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病毒對甘藷農藝性狀的影響[1]

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摘要：甘藷臺農63號及臺農57號田間自然複合感染病毒株（Vc 病株），其塊根產量分別比健株極顯著減產 30.8% 及 33%，莖葉產量亦分別減產 24.3% 及 6.7%，但 SPV-A 及 SPV-N 病毒單獨感染或二者複合感染株，其塊根及莖葉產量等農藝性狀與健株比較則無顯著的差異，同時 V_c 病株及 SPV-A 與 SPV-N 單獨或複合感染之病株，對莖葉及塊根主成分含量亦無顯著的影響，顯示本省甘藷自然感染病毒之病株中，尚有嚴重影響產量的重要因子存在，有待進一步的研究。

甘藷（*Ipomoea batatas* Lam.）是本省重要的輔助糧食作物，栽培面積曾高達 24 萬公頃，雖然歷年來各試驗場所均有豐產的優良品種育成，推廣栽培，但單位面積鮮藷產量並未顯著提高。據69年度臺灣省農業年報統計，收穫面積已降爲 6 萬餘公頃，平均每公頃之鮮藷產量僅達 16.6 公噸[(1)]，且多數優良品種有劣變之跡象，此現象可能爲病毒所引起。廖等[(11)]曾從甘藷田間複合感染病毒株中分離出兩種長型病毒，其中甘藷病毒 A（SPV-A）能經蚜蟲以非永續性方式傳播，其寄主範圍限於旋花科及黎科植物；而甘藷病毒 N（SPV-N）則能感染旋花科、黎科及少數茄科植物，但媒介昆蟲未詳。鐘等[(4)]報告由複合感染病毒之臺農63號病株亦分離得甘藷捲葉病，雖未證明爲病毒所引起，但亦爲甘藷的系統性病害。廖和鐘[(12)]及廖等[(13)]報告，複合感染甘藷病毒株經熱處理配合莖頂組織培養，可培育出相當高比率的無病毒苗。鐘等[(3)]又報告數種甘藷品種之病毒複合感染株的塊根產量比無病毒苗極顯著減產 24.5～55.9%。本文爲探討 SPV-A 與 SPV-N 病毒對甘藷臺農 57 號及臺農63號之產量、品質等農藝性狀的影響，以提供栽培管理及育種的參考。

材料與方法

本試驗分二年進行，民國69年 9 月至70年 2 月間，在臺中縣霧峰鄉臺灣省農業試驗所農場舉行，土壤爲礫質壤土，供試品種爲臺農63號，民國70年 9 月至71年 2 月間，在嘉義農業試驗分所農場舉行，土壤爲砂質壤土，供試品種爲臺農57號。二供試品種之病毒複合感染株（以下簡稱 Vc 病株），均採自田間，且經血清及指示植物測定，至少複合感染有 SPV-A 及 SPV-N 二種以上的病毒。無病毒苗爲從 Vc 病株經 38 °C熱處理，配合莖頂培養所培育的試管苗，並經血清或指示植物檢定不含SPV-A, SPV-N 病毒及甘藷捲葉病的健株。SPV-A 及 SPV-N 單獨感染及二者混合感染的罹病株，均由健株以人工接種獲得，各供試株均在隔離網室內繁殖。

1.臺灣省農業試驗所　研究報告等 1104號，本研究爲第一作者碩士論文之部分，研究期間蒙行政院國科會輔助經費，稿成後蒙本所劉大江博士斧正，謹此致謝。
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田間規劃：採逢機完全區集設計，試區行長 8 m，行距 1m，株距 0.25 m，單行區，重複6次，生育期五個月，種植前每公頃施用 10% 必滅松粒劑（10% Primicid G.）30 kg，以防除地下害蟲。生育期中每個月各噴90% 萬靈可濕性粉劑（90% Lannate W. P.）及 50% 萬力可濕性粉劑（50% Benlate W. P.）1000 倍液1次。

