2)	88	10	30	36	153	13	103	56	110	18	28	39
Shenkang (1)	20	8	20	22	38	13	20	25	28	15	18	21
(2)	38	15	23	28	58	30	18	38	48	18	20	31
Tatu (1)	48	53	13	25	70	33	60	24	23	13	60	25
(2)	55	15	31	23	78	23	77	54	40	8	40	35
Lungching (1)	73	35	43	25	93	35	99	44	68	35	54	30
(2)	38	18	11	26	38	18	16	28	38	8	38	23

[1] See table 1.

表二十二　指標作物監測站落花生植物體之銅含量 (ppm)（76 年 1 期）

Talbe 22. Copper contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	7	13	3	10	8	16	10	10	8	14	9	8
(2)	9	13	2	8	9	15	0.5	9	8	17	1	13
Homei (1)	5	5	5	4	7	3	5	5	6	2	6	9
(2)	5	6	6	12	9	8	5	8	6	6	7	6
Shenkang (1)	2	3	6	3	5	4	7	5	2	2	5	4
(2)	5	5	6	6	8	3	10	7	5	5	7	7
Tatu (1)	7	4	5	5	8	4	6	5	6	5	6	5
(2)	6	7	6	4	7	4	6	5	7	15	8	5
Lungching (1)	5	4	5	5	7	4	6	5	4	5	6	6
(2)	6	3	10	3	6	6	6	4	6	5	5	4

[1] See table 1.

表二十三　指標作物監測站落花生植物體之鎳含量 (ppm)（76 年 1 期）

Talbe 23. Nickel contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	8	22	18	30	19	20	24	28	15	22	20	22
(2)	9	22	22	23	15	20	22	21	15	30	25	25
Homei (1)	9	13	9	9	8	12	12	7	10	11	13	1
(2)	10	13	13	13	14	13	12	13	13	15	12	12
Shenkang (1)	11	9	8	9	11	11	8	12	9	11	10	11
(2)	10	11	13	12	11	12	9	9	9	12	10	10
Tatu (1)	14	14	7	11	8	15	8	12	8	13	8	12
(2)	8	15	10	11	11	13	7	11	9	11	9	8
Lungching (1)	13	17	8	11	11	16	8	8	13	15	10	11
(2)	11	12	9	9	12	13	9	11	6	13	9	9

[1] See table 1.

表二十四　指標作物監測站落花生植物體之鉻含量 (ppm)（76 年 1 期）

Talbe 24. Chromium contents in the different parts and different stages of peanut plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	21	17	15	15	20	15	15	13	16	16	16	14
(2)	17	15	16	14	17	18	19	16	19	15	16	16
Homei (1)	15	10	11	8	14	10	13	11	11	11	12	10
(2)	12	8	11	10	14	10	11	10	13	10	10	9
Shenkang (1)	13	9	10	9	14	13	10	10	12	11	11	10
(2)	9	13	11	13	13	10	10	11	12	10	10	10
Tatu (1)	12	11	8	11	13	9	9	12	12	9	7	11
(2)	14	11	8	11	12	11	8	11	13	9	7	10
Lungching (1)	10	10	9	10	11	9	9	9	10	7	8	9
(2)	10	9	7	9	11	10	7	8	13	10	8	8

[1] See table 1.

表二十五　指標作物監測站之唐菖蒲生育調查（75 年 2 期）

Table 25. The growth and yield of gladiolus at monitoring plots (2nd crop, 1986)

Places	Crops	Plant height cm	Detah rate %	Flowered plants %	No. of flower per panicle
Huatan (1)[1]	Gladiolus	45.6	80.5	21.4	4.0
(2)	Gladiolus	48.9	66.2	37.2	5.4
Homei (1)	Gladiolus	55.7	0	100.0	7.4
(2)	Gladiolus	75.2	0	100.0	11.2
Shenkang (1)	Gladiolus	68.4	0	100.0	11.7
(2)	Gladiolus	72.5	0	100.0	10.8
Tatu (1)	Gladiolus	90.4	0	100.0	12.0
(2)	Gladiolus	92.2	0	100.0	11.2

[1] See table 1.

