臺東區農業改良場研究彙報 9：1～17（1998）

竹芋栽培技術之研究

黃 秋 蘭[1]

摘　要

竹芋外型優美，種類多，可供盆栽及切葉用。爲探討栽培措施對其生育之影響，本試驗以 15 種竹芋爲材料，分別進行適應性觀察、繁殖、肥培及遮光處理等研究。首先觀察在臺東地區栽培的適應性，結果以箭尾竹芋等 9 種適應性良好，其中箭尾竹芋及紅羽竹芋既可盆栽亦可切葉栽培，是本區值得推介栽培的種類。竹芋一般繁殖方式以分株及扦插爲主，其中彩虹竹芋、圓葉竹芋及斑馬竹芋分株繁殖速率最慢。可行扦插繁殖的種類有馬山竹芋、雙色竹芋及黃斑竹芋。

不同液態肥料種類影響竹芋生育，其中浪星竹芋以 $N-P_2O_5-K_2O=30-10-10$ 施用，生育初期株高較高，且中後期之葉片數亦維持較多，施肥次數以一至二週一次者，株高較高。孔雀竹芋生育初期各處理間差異不顯著，中後期以 $N-P_2O_5-K_2O=30-10-10$ 施用，其株高、葉柄長及葉片數較高，而施肥次數以每週一次，葉片數最多。箭尾竹芋生育初期各處理間差異不顯著，中後期以 $N-P_2O_5-K_2O=20-20-20$ 施用，其株高及葉柄長較高，但以 $N-P_2O_5-K_2O=30-10-10$ 施用，葉片數最多，而施肥次數至後期三週一次，葉片數最少。

紅羽竹芋對緩效性肥料不同劑量之處理，於生育初期即有顯著的反應，無論株高、葉柄長、葉長、葉寬或完整葉片數，皆以施用 5 克者最優，並隨施用劑量之增加而遞減。箭尾竹芋對不同肥料劑量之反應更爲敏感，受傷枯化葉片數隨施用劑量之增加而增加。

慧心竹芋以 75%、紅羽竹芋以 85%、箭尾竹芋以 95%遮光處理下生育較優。切葉產量及品質於 85%、90%及 95%遮光處理下進行比較，紅羽竹芋各處理間差異不顯著，但綜合各性狀，如葉柄長、葉片長、葉片寬、葉厚及瓶插壽命，則以 90%遮光率較佳，切葉產量則以 85%遮光率較高。箭尾竹芋各品質性狀以 90%～95%遮

[1] 臺東區農業改良場助理研究員。

光率處理較好，切葉產量以 95%遮光率處理較多。

關鍵詞：竹芋、栽培、肥料、遮光。

前　言

竹芋科（Marantaceae）又稱爲葛鬱金科，原產熱帶非洲及中南美洲，約有三十屬近四百多種原生種，園藝上常見的種類大部分屬於竹芋屬、葛鬱金屬、錦竹芋屬等三屬。其園藝特性爲葉形變化多，葉表具獨特臘質、光澤及多彩斑紋，葉背則爲紅紫色，對比鮮明美麗，爲極佳之觀葉或觀花植物。

近年花農引入本省栽培，結果發現各品種之生育習性，及對光線、溫度、水分的要求不一，面臨栽培技術困境。而國外之栽培研究，大多數針對孔雀竹芋一品種。Verdonck & Cappaert[24] 認爲以樹皮 (wet bark)及每立方米施用 2 公斤 Plantsan 4D (20-10-15-6)肥料，對孔雀竹芋栽培效果最好。Conover & Poole[12,17,19] 對栽培孔雀竹芋推薦介質爲 3 泥炭土(peat) : 1 砂(sand) ; 施用肥料爲 Osmocote (14-14-14)。Chase & Poole[9,10] 以 Osmocote (19-3-10)及 Osmocote (19-6-12) 對 5 種竹芋進行施用量試驗結果以 5-14g/5-inch pot/3 months 可得較佳品質。Basoccu[5] 以 GA_3 噴施孔雀竹芋，可增加葉柄長及葉面積，但葉數會減少。Conover & Poole[11]建議竹芋之栽培光度爲 1000-2000 foot-candle。而 Mulkey 等[16]以遮蔭栽培 *C. inocephala* 反而使新葉之生成減少。Czerwinski 等[13]推論竹芋葉尖枯萎與 Cl^- 累積有關。Pool & Conover[18] 試驗證明最高氣溫超過 38℃，孔雀竹芋品質會降低。可見竹芋對環境反應較爲敏感，且各品種間差異頗大，故而本研究除觀察各竹芋品種在本區的適應性,以篩選適栽品種外，並探討浪星竹芋、孔雀竹芋、紅羽竹芋及箭尾竹芋在本區氣候條件下，最適之肥培管理方法與遮陰程度，期能提供花農做爲栽培上之參考。