採收時調查其莖葉及塊根產量、乾物率等，其各部位的主成分分析則以 Micro-Kjeldahl 法分析乾物粗蛋白質含量，Clegg 氏法粹取乾物可溶性醣及澱粉，粹取液再以 Mc Cready 氏等的分析測定法，經光電比色計測定澱粉及可溶性醣含量。

結　　果

採收時莖葉及塊根產量等農藝性狀及品質分析調查結果列於表1，雖然採收時各處理莖蔓已呈老化，老葉枯黃或脫落，但 Vc 病株的莖葉產量仍較臺農57號及 63號健株分別減產6.7%及24.3%，且臺農 57 號 Vc 病株的蔓長、節間長均顯著的短於健株。葉面積及莖葉乾物率除臺農57號之 Vc 病株莖乾物率稍高外，則無顯著差異。莖葉主成份分析結果，葉部粗蛋白質含量及莖部澱粉含量，在供試二品種中 Vc 病株的含量互異，臺農 63 號 Vc 病株葉部粗蛋白質含量高於健株，莖澱粉含量則低於健株，但臺農 57 號 Vc 病株葉部粗蛋白質含量低於健株，而莖部澱粉含量則高於健株。除此之外，莖乾物粗蛋白質含量，莖葉可溶性醣含量及葉澱粉含量等，在病株與健株間則無顯著的差異。

供試二品種臺農 57 號及臺農 63 號的 Vc 病株塊根產量分別比健株極顯著減產30.8%及33%。供試二種病毒中，除臺農 57 號之 SPV-N 病株塊根較健株顯著減產外，臺農 63 號之 SPV-N 病株及 SPV-A 單獨或與 SPV-N 混合感染，對二供試品種塊根產量則無顯著影響。

由塊根乾物成份分析結果，除臺農 63 號 Vc 病株可溶性醣含量有顯著降低外，其餘如粗蛋白質含量、澱粉含量等，在病株與健株間均無顯著的影響。

討　　論

根據前人研究報告指出作物感染病毒後除植株乾物產量（total dry yield）或經濟產量（economic yield）均有降低的趨勢外 [6,8,14]，亦可因品質低劣而影響商品價值 [2,7]。產量損失情形因病毒種類 [6]、作物品種及其對病毒的抗病性 [2,9] 以及感染病毒的生育期不同而異 [8,14]。本文發現複合感染多種病毒之病株產量均極顯著低於健株的結果與許多學者報告多種病毒複合感染之甘藷，可嚴重影響塊根產量的結果極爲一致，而 SPV-A 與 SPV-N 單獨或混合感染株與健株間的差異不顯著，但仍受病毒感染的影響，產量略低於健株，此一結果顯示本省甘藷感染的病毒除 SPV-A 與SPV-N外，尚有對塊根產量影響更大的病毒或系統性病害存在。由甘藷莖葉及塊根的主要成份分析結果得知，病株與健株間各成份含量的差異多不顯著，故本省甘藷病毒對塊根品質並無重大的影響。但病毒的危害仍可能爲歷年來優良甘藷品種產量下降及劣變的主因，有關這方面的問題有待更進一步的研究。

Table 1. Effect of sweet potato viruses on the agronomic characters of varieties Tainung 63 and Tainung 57