表二十六　指標作物監測站唐菖蒲植物體之氮硫氟含量（75 年 2 期）

Table 26. Nitrogen, sulfur, and fluorine contents in the gladiolus plants at monitoring plots (2nd crop, 1986)

Places	Crops	Nitrogen, %			Sulfur, %			Fluorine, ppm		
		UL	LL	WP	UL	LL	WP	UL	LL	WP
Huatan (1)[1]	Gladiolus			1.45			0.42			134
(2)	Gladiolus			1.63			0.41			68
Homei (1)	Gladiolus	1.61	1.84	1.26	0.21	0.31	0.20	5	5	4
(2)	Gladiolus	1.87	1.65	1.47	0.19	0.25	0.19	5	5	4
Shenkang (1)	Gladiolus	1.49	1.48	1.45	0.25	0.41	0.34	4	5	4
(2)	Gladiolus	1.98	1.96	1.69	0.40	0.52	0.37	4	4	4
Tatu (1)	Gladiolus	2.02	2.23	1.76	0.21	0.28	0.24	17	12	15
(2)	Gladiolus	2.10	1.72	1.39	0.19	0.28	0.23	15	15	12

1 See table 1; UL-upper leaves; LL-lower leaves; WP-whole plant.

表二十五　指標作物監測站之唐菖蒲生育調查（75 年 2 期）

Table 25. The growth and yield of gladiolus at monitoring plots (2nd crop, 1986)

Places	Crops	Plant height cm	Detah rate %	Flowered plants %	No. of flower per panicle
Huatan (1)[1]	Gladiolus	49.0	76.5	29.4	4.5
(2)	Gladiolus	49.8	61.2	42.6	6.2
Homei (1)	Gladiolus	53.3	2.4	100.0	7.3
(2)	Gladiolus	73.8	0.6	100.0	11.0
Shenkang (1)	Gladiolus	64.2	1.2	100.0	11.1
(2)	Gladiolus	75.1	2.1	100.0	11.0
Tatu (1)	Gladiolus	92.0	0	100.0	13.3
(2)	Gladiolus	98.3	0	100.0	13.3
Lungching (1)	Gladiolus	86.3	0	100.0	9.8
(2)	Gladiolus	84.0	0	100.0	15.8

[1] See table 1.

表二十八　指標作物監測站唐菖蒲植物體之氮含量 (%)（76 年 1 期）

Talbe 17. Nitrogen contents in the different parts and different stages of gladiolus plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	1.95	2.82	2.42		2.52	1.86	1.81		2.08	2.50	2.39	
(2)	1.62	1.91	2.07		3.05	2.58	1.25		2.62	2.24	1.77	
Homei (1)	1.93	1.33	1.14		2.05	2.62	0.79		1.67	2.69	1.15	
(2)	1.63	2.40	1.30		2.80	1.40	1.63		2.53	1.06	1.24	
Shenkang (1)	2.90	1.35	1.67		2.89	2.02	1.55		2.56	1.84	1.55	
(2)	2.17	1.60	1.42		3.16	2.93	1.33		2.61	2.24	1.05	
Tatu (1)		2.21	1.33			1.86	0.93			1.40	1.74	
(2)		0.80	1.60			1.25	0.52			0.90	1.06	
Lungching (1)		1.69				1.72				0.94		
(2)		2.80	0.64			2.08	2.16			1.17	2.00	

[1] See table 1.

表二十九　指標作物監測站唐菖蒲植物體之硫含量 (%)（76 年 1 期）

Talbe 17. Sulfur contents in the different parts and different stages of gladiolus plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	0.29	0.16	0.39		0.31	0.23	0.82		0.32	0.28	0.58	
(2)	0.32	0.27	0.27		0.37	0.36	0.66		0.39	0.41	0.30	
Homei (1)	0.22	0.26	0.21		0.35	0.40	0.19		0.34	0.39	0.36	
(2)	0.16	0.21	0.27		0.31	0.27	0.44		0.22	0.27	0.29	
Shenkang (1)	0.31	0.25	0.46		0.41	0.41	0.02		0.34	0.39	0.29	
(2)	0.21	0.14	0.18		0.24	0.23	0.25		0.27	0.21	0.12	
Tatu (1)		0.21	0.58			0.39	0.89			0.31	0.30	
(2)		0.23	0.30			0.29	0.48			0.42	0.36	
Lungching (1)		0.38				0.56				0.36		
(2)		0.45	0.29			0.56	0.48			0.36	0.30	

[1] See table 1.