材料與方法

品種適應性與繁殖觀察

本項觀察參試的品種計有竹芋屬之 11 品種、錦竹芋屬之 2 品種及葛鬱金屬之 2 品種，共計 15 品種。採用 5 吋盆盆栽，於溫室內栽培觀察。並取馬山竹芋、雙色竹芋及黃斑竹芋之頂芽與莖段，進行扦插繁殖觀察。

液態肥料種類與施用次數對竹芋生育的影響

本項試驗以箭尾竹芋、孔雀竹芋、浪星竹芋等三種參試。試驗採完全逢機複因子設計，四重複，因子一爲市售三種不同 $N-P_2O_5-K_2O$ 比例之速效肥料，分別爲 30-10-10、20-20-20、15-20-25。因子二爲三種不同施用次數，分別爲每週一次、二週一次、三週一次。共計九處理組合。每小區爲十盆，盆缽採用 5 吋盆，介質爲泥炭土:樹皮堆肥:粗蛇木屑=2:1:1(V:V:V)，並於盆底施用緩效性粒狀肥（14-14-14）5g/pot 做爲基肥。每兩個月調查一次，調查項目爲株高、葉柄長、葉長、葉寬、葉片數。

緩效性肥料用量對竹芋的生育影響

本項試驗的參試品種爲紅羽竹芋及箭尾竹芋。肥料種類爲市售 $N-P_2O_5-K_2O$ 比例爲 18-6-12 之緩效性粒狀肥料。試驗採用完全逢機設計，四重複，肥料施用量分別爲 5g、10g、15g、20g、25g，共計五處理，每小區爲十盆，盆缽採用 5 吋盆，介質爲泥炭土:樹皮堆肥:粗蛇木屑=2:1:1(V:V:V)。調查項目爲株高、葉柄長、葉長、葉寬、葉片數(完整葉片數及受傷葉片數)。

遮光度對竹芋生育的影響

本項試驗的參試品種爲箭尾竹芋、紅羽竹芋及慧心竹芋。試驗採完全逢機設計，遮光處理爲 75%、85%及 90%等三種遮光率，三重複。作畦栽培，小區面積爲 0.9m×1.5m＝1.35m^2，行株距 30cm×30cm，二行植，每小區爲十株。調查項目爲株高、葉柄長、葉長、葉寬及葉數。

遮光度對竹芋切葉產量及品質的影響

本項試驗的參試品種爲紅羽竹芋及箭尾竹芋。試驗採完全逢機設計，遮光處理爲 85%、90%及 95%等三種遮光率，四重複。於簡易溫室栽培床栽培，以行株距 30cm×30cm 種植，每小區爲八株。每兩個月進行切葉調查一次，測量其葉柄長、

葉長、葉寬、葉面積、葉厚及切葉數，並進行瓶插壽命調查。

結果與討論

品種適應性與繁殖觀察

竹芋原生熱帶地區，屬嗜陰性植物，須遮陰栽培，尤其在夏季強光下，遮光程度須在 60%以上，才能避免葉片日燒。各品種在本區盆栽試種觀察結果如表一所示。孔雀竹芋(*C. makoyana*)適合盆栽及切葉，瓶插壽命達 17-20 天，唯在本區適應性並非極佳，夏季高溫植株生長較差，以分株繁植爲主，繁殖速率屬中等，

表一、竹芋科植物各品種之適應性、繁殖方式及速率

Table 1. The adaptability,propagation method and rate of Calathea.

		Propagation	
	Adaptability	Method	Rate[1]
1. *Calathea makoyana*	medium	dividing	medium
2. *Calathea insignis*	good	dividing	medium
3. *Calathea ornata*	good	dividing	medium
4. *Calathea rosepicta*	medium	dividing	slow
5. *Calathea zebrina*	medium	dividing	slow
6. *Calathea rotundifolia*	medium	dividing	slow
7. *Calathea leopardina*	good	dividing	fast
8. *Calathea rufibarba*	good	dividing	fast
9. *Calathea louisae*	good	dividing	fast
10. *Calathea stromata*	medium	dividing	fast
11. *Calathea orbifolia*	good	dividing	medium
12. *Maranta bicolor*	good	cutting	fast
13. *Maranta leuconeura*	good	cutting	fast
14. *Ctenanthe lubbersiana*	good	cutting	fast
15. *Ctenanthe oppenheimiana*	bad	dividing	fast

[1] Slow, medium and fast represents the propagation ratio below 5 plants per year, between 5-10 plants per year and above 10 plants per year, respectively.

