

# 植物生長調節劑在桃李栽培上之應用

廖萬正 林嘉興

台中區農業改良場

## 摘 要

在桃李栽培上可利用氰胺 (hydrogen cyanamide) 或益收生長素 (Ethrel, ethephon) 促進萌芽、開花而提早產期。益收生長素可延遲萌芽，而防止晚霜之為害；利用萘乙酸及其鈉鹽 (NAA, Na-NAA)、益收生長素及加保利 (賽文, Sevin, carbaryl) 等可進行疏花疏果以節省人工疏果勞力；利用生長抑制劑如亞拉生長素 (Alar, daminozide)、克美素 (CCC, Cycocel, chlormequat)、益收生長素及paclobutrazol等可以抑制植株之徒長，促進花芽分化，並能減少冬季修剪量；利用細胞分裂素 (cytokinins) 以及勃激素 (gibberellins) 能促使果實肥大，提高果實品質。

## 前 言

為提高桃李栽培之經濟性，有許多植物生長調節劑可供應用。如能促使桃李提前萌芽、開花，則其產期當然能較一般栽培者為早，而提高其產值；又如能利用藥劑延遲其萌芽而避免晚霜之為害，則能提高產量；為降低人工之疏花、疏果勞力之支出，可用藥劑行疏花及疏果工作；為防止植株徒長、促進花芽分化、減少冬季修剪量等，可用生長抑制劑處理以達到目的；為提高果實品質，亦可利用藥劑促使果實肥大。

但在桃李栽培上，應以一般正常田間管理作業為主，植物生長調節劑僅是為達某種特定目的，而在一般田間管理無法達到時，才使用它。本文依據在桃李栽培上各種植物生長調節劑之使用目的及方法，就前人有關研究做扼要介紹。

## 內 容

### 一、促進萌芽及開花

落葉果樹皆具有休眠性，通常需經過一定低溫 (7°C) 時數，才能正常萌芽，當然，不同種類及同種之不同品種其所需低溫時數亦不同。在同一地區內之同一品種，若能促使其花芽提前萌發，則能提早採收而提高其經濟價值。經學者研究，氰胺 (hydrogen cyanamide) 能促使一般落葉果樹提前萌芽 (表1)<sup>(23)</sup>，利用益收生長素 (Ethrel, ethephon, CEPA)<sup>(1,2)</sup> 亦能打破其休眠 (表2)<sup>(1)</sup>。

在本省中低海拔地區，因冬季氣溫尚高，故在理論上，桃李在其花芽分化完成後就可利用1% 氰滿素 (Alzodef, 49% a.i. hydrogen cyanamide) 或0.05% 益收生長素噴施，以促其萌芽、開花，但若處理時期太早，則可能因氣溫太高或相對濕度太低等原因致使著果情形不甚良好，若能在11月下旬或12月上旬處理，其著果情形良好，則其產期能較正常提前20~40日收穫<sup>(1,2)</sup>。

### 二、延遲萌芽

桃李於萌芽後若遇晚霜，則容易發生寒害而導致落花、落果，而使產量大減，故若能延

遲其萌芽期則能減少晚霜之為害。據國外學者之研究<sup>(5,13,29,30)</sup>，以收益生長素及勃激素於秋季落葉前噴施植株，則能延遲翌年萌芽2~13日（表3）<sup>(13)</sup>，但使用益收生長素濃度太高時，則易造成提前落葉及導致植株、果實流膠，甚至植株死亡現象。在本省，正常之產期甚少有晚霜發生，故此項作應可省略。

表 1. 各種落葉果樹處理氰胺之效果<sup>(23)</sup>

Table 1. Effect of sprays of commercial cyanamide, "Liquid Cyanamide" on various trees.

Species	H <sub>2</sub> CN <sub>2</sub> (Conc. %)	Days before natural bud break	Effect
Apple	2.5	30	Uniform bud break of different cultivars and increases pollination ; die-back of twigs.
Almond	1-3	40	Better leaf bud opening
	1-3	20	Poor flowering
Apricot	2.5	40	Very early bud break, overcropping and small fruits
Fig	2	40	Full and early bud break; more brebans
Grapevine	2-5	at pruning	Early, k full and uniform bud break
Actinidia	0.5-1.5	40	Full bud break; increased fruit number
Early peach	1-2	25-30	Poor flower bud opening ; die back of twigs
Late peach	1-2	25-30	Early and uniform bud break
Pear	2	40	Uniform bud break of various cultivars improved pollination
Persimmon	2	40	Better and full bud break
Plum	1-2	30	Uniform and early bud break
	2-3	30	Poor flower bud opening

表 2. 益收生長素 2000 ppm 處理對桃李開花及著果之效果<sup>(1)</sup>

Table 2. Effects of Ethrel 2000 ppm treatment on blooming and fruit set of peaches and plums.