表三十　指標作物監測站唐菖蒲植物體之氟含量 (ppm)（76 年 1 期）

Talbe 30. Fluorine contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	53	55	87		54	51	71		51	49	77	
(2)	62	60	185		67	62	130		57	54	136	
Homei (1)	43	12	16		38	11	14		28	11	13	
(2)	30	9	16		30	8	14		28	8	15	
Shenkang (1)	33	10	14		34	13	14		36	13	13	
(2)	33	10	13		32	13	13		32	11	12	
Tatu (1)		10				9				9		
(2)		10	8			9	9			9	8	
Lungching (1)		8				9				8		
(2)		8	7			10	7			8	7	

[1] See table 1.

表三十一　指標作物監測站唐菖蒲植物體之鐵含量 (ppm)（76 年 1 期）

Talbe 31. Iron contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	27	150	270		36	545	640		35	1065	275	
(2)	25	395	175		29	325	890		28	400	430	
Homei (1)	70	90	110		280	223	373		108	178	210	
(2)	108	325	120		115	100	158		175	360	240	
Shenkang (1)	133	63	75		213	63	173		133	78	60	
(2)	125	55	85		130	70	93		133	60	65	
Tatu (1)		210	46			140	81			88	79	
(2)		143	116			100	121			68	79	
Lungching (1)		78				120				68		
(2)		203	103			118	285			115	126	

[1] See table 1.

表三十二　指標作物監測站唐菖蒲植物體之錳含量 (ppm)（76 年 1 期）

Talbe 32. Manganese contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	105	130	375		115	100	680		100	310	675	
(2)	245	335	115		350	335	200		290	395	175	
Homei (1)	42	218	125		213	183	205		215	540	150	
(2)	80	165	140		145	100	178		90	48	93	
Shenkang (1)	475	45	173		118	120	193		170	53	95	
(2)	39	55	118		41	54	130		32	37	100	
Tatu (1)		20	139			48	208			53	88	
(2)		40	129			80	135			110	106	
Lungching (1)		128				148				38		
(2)		75	130			40	186			93	148	

[1] See table 1.

表三十三　指標作物監測站唐菖蒲植物體之鋅含量 (ppm)（76 年 1 期）

Talbe 33. Zinc contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	60	25	40		55	25	40		60	25	40	
(2)	70	40	40		60	50	35		65	35	40	
Homei (1)	35	28	28		23	13	13		28	28	25	
(2)	43	18	49		55	55	59		48	90	23	
Shenkang (1)	43	15	18		30	8	18		35	15	18	
(2)	45	10	15		30	8	15		40	13	15	
Tatu (1)		13	11			15	13			15	26	
(2)		10	13			40	11			13	19	
Lungching (1)		13				20				13		
(2)		28	21			25	14			13	10	

[1] See table 1.

表三十四　指標作物監測站唐菖蒲植物體之銅含量 (ppm)（76 年 1 期）

Talbe 34. Copper contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	23	20	20		17	14	15			16	16	
(2)	20	16	5		14	13	4		16	10	13	
Homei (1)	11	9	7		9	3	6		9	8	9	
(2)	9	5	7		7	6	6		10	5	6	
Shenkang (1)	11	7	8		7	5	8		9	6	5	
(2)	11	7	8		7	6	7		11	5	7	
Tatu (1)		8	8			4	9			6	8	
(2)		7	9			7	17			7	7	
Lungching (1)		5				6				3		
(2)		3	9			6	9			5	7	

[1] See table 1.

表三十五　指標作物監測站唐菖蒲植物體之鎳含量 (ppm)（76 年 1 期）

Talbe 35. Nickel contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	25	21	50		25	19	23		25	22	28	
(2)	20	18	25		20	19	24		35	23	24	
Homei (1)	12	16	9		12	12	10		10	13	12	
(2)	8	16	11		14	12	10		13	13	9	
Shenkang (1)	9	13	8		9	11	9		11	13	8	
(2)	8	12	8		10	12	6		10	9	8	
Tatu (1)		12	7			13	8			9	7	
(2)		14	9			11	9			13	11	
Lungching (1)		15				14				14		
(2)		10	8			10	7			12	7	

[1] See table 1.