每年有 6-8 個分株。箭尾竹芋(*C. insignis*)適合盆栽及切葉，瓶插壽命達 18-23 天，適應性良好，全年生育皆良好，尤以秋至翌春期間生長較快。以分株繁殖，每年約有 5-8 個分株。紅羽竹芋(*C. ornate*)適合盆栽及切葉，瓶插壽命達 18-23 天，適應性良好，以夏季生長快速，春季有紅蜘蛛發生，至夏季不藥而癒，以分株繁殖爲主，年約有 4-7 個分株。彩虹竹芋(*C. rosepicta*)、斑馬竹芋(*C. zebrina*)、圓葉竹芋(*C. rotundifolia*) 此三品種葉形較大，盆栽非常美麗，唯在夏季高溫期長較差，且分株繁殖率低，年約 2-3 株。熊貓竹芋(*C. leopardina*)葉片翠綠，適合盆栽，適應性良好，全年不斷開花與分株，將花芽摘除可使延緩葉片黃化，分株繁殖率高，年約 7-8 株。爲極易爲紅蜘蛛爲害，須注意防治。浪星竹芋(*C. rubibarba*)適合盆栽，切葉瓶插壽命達 20-24 天，唯葉表具細絨毛，插花市場之接受力較弱，適應性良好，生長勢非常旺盛，尤其以夏季高溫期生長更快速，分株繁殖率高，年約 8-12 株，唯寒流期間葉緣易枯萎。白竹芋 (*C. louisae*)，適合盆栽及切葉，瓶插壽命 18-23 天，適應性良好，分株繁殖，每年約有 5-7 個分株。鳳眉竹芋(*C. stromata*)，爲小型盆栽與吊盆，在秋至翌春之期間生長較好，夏季高溫期葉片易黃化枯萎，分株繁殖率高，可年分 10-20 株。優雅竹芋(*C. orbifolia*)，適應性良好，基部於春季開白色小花，具香味，以分株繁殖，每年約有 4-6 個分株。雙色竹芋(*M. bicolor*)、馬山竹芋 (*M. leuconeura*)，適合盆栽及吊盆，適應性良好，前者須注意介殼蟲防治，可以扦插繁殖，以頂芽扦插，不論以蛭石、珍珠石或粗砂爲介質，發根率皆在 80%以上；若以單葉單節扦插則發根率在 80%以下，尤其馬山竹芋以蛭石及珍珠石爲介質，其發根率僅 13%(表二)。黃斑竹芋 (*C. lubbersiana*)，適合盆栽，亦可扦插繁殖，適應性良好。慧心竹芋 (*C. oppenheimiana*)，雖極易分株，繁殖速率快，惟在夏季或寒流期間，葉尖極易枯萎，失去觀察價值。

液態肥料種類與施用次數對竹芋生育的影響

本試驗自 83 年 8 月開始進行施肥處理，每二個月調查一次植株生長情形，全期 8 個月，共計調查四次，結果如表三～五所示。

浪星竹芋經處理 2 個月後，不同肥料處理間，株高及葉寬有顯著差異，以 30-10-10 處理者，株高較高。4 個月後，不同肥料處理間，葉片數有顯著差異，亦以 30-10-10 處理者較多，以 15-20-25 處理者偏少；施肥次數間，葉柄長度有

顯著差異，以三週一次者較短。8 個月後，不同肥料處理間，葉片數達極顯著差異，以 30-10-10 處理者較多；施肥次數間，株高及葉柄長度有顯著差異，以三週一次者較小。

表二、竹芋於不同介質扦插後一個月,其發根率、根長及根數

Table 2. Rooting ratio,root length and number under potting medium for one month after cutting of Calathea.

Cutting media	*M. leuconeura*		*M. bicolor*		*Ctenanthe lubbersiana*
	Top shoot	Single node shoot	Top shoot	Single node shoot	
		Rooting ratio (%)			
Vermiculate	100	13[b]	80	53[b]	80
Perlite	80	13[b]	100	80[a]	100
Sand	100	53[a]	100	80[a]	60
		Root length (cm)			
Vermiculate	2.4	0.8[b]	4.4[a]	2.0	3.3
Perlite	2.0	0.5[b]	2.1[b]	1.6	2.8
Sand	1.7	2.2[a]	4.4[a]	1.9	3.5
		Root number (no.)			
Vermiculate	4.6[b]	1.0[b]	7.0[a]	3.1	3.0
Perlite	2.6[c]	1.0[b]	4.2[b]	4.1	2.8
Sand	7.8[a]	3.6[a]	8.2[a]	2.7	4.2

[1] Means within each column followed by the letter are not significantly at 5% level by L.S.D. test.