Cultivar	Peach		Plum	
	"Engo"	"June"	"Sa-lain"	"I-lan"
Days from treatment to blooming	29	25	22	20
% Blooming	74.33	61.49	30.51	34.24
Fruitset	10.86	7.31	23.75	25.98

表 3. 10 月噴施益收生長素對翌年開花及著果之影響<sup>(13)</sup>

Table 3. Influence of an October ethephon spray on time of bloom and number of fruit the following year.

Cultivars	Bloom rating April 16*				Bloom rating April 23**				Fruit/ tree
	TRT. mean	Ck	10	120	TRT. mean	Ck	10	120	
Redgold	3.6	4.8	3.6	2.4	3.0	4.4	3.3	1.5	15.9
Glohaven	1.9	2.3	2.0	1.3	2.5	2.7	3.0	1.9	4.9
Redhaven	1.7	2.5	1.7	1.0	2.8	3.7	3.3	1.3	24.3
<b>Ethephon Rate</b>									
Check	3.2				3.6				8.4
60 ppm	2.4				3.2				19.8
120 ppm	1.6				1.6				16.8

\*1 = no pink; 2 = first pink; 3 = pink petals; 4 exerted petals; 5 = open

\*\*0 = no buds open; 1 = 1-10%; 2 = 10-30%; 3 = 30-50%; 4 = 50-70%; 5 = 70-100%

### 三、疏花及疏果

桃李若開花及著果過多，則需以人工加以疏花及疏果，以提高果實品質。據國外學者多年之研究<sup>(4,6,7,8,9,12,15,16,25)</sup>，萘乙酸鈉 (Na-NAA)、益收生長素、加保利 (賽文, Sevin carbaryl) 等藥劑可以疏花、疏果 (圖 1,2; 表 4.5)<sup>(25)</sup>，雖然這些藥劑處理會因外界環境之影響，而不能使疏果作用恰到好處，尚需配合人工再加以疏果，但已可減少人工之支出。本省在利用藥劑進行疏花、疏果工作方面，因開花之氣象條件年年不同，且樹體之生育情況亦不穩定，不易把握正確的藥劑量，故不易實施藥劑疏果工作，可行辦法為視萌芽情形而定是否先行疏蕾，則能減輕後疏果之勞力。

表 4. 不同疏果劑對桃 Cardinal 品種果實大小及固形物含量之影響<sup>(25)</sup>

Table 4. The influence of thinning agents on fruit size and total soluble solids content on Cardinal peach variety.

	Fruit Research Station Banaasa			Fruit Research Station Constantze		
	Mean fruit wt.	Soluble solids		Mean fruit wt.	Soluble solids	
	g	%	%	g	%	%
Control	92.0	100.00	12.4	75.7	100.00	10.0
Sevin 50WP, 1000 ppm	118.0	128.2	12.7	75.3	99.5	9.7
Sevin 50WP, 2000 ppm	125.5	136.4	13.3	76.3	100.8	10.0
Flordimex, 240 ppm	130.0	131.3	13.6	85.0	112.3	10.0
Flordimex, 360 ppm	137.0	148.8	13.8	87.2	115.2	10.7