Items of measurement	Tainung 63[1]					Tainung 57[2]				
	Vc[3]	A	N	AN	H	Vc	A	N	AN	H
Stem and leaf										
Fresh top yield (tons/ha)[4]	20.3[b]	26.8[a]	26.6[a]	25.5[a]	26.8[a]	12.5[b]	13.3[b]	16.2[a]	12.8[b]	13.4[b]
Vine length (cm)	—	—	—	—	—	69.57[b]	86.28[a]	84.75[a]	84.98[a]	84.78[a]
Leaf area (cm^2/leaf)	—	—	—	—	—	27.11	29.56	27.21	28.01	26.74
Stems/plant	—	—	—	—	—	6.97	6.90	7.88	6.98	7.02
Internode length (cm)	—	—	—	—	—	1.96[b]	2.43[a]	2.36[a]	2.35[a]	2.39[a]
Dry matter content of leaf (%)	19.57	19.94	19.79	19.94	19.34	19.79	19.28	19.00	19.37	19.25
Dry matter content of stem (%)	12.63	12.34	12.37	12.73	12.24	12.59[a]	10.47[b]	11.18[b]	10.87[b]	10.99[b]
In dry matter										
Leaf crude protein (%)	22.66[a]	22.07[abc]	21.43[c]	21.70[bc]	22.49[ab]	19.79[b]	21.80[a]	21.02[ab]	21.76[a]	20.82[ab]
Stem crude protein (%)	6.77	6.46	5.99	6.09	6.51	5.92	5.79	5.96	6.25	6.09
Leaf soluble sugar (% as glucose)	5.99	6.13	5.99	6.18	6.06	11.53	12.40	12.11	14.38	14.10
Stem soluble sugar (% as glucose)	16.55	17.25	17.32	17.71	17.49	23.45	24.51	24.83	22.95	23.10
Leaf starch (% as glucose)	1.98	1.94	2.04	2.00	2.05	6.34	6.43	6.28	7.57	7.35
Stem starch (% as glucose)	2.57[b]	2.86[ab]	3.63[a]	3.19[ab]	3.44[a]	4.27[a]	2.88[b]	3.20[b]	3.10[b]	2.94[b]
Fleshy root										
Fresh yield (tons/ha)	29.4[b]	39.3[a]	39.6[a]	41.8[a]	42.5[a]	21.7[c]	31.8[a]	28.7[b]	31.1[ab]	32.4a
Dry matter (%)	21.11[a]	19.51[b]	19.63[b]	19.86[b]	19.57[b]	30.39	29.52	29.50	28.43	28.20
Dry yield (tons/ha)	6.2[b]	7.6[a]	7.7[a]	8.3[a]	8.3[a]	6.6[b]	9.4[a]	8.5[a]	8.8[a]	9.1a
In dry matter										
Crude protein (%)	8.80	8.92	8.31	7.80	8.88	3.87	3.42	3.97	4.16	3.40
Soluble sugar (% as glucose)	12.73[b]	13.96[a]	14.84[a]	14.79[a]	14.44[a]	12.18	12.15	11.98	12.50	11.80
Starch (% as glucose)	32.92[b]	29.65	30.83	30.80	28.67	75.32	75.04	71.62	72.20	73.46

1. Trial at TARI, from Sept. 1980 to Feb. 1981.
2. Trial at Chiayi Agricultural Experiment Station (TARI), from Sept. 1981 to Feb. 1982.
3. Vc : Viruses complex infected plant. A : SPV-A virus infected plant N : SPV-N virus infected plant. AN : Both SPV-A and SPV-N viruses infected plant.
4. Means followed by a common letter are not significantly different at 0.05 level (Duncan's multiple range test).

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Influence of Sweet Potato Viruses on the Performances of Some Agronomic Characteristics of Sweet Potatoes (*Ipomoea batatas* (L.) Lam.)[1]

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Summary

Healthy and virus-free sweet potato seedlings of two varieties, Tainung No. 57 and Tainung No. 63, were obtained through the combination of heat treatment (38 °C) and shoot-tip culture techniques. Sweet potato virus A (SPV-A), sweet potato virus N (SPV-N) and SPV-A+SPV-N were inoculated onto healthy and virus-free seedlings to determine their possible detrimental effects on the yield and some agronomic characteristics. Plants carrying a virus complex (Vc) obtained directly from the field were also used for comparison. Results indicated that sweet potato plants subjected to various types of virus inoculations showed no difference in crude protein, soluble sugar and starch contents in the root and top stem on a dry weight basis. Tainung No. 57 and Tainung No. 63 carrying a virus complex (Vc) yielded 33% and 31%, respectively, less fleshy root than the healthy plants. The corresponding values of the yield reducation of stem plus leaf were 7% and 24% for the two varieties. However, yields of both root tuber and stem plus leaf were not affected by the infection of SPV-A, SPV-N or SPV-A+SPV-N. It suggested that some systematic disease agent (s) other than SPV-A and SPV-N which have not yet determined might exist.

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