孔雀竹芋生育初期各處理間差異不顯著，至 4 個月後，葉片數於各處理間達顯著差異，以 20-20-20 肥料處理者葉片數最多，以 15-20-25 肥料處理者葉片數最；以每週施肥一次者，葉片數最多，以三週施肥一次者，葉片數最少。6 個月後及 8 個月後，不同肥料處理間，株高、葉柄長及葉片數皆達顯著差異，以 30-10-10 處理者，株高較高，葉柄較長，葉片數亦較多，以 15-20-25 處理者，株高較低，葉柄較短，葉片數亦較少；施肥次數間，葉片數有顯著差異，以每一週一次者葉片數較多，每三週一次者葉片數較少。

箭尾竹芋在生育初期各處理間差異不顯著，至六個月後，不同肥料處理間株高、葉柄長及葉寬有顯著差異，以 20-20-20.處理者爲最大，以 15-20-25 處理者爲最小。至八個月後，不同肥料處理間，株高、葉柄長及葉片數有顯著差異，以 20-20-20 處理者，株高較高，葉柄較長，葉片數較少，以 30-10-10 處理者，株高較低，葉柄較短，但葉片數較多；施肥次數間，則以葉片數有顯著差異，以每週一次者較多，三週一次者較少。

表三、施用液態肥料對浪星竹芋生育之影響

Table 3. Influences of liquid fertilizer on the growth of *Calathea rufibarba* .

(1994.8-1995.4)

Treatment	Plant height (cm)	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Leaf number (no.)
Fertilizer kind[1]					
30-10-10	57.5	35.6	23.9	4.8	41.6
20-20-20	58.1	35.7	24.3	4.8	38.4
15-20-25	58.0	34.0	23.7	5.0	36.2
Fertilizing frequency					
1 time / week	58.2	35.3	24.1	5.0	39.9
1 time / biweek	59.4	35.9	24.1	4.9	39.2
1 time / triweek	55.9	34.1	23.7	4.8	37.1
Significant effects[2]					
Kind	NS	NS	NS	NS	**
Frequency	*	*	NS	NS	NS
Kind * Frequency	*	*	NS	NS	NS

[1] 30-10-10,20-20-20,15-20-25 respective different ratio of $N:P_2O_5:K_2O$.

[2] Significant at 1% (**) or 5% (*) levels, no significance (NS).

表四、施用液態肥料對孔雀竹芋生育之影響

Table 4. Influences of liquid fertilizer on the growth of *Calathea makoyana* .

(1994.8-1995.4)

Treatment	Plant height (cm)	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Leaf number (no.)
Fertilizer kind[1]					
30-10-10	21.0	10.3	11.5	7.2	23.3
20-20-20	20.0	10.0	11.4	6.8	18.8
15-20-25	19.1	8.9	10.9	6.4	14.3
Fertilizing frequency					
1 time / week	20.8	10.2	11.6	7.0	19.8
1 time / biweek	19.0	9.5	10.7	6.7	19.4
1 time / triweek	20.3	10.1	11.5	6.7	17.2
Significant effects[2]					
Kind	*	*	NS	*	**
Frequency	NS	NS	NS	NS	*
Kind * Frequency	NS	NS	NS	NS	NS

[1] 30-10-10,20-20-20,15-20-25 respective different ratio of $N:P_2O_5:K_2O$.

[2] Significant at 1% (**) or 5% (*) levels, no significance (NS)

表五、施用液態肥料對箭尾竹芋生育之影響

Table 5. Influences of liquid fertilizer on the growth of Calathea insignis .

(1994.8-1995.4)

Treatment	Plant height (cm)	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Leaf number (no.)
Fertilizer kind[1]					
30-10-10	29.7	8.7	20.8	5.3	40.4
20-20-20	30.8	9.2	21.3	5.4	38.4
15-20-25	30.2	9.0	21.2	5.3	39.0
Fertilizing frequency					
1 time / week	30.0	8.9	21.0	5.4	39.8
1 time / biweek	30.5	9.0	21.2	5.3	39.1
1 time / triweek	30.3	8.9	21.1	5.4	38.8
Significant effects[2]					
Kind	*	*	NS	NS	*
Frequency	NS	NS	NS	NS	*
Kind * Frequency	NS	*	NS	NS	NS

[1] 30-10-10,20-20-20,15-20-25 respective different ratio of $N:P_2O_5:K_2O$.