表三十六　指標作物監測站唐菖蒲植物體之鉻含量 (ppm)（76 年 1 期）

Talbe 36. Chromium contents in the different parts and different stages of gladiolus plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]		14	19			17	21			25	23	
(2)		16	16			18	18			22	17	
Homei (1)	12	11	11		12	12	15		11	12	15	
(2)	13	15	12		12	10	12		11	15	13	
Shenkang (1)	12	11	13		12	11	11		11	12	10	
(2)	14	11	13		12	10	13		12	12	13	
Tatu (1)		9	9			8	9			8	8	
(2)		9	8			9	9			9	8	
Lungching (1)		9				11				9		
(2)		10	8			9	7			9	9	

[1] See table 1.

表三十七　指標作物監測站之甜玉米生育調查（76 年 1 期）

Table 37. The growth and yield of sweet corn at monitoring plots (1st crop, 1987)

Places	Crops	Plant height cm	Detah rate %	Flowered plants %	No. of flower per panicle
Huatan (1)[1]	Sweet corn Tainan 15	137	13.0	100	1,765
(2)	Sweet corn Tainan 15	145	15.2	117	2,448
Homei (1)	Sweet corn Tainan 15	146	18.0	154	3,850
(2)	Sweet corn Tainan 15	189	20.7	203	4,242
Shenkang (1)	Sweet corn Tainan 15	202	21.8	228	4,562
(2)	Sweet corn Tainan 15	170	20.9	188	4,241
Tatu (1)	Sweet corn Tainan 15	187	21.2	175	4,146
(2)	Sweet corn Tainan 15	183	21.4	166	4,026
Lungching (1)	Sweet corn Tainan 15	190	21.3	221	4,460
(2)	Sweet corn Tainan 15	166	15.2	121	3,194

[1] See table 1.

表三十八　指標作物監測站甜玉米植物體之氮含量 (%)（76 年 1 期）

Talbe 38. Nitrogen contents in the different parts and different stages of sweet corn plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	2.95	1.47	2.40		2.05	2.07	2.01		1.66	2.06	1.65	
(2)	2.68	2.73	2.45		2.00	1.78	2.01		1.49	1.28	1.37	
Homei (1)	2.86	2.20	2.33		2.04	2.02	2.26		1.69	1.80	2.31	
(2)	1.39	1.38	2.10		1.96	2.10	2.14		1.32	1.78	1.30	
Shenkang (1)	2.81	0.62	2.12		2.21	0.99	1.61		2.34	1.18	1.76	
(2)	3.24	0.90	1.72		2.32	1.86	1.39		1.95	0.96	0.60	
Tatu (1)		2.16	1.74			1.91	1.32			1.77		
(2)		1.53	0.56			1.23	0.80			1.34	0.45	
Lungching (1)		1.11	1.89			2.97	1.99			2.38		
(2)		2.88	1.09			1.63	0.94			3.59	0.61	

[1] See table 1.

表三十九　指標作物監測站甜玉米植物體之硫含量 (%)（76 年 1 期）

Talbe 39. Sulfur contents in the different parts and different stages of sweet corn plants (%) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	0.18	0.20	0.21		0.32	0.28	0.48		0.20	0.41	0.23	
(2)	0.41	0.16	0.35		0.33	0.47	0.43		0.35	0.17	0.21	
Homei (1)	0.17	0.08	0.25		0.15	0.13	0.19		0.08	0.14	0.38	
(2)	0.14	0.21	0.21		0.15	0.30	0.44		0.18	0.30	0.15	
Shenkang (1)	0.41	0.33	0.33		0.59	0.69	0.81		0.37	0.33	0.17	
(2)	0.20	0.13	0.11		0.27	0.51	0.56		0.22	0.11	0.13	
Tatu (1)		0.33	0.34			0.60	0.58			0.21		
(2)		0.16	0.39			0.35	0.49			0.19	0.21	
Lungching (1)		0.23	0.38			0.59	0.46			0.25		
(2)		0.45	0.30			0.64	0.32			0.26	0.43	

[1] See table 1.

表四十　指標作物監測站甜玉米植物體之氟含量 (ppm)（76 年 1 期）

Talbe 40. Fluorine contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	66	57	147		60	70	182		53	58	138	
(2)	79	72	397		91	81	334		82	55	176	
Homei (1)	82	13	12		83	13	12		84	12	11	
(2)	32	10	23		33	10	17		31	9	17	
Shenkang (1)	33	12	13		36	11	14		32	10	13	
(2)	59	10	13		54	10	14		43	11	12	
Tatu (1)		12	6			12	7			11		
(2)		9	9			8	9			8	8	
Lungching (1)		8	17			8	18			9		
(2)		9	11			8	11			8	7	

[1] See table 1.