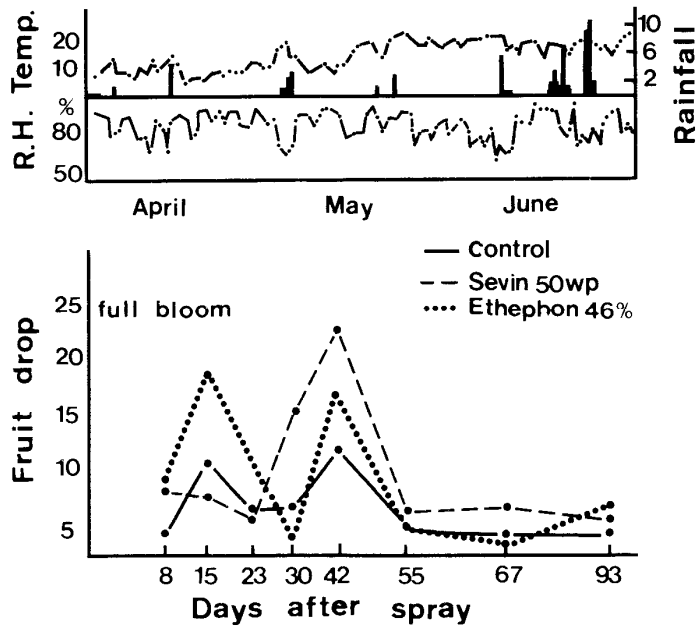


圖 1. 不同疏果劑對桃 Cardinal 品種落果之影響<sup>(25)</sup>

Fig. 1. The influence thinning agents on fruit drop (%) of Cardinal variety.

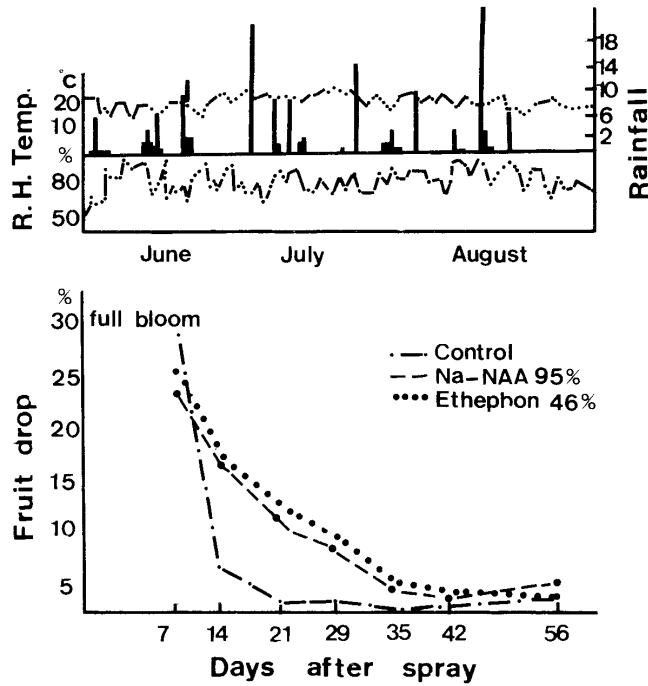


圖 2. 不同疏果劑對桃 Redhaven 品種落果之影響<sup>(25)</sup>

Fig. 2. The influence thinning agents on fruit drop (%) of Redhaven variety.

表 5. 不同疏果劑對桃 Redhaven 品種果實大小及固形物含量之影響<sup>(25)</sup>

Table 5. The influence of thinning agents on fruit size and total soluble solids content on Redhaven peach variety.

	Fruit Research Station Banaasa			Fruit Research Station Constantze		
	Mean fruit wt.		Soluble solids	Mean fruit wt.		Soluble solids
	g	%	%	g	%	%
Control	112.0	100.0	13.8	110.5	100.0	9.0
Na-NAA 95%, 20 ppm	134.3	119.9	14.0	115.0	104.0	8.9
Na-NAA 95%, 30 ppm	138.3	123.5	13.9	118.2	106.9	9.3
Flordimex, 240 ppm	129.7	115.8	14.4	116.5	105.4	9.8
Flordimex, 360 ppm	135.0	120.5	14.3	117.0	105.9	9.7

## 四、抑制徒長及促進花芽形成

桃李有某些品種極為旺盛，為防止徒長枝之萌生，以減少樹體養份之浪費及冬季修剪量可用生長抑制劑加以控制<sup>(2,10,115,14,17,18,19,20,22,24,26,27,28,31,32)</sup>，常用之生長抑制劑有亞拉生長素 (Alar, daminozide, SADH)，克美素 (CCC, Cycocel, chlormequat)，益收生長素及 paclobutrazol 等。其使用方法為在開花後約2個月，當新梢長10~15公分時，以亞拉生長素1000~2000ppm (400~800倍)，克美素250~500ppm (2000~3000倍)，益收生長素50~100ppm (4000~8000倍) 或 paclobutrazol 300~350ppm 噴施植株1~2次則能有效制其徒長 (圖3, 表6)<sup>(2)</sup>。Paclobutrazol 亦能利用土面灌方式處理，但使用量應視土壤是否容易滲透而定。桃使用生長抑制劑後，能減少枝條徒長使花芽數增多且果實不致發育不良等 (表7)<sup>(22)</sup>。

表 6. 不同植物生長抑制劑對桃枝條生育之影響<sup>(2)</sup>

Table 6. Effects of growth retardants on shoot growth of peach.