[2] Significant at 1% (**) or 5% (*) levels, no significance (NS).

緩效性肥料用量對竹芋的生育影響

爲節省施肥所費之人力與時間，不噴施液態肥料，僅於竹芋移植成活後，施用市售氮、磷、鉀比例爲 18:6:12 之緩效性肥料，比較不同施用量對紅羽竹芋及箭尾竹芋生育的影響，試驗於 84 年 8 月施行不同的肥料處理，並於三個月後及六個月後調查竹芋生育的情形，結果如表六及表七所示。

紅羽竹芋對不同肥料量之處理，於生育初期即有顯著的反應，無論株高、葉柄長、葉長、葉寬或完整葉片數皆以施用 5g 量表現最好，並隨施用量的增加而遞減，且受傷枯化葉片數亦隨施用量增加而增加，於處理後六個月此種趨勢更加顯著。而箭尾竹芋對不同肥料劑量之反應更爲敏感，受傷枯化葉片數隨施用劑量之增加而增加，尤其在處理後六個月調查時，劑量 25 克之處理其完整葉片數已經所剩無幾。

綜合兩年肥料試驗結果，顯示竹芋對肥料反應極敏感。一般觀葉植物如黛粉葉、白鶴芋、蔓綠絨等肥料施用量，以減量 1/2、增量 1/2、甚至增量至三倍用量施用，增量施肥仍可稍微增進品質[20,21]。合果芋施用 19N-2.6P-10K 之緩效性肥料，其施用量爲 4.9-34.0 克[8]。雖 Chase & Poole[9,10] 以 Osmocote (19-3-10)

表六、施用緩效性粒狀肥料對紅羽竹芋生育之影響

Table 6. Influences of slow-release fertilizer on the growth of *Calathea ornata* .

(1995.8-1996.2)

Fertilizer treatment (g/pot)	Plant height (cm)	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Healthy leaves (no.)	Necrotic leaves (no.)
		3 months after treatment				
5	40.35[a1]	30.73[a]	19.98[a]	10.08[a]	11.65[a]	0.75[a]
10	36.08[ab]	28.05[ab]	20.03[a]	10.23[a]	9.85[b]	0.95[a]
15	35.88[ab]	25.40[bc]	18.88[bc]	10.03[ab]	9.10[bc]	1.90[b]
20	34.53[bc]	23.53[cd]	18.55[c]	9.28[bc]	10.15[ab]	2.15[ab]
25	29.75[c]	22.03[d]	16.90[d]	9.05[c]	8.10[c]	2.55[a]
		6 months after treatment				
5	56.08[a]	36.23[a]	20.13[a]	10.20[a]	10.00[a]	4.28[b]
10	54.45[a]	34.15[a]	20.80[a]	9.90[a]	7.40[b]	5.20[b]
15	51.80[ab]	32.53[ab]	19.10[ab]	10.13[a]	6.00[c]	6.51[b]
20	46.20[b]	28.95[b]	17.25[b]	8.03[b]	4.70[c]	9.40[ab]
25	32.20[c]	21.30[c]	12.40[c]	6.23[c]	1.40[d]	10.20[a]

[1] Means within each column followed by the letter are not significantly at 5% level by L.S.D. test.

及 Osmocote (19-6-12) 對 5 種竹芋進行施用量試驗結果以 5-14g/5-inch pot/3 months 可得較佳品質。但在本試驗中則以施用 5g 量表現最好，若過量施用則有肥害發生，但若配合適當的液態肥料施用，則可增進品質。

遮光度對竹芋生育的影響

大多數的觀葉植物原生於高溫多溼的熱帶雨林中，需光量少，喜歡有遮陰的環境生長，在強光下則易有日燒、脫水枯萎等傷害。竹芋科植物即屬此類陰性植物。但不論是陰性植物或陽性植物，亦可經由馴化過程使其在某一光線照度範圍內生長良好。各種植物的最適光照條件各有所不同，如觀音蓮在遮光 80%下就比遮光 99%下之光合作用強且葉片較厚[22,23]。萬年竹遮陰栽培可增加株高及葉片數，而黛粉葉遮陰栽培雖株高增加但葉片減少，且若光照由 60 m mol m^{-2} s^{-1} 減少至 2 m mol m^{-2} s^{-1} 乾物重亦顯著減少[4,15]。粗肋草在 2.7 m mol m^{-2} s^{-1} 與 5.4 m mol m^{-2} s^{-1} 兩種條件下生長，以前者的葉片較小較薄，但葉綠素較多[6,7]。合果芋及垂榕光照強度由 60 m mol m^{-2} s^{-1} 增加至 120 m mol m^{-2} s^{-1} 乾物重顯著增加[14]。

表七、施用緩效性粒狀肥料對箭尾竹芋生育之影響

Table 7. Influences of slow-release fertilizer on the growth of *Calathea insignis* .