表四十一　指標作物監測站甜玉米植物體之鐵含量 (ppm)（76 年 1 期）

Talbe 41. Iron contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	39	360	165		199	1130	1220		66	350	480	
(2)	27	125	160		49	130	1535		32	100	280	
Homei (1)	184	213	218		733	548	423		605	165	270	
(2)	178	115	100		423	530	538		200	318	265	
Shenkang (1)	228	78	100		458	540	598		133	120	173	
(2)	208	75	130		465	253	265		243	98	318	
Tatu (1)		210	141			293	371			105		
(2)		580	171			420	453			93	154	
Lungching (1)		110	119			255	385			125		
(2)		250	173			338	538			53	226	

[1] See table 1.

表四十二　指標作物監測站甜玉米植物體之錳含量 (ppm)（76 年 1 期）

Talbe 42. Manganese contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	75	95	230		205	255	220		95	55	165	
(2)	250	175	410		460	105	495		190	240	230	
Homei (1)	34	38	230		80	45	110		33	123	113	
(2)	150	263	150		365	73	200		70	78	125	
Shenkang (1)	98	38	158		250	188	313		83	145	100	
(2)	218	58	155		48	135	213		48	39	108	
Tatu (1)		78	158			108	164			115		
(2)		145	144			193	165			88	74	
Lungching (1)		128	158			475	150			68		
(2)		423	150			115	151			125	850	

[1] See table 1.

表四十三　指標作物監測站甜玉米植物體之鋅含量 (ppm)（76 年 1 期）

Talbe 43. Zinc contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	45	10	30		50	10	35		60	30	35	
(2)	65	15	40		60	25	35		80	30	40	
Homei (1)	20	5	18		15	10	13		20	8	15	
(2)	43	23	23		65	55	30		60	15	30	
Shenkang (1)	25	5	25		23	8	18		33	18	15	
(2)	38	18	28		40	13	20		50	18	30	
Tatu (1)		35	41			18	19			10		
(2)		15	45			15	15			40	21	
Lungching (1)		15	28			45	27			38		
(2)		10	29			28	40			20	69	

[1] See table 1.

表四十四　指標作物監測站甜玉米植物體之銅含量 (ppm)（76 年 1 期）

Talbe 44. Copper contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	19	12	21		23	15	23		18	16	22	
(2)	19	12	15		21	13	11		17	17	1	
Homei (1)	8	4	9		10	7	8		6	4	7	
(2)	12	4	14		17	8	17		10	5	11	
Shenkang (1)	10	4	10		11	7	12		8	6	7	
(2)	11	7	10		15	10	13		9	6	10	
Tatu (1)		2	18			3	14			6		
(2)		3	17			1	12			3	8	
Lungching (1)		4	16			7	12			4		
(2)		3	18			6	18			4	19	

[1] See table 1.

表四十五　指標作物監測站甜玉米植物體之鎳含量 (ppm)（76 年 1 期）

Talbe 45. Nickel contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]	10	21	15		10	18	19		30	17	17	
(2)	15	18	25		25	19	21		25	20	20	
Homei (1)	8	13	10		10	15	8		9	13	9	
(2)	9	15	10		10	14	11		11	16	12	
Shenkang (1)	11	10	10		9	9	9		7	12	10	
(2)	9	10	8		7	12	8		7	9	8	
Tatu (1)		13	7			14	8			12		
(2)		12	7			10	8			16	9	
Lungching (1)		11	7			11	8			14		
(2)		12	7			12	7			14	8	

[1] See table 1.

表四十六　指標作物監測站甜玉米植物體之鉻含量 (ppm)（76 年 1 期）

Talbe 46. Chromium contents in the different parts and different stages of sweet corn plants (ppm) (1st crop, 1987)

Places	Upper leaves				Lower leaves				Whole plant			
	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days	25 days	50 days	75 days	100 days
Huatan (1)[1]		20	15			21	19			21	18	
(2)		17	14			15	18			15	18	
Homei (1)	13	11	12		12	14	13		12	10	16	
(2)	12	10	11		14	9	12		13	10	14	
Shenkang (1)	14	9	9		15	11	12		12	10	11	
(2)	14	10	12		12	12	13		13	11	17	
Tatu (1)		9	8			8	9			9		
(2)		10	8			8	10			9	8	
Lungching (1)		9	9			10	8			10		
(2)		9	8			9	8			9	8	

[1] See table 1.