Treatments	Shoot length (cm)	Number of node	Internode length (cm)	Number of flower bud	Flower bud formation rate (%)	Ist Bud location (node)
Paclobutrazol 500 ppm	38.16	27.65	1.38	8.90	32.19	7.34
Paclobutrazol 333 ppm	41.28	27.26	1.51	8.17	29.97	9.18
Paclobutrazol 250 ppm	49.21	31.27	1.57	10.14	32.42	9.47
Paclobutrazol 80 ml (drench)	55.26	27.91	1.98	21.25	76.13	4.51
CCC 230 ppm	55.29	38.13	1.45	11.93	31.28	8.25
Ethrel 50 ppm	51.45	33.85	1.52	9.46	27.94	10.21
Ethrel 33ppm	58.75	37.51	1.65	9.07	25.39	11.85
CK (control)	84.21	40.68	2.07	9.31	22.89	12.73

表 7. 葉面噴施 Cultar 對兩品種桃之抑制率及產量、果實大小之影響<sup>(22)</sup>

Table 7. Foliar applications of Cultar to Red Haven (RH) and Early Red Haven (ERH) Peach Italy, 1984.

Culuar foliar treatment method	% of Untreated contol					
	Retardation		Yield tree		Fruit size	
	RH	ERH	RH	ERH	RH	ERH
Single spray, Stage I 1.0kg ai/ha	39B	40BC	109	121ABC	108ABC	106
Single spray, Stage II 1.0kg ai/ha	27	33	114	126	107	101
Single spray, Stage III 1.0kg ai/ha	1	23	105	126	104	103
Sequential spray 0.25kg ai/ha x 4 ( I, II, III + IV )	35	56*	114	119	104	102
Untreated control ( value )	— (85cm)	— (75cm)	100 (37kg)	100 (18kg)	100 (146g)	100 (112)

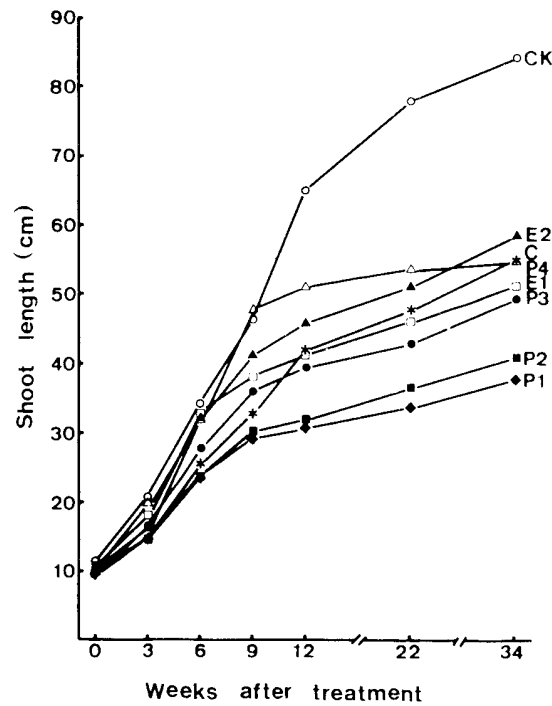
圖 3. 不同植物生長抑制劑處理對桃梢生長之效果<sup>(2)</sup>

Fig. 3. Effects of different plant growth plant growth retardants on shoot growth of peach P1 :  
 Paclobutrazol 500ppm, P2 : Paclobutrazol 333ppm, P3 : Paclobutrazol 250ppm, P4 : Paclobutrazol  
 (25%) 80 ml drench, C : CCC 50ppm, E : Ethrel 33ppm, CK : control

## 五、促進果實肥大

促進果實肥大之方法有疏果及抑制枝條徒長等方法，但亦可利用細胞分裂素(cytokinins)或勃激素處理果實，在開花後30日以KT-30(一種BA之商品名)及勃激素膏劑處理果實能促進果實肥大(表8)<sup>(3)</sup>。

表 8. 勃激素(GA)及細胞分裂素(BA)處理桃果實之效果<sup>(3)</sup>  
Table 8. Effect GA and BA treatments on peach fruit quality.