(1995.8-1996.2)

Fertilizer treatment (g/pot)	Plant height (cm)	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Healthy leaves (no.)	Necrotic leaves (no.)
		3 months after treatment				
5	17.10	4.74	15.90	4.25	15.60	1.10
10	17.70	5.64	16.18	4.18	14.55	1.45
15	16.68	5.08	15.53	4.30	13.60	1.60
20	17.18	4.50	15.03	4.08	13.65	1.45
25	18.60	5.28	15.53	4.25	11.65	2.35
		6 months after treatment				
5	23.58	7.05	16.85	4.38	11.54[a1]	9.20[b]
10	24.75	6.75	16.88	4.43	11.83[a]	8.24[b]
15	22.58	6.55	15.65	4.40	10.90[a]	9.69[b]
20	22.78	6.30	16.55	5.90	10.55[a]	9.15[b]
25	24.23	7.63	16.60	4.28	3.80[b]	13.03[a]

[1] Means within each column followed by the letter are not significantly at 5% level by L.S.D. test.

若合果芋光照強度由 200 m mol m^{-2} s^{-1}（遮光 80%）再增加至 700 m mol m^{-2} s^{-1}（遮光 47%）則株高減低，葉片變小[8]；Conover & Poole[11] 指出適合竹芋屬植物生長的光照強度爲 1000～2000 foot-candles。但各地的氣條件不同，對各植物所需的遮光程度亦有不同，在本區（台東市）麗莎蕨以 80%+50%二層遮光網栽培最適合[2]，但在北部則以 60%遮光生長最好[1]。且同種植物不同品種間亦有差異，彩葉芋一般在遮光 80%下生長，株高較高，葉片較大，但亦有喜歡全日照的品種[3]。本研究最初於遮光 40%、60%、80%下進行栽培觀察，其全年晴天月平均光照強度分別爲 3.3～7.9 萬 lux、2.9～5.7 萬 lux、1.9～4.9 萬 lux，結果在遮光 60%以下，葉片即有日燒。爲進一步掌握各品種栽培之最適光照強度，執行本項試驗，以遮光 75%、85%、95%處理，其全年晴天月平均光照強度分別爲 2.0～5.2 萬 lux、1.2～3.1 萬 lux、0.4～1.1 萬 lux，結果如表八所示。各品種的反應不同，慧心竹芋以 75%遮光處理下栽培生育較好，無論株高、葉柄長、葉長、葉寬或完整葉片數皆隨遮光率的增加而遞減，尤以完整葉片數差異達顯著水準。紅羽竹芋以 85%

表八、不同遮光度對竹芋生育之影響

Table 8. Influences of shading on growth of Calathea. (1996.2-1996.10)

Shading rate	Plant height (cm)	Petiole length (cm)	Laf length (cm)	Leaf width (cm)	Healthy leaves (no.)
		Calathea ornata			
75	77.7	43.0	34.7	19.3	16.3[ab]
85	87.5	50.7	35.0	21.0	20.3[a]
95	53.0	27.3	25.7	16.0	10.7[b]
		Calathea insignis			
75	36.3[b]	12.0	24.3[b]	5.9	25.3[c]
85	46.0[ab]	15.7	30.3[ab]	6.3	61.7[b]
95	58.0[a]	21.3	36.7[a]	6.6	87.3[a]
		Ctenanthe oppenheimiana			
75	91.3	62.0	29.3	11.0	166.0[a]
85	82.3	53.7	28.7	10.7	120.7[ab]
95	75.7	50.3	25.3	10.7	100.0[b]

[1] Means within each column followed by the letter are not significantly at 5% level by L.S.D. test.

表九、不同遮光度對竹芋切葉產量及品質之影響

Table 9. Influences of shading on cut frond yield and quality of Calathea.