表四十七　指標作物監測站之土壤分析結果（76年1期）

Table 47.　Analyses of the soils in the monitoring plots (1st crop, 1987)

	Places	Texture	PH	EC mmhos/cm	OM %	SO_4- S ppm	Extr F ppm	Exchangeable				Extractable					
								K	Na ppm	Ca	Mg	Fe	Mn	Zn ppm	Cu	Ni	Cr
Huatan	(1) P addy	L	5.9	0.76	2.75	71	3.8	108	78	1060	267	722	147	2.6	5.7	8.5	3.2
	Upland	L	5.1	0.60	2.48	60	6.3	50	54	970	249	410	117	2.5	4.5	8.5	2.5
	(2) Paddy	SL	6.3	0.53	1.79	59	3.8	75	60	800	222	955	166	2.5	6.0	8.0	3.8
	Upland	SL	4.3	1.00	2.06	118	8.9	58	48	560	121	448	109	2.6	4.8	9.3	1.8
Homei	(1) P addy	SiL	6.2	0.17	0.69	1	1.5	42	30	620	160	233	54	2.5	2.0	9.7	3.8
	Upland	fLS	7.7	0.20	0.96	20	2.5	33	42	1480	312	463	137	2.5	3.5	7.7	5.2
	(2) Paddy	L	5.4	0.28	2.61	75	1.8	58	48	1190	284	698	25	2.7	8.8	9.7	2.0
	Upland	fLS	4.2	1.66	1.24	210	8.8	91	36	670	117	420	29	2.7	5.0	9.1	1.8
Senkang	(1) P addy	LS	6.6	0.99	1.79	130	3.6	33	60	980	229	860	81	2.7	4.3	9.0	1.3
	Upland	LS	7.3	1.01	0.69	124	3.3	66	54	760	187	395	71	2.6	2.3	8.3	0.8
	(2) Paddy	LS	7.5	0.41	1.79	24	2.0	54	42	1130	282	543	35	2.6	5.3	9.8	4.5
	Upland	SL	6.2	0.18	1.24	4	1.5	54	30	600	146	305	33	2.5	3.5	7.7	0.3
Tatu	(1) P addy	fSL	5.5	0.30	1.24	37	2.9	42	36	610	160	740	14	2.5	3.5	8.5	5.0
	Upland	fSL	4.3	4.01	1.05	288	9.3	58	54	980	163	420	15	2.5	2.5	8.5	2.0
	(2) Paddy	SL	4.8	0.48	1.65	82	2.6	50	42	590	144	610	15	2.6	4.5	8.3	1.8
	Upland	SL	5.1	0.22	1.51	18	3.3	66	72	710	182	335	16	2.5	3.8	8.6	1.8
Lungching	(1) P addy																
	Upland	SL	4.8	0.90	2.06	55	4.3	83	48	610	151	940	33	2.6	4.0	8.2	2.8
	(2) Paddy	SL	5.7	0.23	2.61	88	1.5	66	66	1050	282	733	16	2.6	6.3	9.5	1.5
	Upland	SiL	5.5	0.64	2.48	87	1.3	91	94	1450	333	430	23	2.6	7.0	6.8	2.9

誌　　謝

本試驗承蒙蕭金惠小姐協助花壇、和美、伸港等三個監測站之田間管理和採樣並辦理氟硫之測定工作；廖珮蘭小姐協助植物樣品及土壤中一般元素之分析；張清津先生協助大肚和龍井等二個監測站之田間管理和採樣工作，試驗之安排規劃則承行政院農業委員會農糧處及臺灣省政府農林廳植保科指導，謹此誌謝。