Treatment	Fruit wt. (g)	Fruit width (cm)	Fruit length (cm)	Sugar Brix %	Acidity %
CK	101.6	5.74	5.80	7.6	0.23
GA	116.3	6.13	6.16	8.5	0.25
BA	120.3	6.17	6.21	8.2	0.24

## 結 論

桃李栽培上首要之務為培養健壯之樹體，故合理之田間管理是必需的。植物生長調節劑僅為達到某種特殊目的，而當一般田間管理無法達到時才使用，但使用時需考慮使用時期、處理部份、使用濃度及外在環境之影響，否則往往達不到預期效果，有時反而造成反效果或造成污染，不得不慎重。正確且有效的使用植物生長調節劑，當待有關研究人員繼續努力。

## 引用文獻

1. 廖萬正 1985 桃與李之產期調節 (林信山編 果樹產期調節研討會專集) 台中區農業改良場特刊第1號 p.53-61。
2. 廖萬正 1987 數種植物生長抑制劑對桃生育之影響(張林仁編 園藝作物產期調節研討會專集) 台中區農業改良場特刊第10號 p.185-191。
3. 長谷川耕二郎、中島芳和 1987 “ ” 果實發育 及 KT-30 GA 影響 日本藝學會昭和62年度秋季大會研究發表要旨 p.184-185。
4. Byers, R.E., C.G. Lyons, Jr., Barden and R.W. Young. 1986. Desiccating chemicals for bloom thinning of peach and photosynthetic inhibition for post-bloom thinning of apple and peach. Acta Hort. 179:763-680.
5. Coston, D.C., T.E. Elkner, and J.G. Williamson. 1986. Mode of action of chemical treatments for peach bloom delay. Acta Hort. 179:157-162.
6. Couvillon G.A., G. Krewer., and J.W. Daniell. 1986. Peach blossom and fruit thinning with CGA 15281 and a possible mode of action. Acta Hort. 179:687-688.
7. David M. and T. Nigicser. 1986. Chemical thinning of midseason peach cultivars in Hungary. Acta Hort. 179:681-686.
8. Dhar, R.P., V.P. Bhutani, and D.R. Gautam. 1984. Chemical thinning of plumcv. Santa Rosa. Punjab Hort. Jour. 24(1/4) 116-120. (Abstr. cited from PGR Abstracts 11(11):151,1985.)
9. Dozier, W.A. Jr., C. Cariton, K.C. Short, and J.A. McGuire. 1981. Thinning 'Loring' peaches with CGA 15281. HortScience 16(1):56-57.