(1996.10-1997.4)

Shading rate	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Leaf area (cm^2)	Leaf thickness (mm)	Vase life (day)	Frond number (no.)
			Calathea ornata				
85	36.0	23.7	14.3	273.1	2.96	7.84	10.12
90	36.1	25.4	15.5	300.0	3.34	8.40	9.12
95	34.7	24.0	14.6	288.4	3.20	8.11	9.00
			Calathea insignis				
85	8.7[b]	26.5	5.4	101.8[b]	1.98	11.04	11.63
90	10.4[a]	27.1	5.9	123.8[ab]	2.08	11.77	12.99
95	9.4[ab]	26.9	6.0	130.9[a]	2.06	11.02	15.00

[1] Means with in each column followed by the letter are not significantly at 5% level by L.S.D. test.

遮光處理下栽培生育較好，75%次之，於 95%下栽培各項調查性狀明顯低落。箭尾竹芋則以 95%遮光處理下栽培生育較好，各項調查性狀則隨遮光率的減少而遞減，尤以完整葉片數爲甚。

遮光度對竹芋切葉產量及品質的影響

竹芋的葉片鮮艷美麗，除盆栽外，亦可行切葉栽培，尤以箭尾竹芋、紅羽竹芋在插花市場上頗受歡迎，爲提高其切葉品質與產量，以遮光率 85%、90%、95%進行切葉栽培處理，經半年的切葉調查(表九)知紅羽竹芋切葉產量及品質於各處理間差異不顯著，但綜合各品質性狀，如葉柄長、葉片長、葉片寬、葉厚及瓶插壽命，皆以 90%遮光率處理較好，而切葉產量則以 85%遮光率處理較多。箭尾竹芋各品質性狀以 90%～95%遮光率處理較好，切葉產量以 95%遮光率處理較多。

參考文獻

1. 李文汕 呂美麗 許東輝 1987 麗莎蕨栽培技術改進-遮光及光質對麗莎蕨生育之影響 花卉生產改進研討會專輯 pp.191-197。
2. 陳進分 王才義 1997 麗莎蕨栽培與繁殖試驗 台東區農業改良場研究彙報 8:13-24。
3. 蘇炳鐸 1996 彩葉芋栽培繁殖之研究 台東區農業改良場研究彙報 7:1-15。
4. Aasha, K., and S. R. Naur. 1992. Effect of varying light intensities on the growth and development of indoor foliage plants. South Indian Hort. 40(1):64-66.
5. Basoccu, L. 1977. Effect of GA_3 on development of *Calathea makoyana*. Acta. Hort. 68:125-132.
6. Benedetto, A. H., and D. H. Cogliatti. 1990. Effects of light intensity and quality on the obligate shade plant *Aglaonema commutatum*. I. Leaf size and leaf shape. J. Hort. Sci. 65(6):689-698.
7. Benedetto, A. H. 1991. Light environment effects on chlorophyll content in *Aglaonema commutatum*. J. Hort. Sci. 66(3):283-289.
8. Chase, A. R., and R. T. Poole. 1987. Effect of fertilizer, temperature,

and light level on growth of *Syngonium podophyllum* 'White Butterfly'. J. Amer. Soc. Hort. Sci. 112(2):296-300.

9. Chase, A. R., and R. T. Poole. 1988. Nutritional response of five Calatheas. Proc. Fla. State Hort. Soc. 101:323-325.

10. Chase, A. R. 1989. Fertilizing Calatheas with slow-release fertilizer. Foliage Digest 12(10):1-3.

11. Conover, C. A., and R. T. Pool. 1984. Light and fertilizer recommendation for production of acclimatized potted foliage plants. Foliage Digest 7(8):1-6.

12. Conover, C. A., and R. T. Poole. 1985. Growth of *Calathea makoyana* as influenced by media, fertilizer and irrigation. Foliage Digest 8(2): 3-5.

13. Czerwinski, Z., K. Czerwinska, J. Andrearczyk, and B. Solinska-Gornicka. 1982. Reasons of leaves withering in tropical plants cultivated under green-house conditions. Acta. Agrobotanica 35(2):303-317.

14. Mortensen, L. M., and S. O. Gromstad. 1990. The effect of lighting period and photon flux density on growth of six foliage plants. Sci. Hort. 41(4):337-342.

15. Mortensen, L. M. 1992. Growth responses of three foliage plant species to temperature and photon flux density. Sci. Hort. 49(1-2):159-166.

16. Mulkey, S. S., A. P. Smith, and S. J. Wright. 1991. Comparative life history and physiology of two understory neotropical herbs. Oecologia 88:263-273.

17. Poole, R. T., and C. A. Conover. 1979. Melaleuca bark and solite as potential potting ingredients for foliage plants. Proc. Fla. State Hort. Soc. 92:327-329.