參考文獻

1. 李國欽、李貽華　空氣污染爲害植物之診斷　臺灣植物保護中心　p. II-1~13, III-1~11。
2. 莊進源、孫岩章　空氣污染公害之鑑定技術及圖鑑　行政院衛生署環境保護局 p. 17-66。
3. 山添文雄　1962　氟化水素　烟害　實態　機作　關　研究　農技研報告 B12:1-125。
4. 山添文雄、真弓洋一　1975　大氣污染　植物被害　鑑定法　關　研究　農技研報告 B27:1-60。
5. 米丸忠太郎　1927　亞硫酸　植物　及　障害作用　農事試報告 47:1-102。
6. 涉谷政夫等　1975　大氣污染　環境污染　農業（博友社） p. 25-93。
7. Brewer, R. F. 1966 Fluorine. In “Diagnostic criteria for plants and soils” p. 180-196, ed. By H. D. Chapman.
8. Page, A. L. 1982. Soluble fluorine and sulfur In “Methods of Soil Analysis” p. 472-473, 501-538, Amer. Soc. Agronomy.
9. Richter, D. D., and D. W. Johnson. 1983. Determination of inorganic sulfate in foliage with barium chloranilate. Soil Soi. Soc. Am. J. 47: 522-524.
10. Sun, E. J., and H. J. Su. 1985. Fluoride injury to rice plants caused by air pollution emitted from ceramic and brick factories. Environmental pollution (series A) 37: 335-342, Bureau of Environmeutal Protection, ROC.
11. Thomas, M. D., and G. R. Hill. 1935. Absorption of sulfur dioxide by alfalfa and its relatin to leaf injury. Plant Physiol. 10: 291-307.
12. Thomas, M. D., and G. R. Hill 1937. Relation of sulfur dioxide in the atmosphere to photosynthesis and respiration of alfalfa. Plant Physiol. 12: 309-383.
13. Zelitch, I. 1957. α-hydroxysulfonates as inhibitor of the enzymic oxidation of glycolic and lactic acids. J. Biol. Chem. 224: 251-260.

An Experiment of Monitoring Air Pollutants by Indicator Plants[1]

C. F. Hsieh[2]

ABSTRACT

This experiment is aimed at studying the feasibility for usiing indicator plants to monitor the air pollutin. As the air pollutants are versatile and the suitable indicator plants are different with pollutants, this experiment only selected three crops, peanut, gladiolus, and corn for detecting the two most prevalent air pollutants, fluorides and sulfur dioxide. Since rice is a staple crop in this district, and rose is a tolerant crop to air pollutants, their responses to the above two air pollutants are also investigated for ref rence.

In this experiment 5 monitoring stations have been established at the five twonships, Huatan, Homei, Shenkang, Tatu, and Lungching. Each station consists of two monitoring plots, one of them closer and another more separated from the source of air pollutants. Huatan Station has been established for monitoring brickfactory gases, and the other four stations at Homei, Shenkang, Tatu and Lungching have been established for monitoring the supposed air pollutants from Taichung Power Station which will start operation in recent years. All the indicator plants were seeded or planted in the first crop and second crop season in accordance with the local planting time. Their leaf symptoms and growth were investigated and recorded periodically, and their plant samples were also collected for the analyses of total nitrogen, soluble sulfate, fluorine, iron, manganese, zinc, copper, nickel, and chromium. The results are summarized as follows:

1. Leaf symptoms and growth data of the indicator plants suggested that there was no significant air pollutants appeared in the monitoring plots in Taichung Power Station area during the period of July, 1986 to June, 1987. Plant analysis also showed no significant accumulation of air pollutants in the plant leaves.
2. Serious leaf symptoms and growth retarding of indicator plants which was a clear evidence of air pollution was found in the monitoring plots in brickfactory area. The concentration of pollutants in the indicator plants in this area was higher than those in the normal area. The dominant pollutant wsa hydrogen fluoride which at the concentration of 5-15 ppb caused clear visible symptoms and significant accumlation of

[1] Contribution No. 0144 of Taichung DAIS

[2] Associate soil scientist of Taichung DAIS

fluorine in all indicator plants. Another important pollutant was sulfur dioxide which at the concentration of 10-50 ppb did not cause significant visible symptoms on indicator plants, however the soluble sulfate in the leaves was generally higher than those in the normal area. Besides the manganese and nickel contents in the idicator plants were higher than in the normal area.

3. Gladiolus and peanut are the two most ideal indicator plants for monitoring fluorine pollution. As to the sulfur dioxide, ti is necessary to wait for developing some more sensitive indicator plants to achieve better monitoring results.
4. Monitoring air pollution with indicator plants is an economical, effective and practical way.
5. However, leaf analysis is also an effective and reliable way for monitoring fluorine pollution.