10. Erez, A. 1984. Dwarfing peaches by pruning and by paclobutrazol. *Acta Hort.* 146 : 235-241.
11. Erze, A. 1986. Effect of soil-applied paclobutrazol in drip irrigated peach orchards. *Acta Hort.* 179:513-52.
12. Filiti, N. and G. Costa. 1986. CEPA fruit thinning in relation to hormone and carbohydrate patterns on early ripening peach. *Acta Hort.* 179:689-692.
13. Funt, R.C. and D.C. Ferree. 1986. Ethephon induced bloom delay of peach trees. Ohio USA. *Acta Hort.* 179:163-169.
14. Gaash, D. 1986. Japanese plums (*P. salicina* L.) in high-density plantings. *Acta Hort.* 160:315-318.
15. Hatzeharise, I.A. 1981. Thinning of Red Haven peaches with ethephon. (Abstr. cited from PGR Abstracts 11(4):435, 1985.)
16. Knight, J.N. 1986. Fruit thinning with carbaryl. *Acta Hort.* 179:707-708.
17. Lever, B.G. 1986. 'Cultar'-a technic technical overview. *Acta Hort.* 179:459-466.
18. Proebsting, E.L. and H.H. Mills. 1985. Clod resistance in peach, apricot, and cherry as influenced by soil-applied paclobutrazol. *HortScience* 20(1):88-90.
19. Quinlan, J.D. and P.J. Richardson. 1986. Uptake and translocation of paclobutrazol implications for orchard use. *Acta Hort.* 179:443-452.
20. Rangelov, B., M. Nesheva, and K. Sarkisyan. 1984. Effect of Flordimex on the vegetative performance of peach. *Gardinarska I Lozarska Nauka* 21(5):15-22. (Abstr.cited from PGR Abstracts 11(5):656, 1985.)
21. Sandhu, A.S. and Z. Sigh. 1983. Effect of (2-chloroethyl) phosphonic acid on apical dominance of peach (*Prunus persica* Batsch.). *Indian Jour. Plant Physiol.* 26(1):105-107. (Abstr. cited from PGR Abstracts 10(7):819, 1984.)
22. Shearing, S.J. and T.Jones. 1986. Fruit tree growth control with Cultar which method of application? *Acta Hort.* 179:505-512.
23. Shulman, Y., G. Nir, and S. Lavee. 1986. Oxidative processes in bud dormancy and the use of hydrogen cyanamide in breaking dormancy. *Acta Hort.* 179:141-148.
24. Sinha, M.M., S.P. Tripathi, J.P. Teward, and R.S. Misra. 1983. Effect of Alar and CCC on flowering and fruiting in peach, cv. Alexander. *Punjab Hort. Jour.* 23(1/2):43-46. (Abstr. cited from PGR Abstracts 10(6):690, 1984.)
25. Stan, S., N. Burloi, P. Ionescu, V. Cociu, N. Patru, E. Topor, and T. Panea. 1985. Chemical thinning of peaches. *Acta Hort.* 173:395-403.
26. Steffens, G.L. and S.Y. Wang. 1986. Biochemical and physiological alterations in apple trees caused by a gibberellin biosynthesis inhibitor, paclobutrazol. *Acta Hort.* 179:433-442.
27. Tukey, L.D. 1986. Plant growth regulator absorption through roots. *Acta Hort.* 179:199-206.
28. Vitagiano, C. and R. Testolin. 1986. Allometric relationship in fruit and shoot growth as affected by GA<sub>3</sub> and Ethrel treatments in peach (*Persica vulgaris* Mill.). *Acta Hort.* 179:237-244.



29. Webster, A.D. 1984. Plant growth regulator sprays to delay the blossoming of Vitoria plum. *J. Hort. Sci.*59(3):377-386.
30. Webster, A.D. 1986. Delaying flowering and improving the yields of plum cultivars with ethephon and gibberellic acid sprays. *Acta Hort.* 179:171-172.
31. Williams, M.W., E.A. Curry, and G.M. Green. 1986. Chemical control of vegetative growth of pome and stone fruit trees with GA biosynthesis inhibitors. *Acta Hort.* 179:453-458.
32. Williamson, J.G. and D.C. Coston. 1986. Growth responses of peach roots and shoots to soil and foliar-applied paclobutrazol. *HortScience* 21(4):100-1003.

## 討 論

林宗賢問：

益收生長素在桃及李樹應用的情形如何？因會引起流膠，應用性是否會降低？

廖萬正答：

目前桃及李樹應用乙烯的情形較少，以前用乙烯催芽，濃度較高時，在來年會產生流膠現象，大概是Auxin的效果。如處理氰胺則不會。

鄭正勇問：

如此處理，是否發現樹有枯死現象？

廖萬正答：

沒有。

## **APPLICATION OF PLANT GROWTH REGULATORS ON CULTIVATION OF PEACH AND PLUM**

wan-Jean Liaw and Jia-Hsing Lin  
Taichung District Agricultural Improvement Station

### **ABSTRACT**

Many plant growth regulators can be used on culture of peach and plum. Hydrogen cyanamide or ethephon can promote bud break and flowering, so the earlier harvesting can be done. Ethephon delays bud break and also avoiding the damage of frost. NAA, Na-NAA, ethephon and carbaryl are used in flower thinning so the save the labor. Growth inhibitors as Alar, Cycocel, ethephon and paclobutrazol inhibit shoot growth and promote flower bud differentiation, and then the pruning labor were lowered. Cytokinins and gibberellins promote fruit enlargement and enhance fruit quality.