18. Poole, R. T., and C. A. Conover. 1981. Influence of maximum air temperatures and irrigation frequencies during high temperature periods on growth of four foliage plants. Hort. Sci. 16(4):556-557.

19. Poole, R. T., and C. A. Conover. 1985. Nitrogen, phosphorus and potassium fertilization of *Brassaia actinophylla*, *Calathea makoyana* and

Chrysalidocarpus lutescens. J. Environ. Hort. 3(1):1-3.

20. Poole, R. T., and C. A. Conover. 1988. Response of foliage plants to minimum temperatures and fertilizer levels. Foliage Digest 11(1):1-3.
21. Poole, R. T., and C. A. Conover. 1989. Fertilization of four indoor foliage plants with osmocote or nutricrte. J. Environ. Hort. 7(3):102-108.
22. Sims, D. A., and R. W. Pearcy. 1991. Photosynthesis and respiration in *Alocasis macrorrhiza* following transfers to high and low light. Oecologia 86(3):447-452.
23. Sims, D. A., and R. W. Pearcy. 1992. Response of leaf anatomy and photosynthetic capacity in *Alocasis macrorrhiza* (Araceae) to a transfer from low to high light. Amer. J. Botany 79(4):449-455.
24. Verdonck, O. F., and I. M. Cappaert. 1978. Growth experitments with barkcompost. Acta. Hort. 82:55-57.

The Research of the Cultivating Technique of Calathea

Chiou-Lan Huang[1]

Abstract

Calathea, which is graceful in shape and plentiful in category, can be used as potted landscape and cut leaves. In order to investigate the effect of the cultivating methods to its growth, fifteen kinds of Calatheas are used as materials in this test to do the researches of adaptability, reproduction, fertilizer and shading treatment. First, we observed the adaptability of the cultivation of Calathea in Taitung, and we found out that the adaptability of nine kinds of them, including *C. insignis* , performed well. Moreover, amid them, *C. insignis* , and *C. ornata* are categories worthy of recommend in this region. Because they can be used as potted landscape or cultivated in cut leaves. The general reproduction methods of Calathea, are mainly in division and cutting. *C. rosepicta, C. rotundifolia* and *C. zebrina*, their division reproduction rate is the slowest. Those can be reproduced by cutting are *M. leuconeura, M. bicolor* and *Ctenanthe lubbersiana.*

Different kinds of liquid fertilizers would affect the growth of Calathea. If we apply $N-P_2O_5-K_2O=30-10-10$ on *C. rufibarba*, at early period of its growth, the plants would grow taller and remain more leaves in middle-last period. For those which are fertilized one time every one or two weeks, the plant grow taller. As for *C. makoyana,* the difference among the treatments is not significant in the early period of its growth. In the middle-last period, if we apply $N-P_2O_5-K_2O=30-10-10$ on it, the plant would be taller, the petiole longer and the leaf amount more. And for the one that fertilized once a week, it has the most leaves. As for *C. insignis*, the difference among the treatments is not significant in the early period of

its growth. In the middle-last period, if we apply $N-P_2O_5-K_2O=20-20-20$ on it, the plant and the petiole would be taller. But if we apply $N-P_2O_5-K_2O=30-10-10$, it would have the most leaves, and if we apply on it every three week in the last period, the leave amount would be the fewest.

C. ornata would have significant reaction toward the treatment of different amount of slow-release fertilizer in the early period of its growth. No matter for the plant height, the petiole length, the leaf length, the leaf width or the amount of the intact leaves, they all react the best to the amount of 5 gram one. Moreover, it would reduce with the increasing amount the fertilizer. As for *C. insignis*, its reaction toward different amount of fertilizer is much serious, and the amount of the wounded and withered leaves soars up with the increase of the amount of application.

Speaking of the shading, if we apply 75% on *Ctenanthe oppenheimiana*, 85% on *C. ornata*, and 95% on *C. insignis*, the growth would be the best. As for *C. ornata* one, its difference of the amount of frond and quality is not significant under the 85%, 90% and 95% shading treatment. But, if we combine every character, for example the petiole length, the leaf length, the leaf width, the leaf thickness and the vase life, it would react better with 90% shading rate and the amount would be more with 85% one. As for every character and quality of *C. insignis*, it would be better with 90%~95% shading treatment, and for the amount of frond, it would be the most with the treatment of 95% shading.

Key words: Calathea, Adaptability, Reproduction, Fertilizer, Shading.

---

[1] Assistant Agronomist of Taitung DAIS.