Chemical Pruning and Induction of Panicles in Mango (*Mangifera indica* L.) [1]

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Abstract: Three chemicals were compared for their ability to cause mango apical panicle destruction and axillary panicle induction in order to save the labor used in hand deblossoming. The results showed that ten days were required to kill the treated panicles. Two more weeks were neesded for the initiated axillary buds to reach a lenght of 0.5 cm. The initiation period needed, however, increased with the length of panicles treated. Side effects caused by these panicle-killing chemicals and possible measures to lessen the injury severity are also discussed. About fifty percent out of all the treatments were successful in axillary panicle induction. The adequate spraying concentrations recommended are: cycloheximide: 0.25 g/l, dinoseb: 0.5 ml/l, PCP: 5.0 g/l.

Key words: Mango, Axillary panicle, Chemical pruning, Induction.

INTRODUCTION

Several practical advantages have been found in the induction of axillary panicles of mango. The primary advantage is to assure a good crop by escaping from or by making up the damages to the panicles caused by prevailing low temperature, frost and incessant rain [16,19]. Another benefit is to provide a remedy for trees render unproductive by malformation [10,13]. In recent years, moreover, orchard owners in the central part of Taiwan have used this technique to produce off-season mango fruits[18]. Shu[17] reported some basic data in axillary panicle inducton by hand pruning for mangos in Taiwan. However, to induce panicles with hand pruning in large scale is cumbersome and costly. Pal and Chadha[13] reported that 3-(-(3,5 dimethyl-2-oxycyclohexyl)-2-hydroxyethyl)-glutarimide (cycloheximide) can be used successfully in panicle pruning in mango. A desiccant chemical, 2-sec-Butyl-4,6-Dinitro-phenol (dinoseb), was used commercially in increasing the bearing capacity of mango by removal of early-season inflorescences in Israel[5]. Pentachloro-phenol monohydrate, sodium salt (PCP) was used as a dormancy-breaking agent in pear[9]. The three above-mentioned deblossoming chemicals were evaluated in this study to try to reduce labor cost used in hand deblossoming.

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MATERIALS AND METHODS

Panicles of 5-7 cm and 15 cm in length of eight-year-old 'Haden' mango trees, located in Fengshan Station, were selected as experiment materials. Five replicates of four treatments were initiated with each replicate consisted of five panicles. The twenty-five panicles in each treatment were sprayed with either cycloheximide, dinoseb or PCP by hand sprayers to run-off on January 29 and February 11, 1983. Trees sprayed with water were served as controls. The formulation, active percentage, concentrations and pHs of the chemicals used are listed in Table 1.

Table 1. Concentrations and pHs of the chemicals used in the pruning of mango panicales

Chemical	Formulation and active percentage	Contentration	pH
Cycloheximide[z]	Pure chemical, powder	0.50g/l	10.3
	(Sigma C6255)	0.25g/l	9.8
Dinoseb[y]	Pure chemical, lipuid	1.0ml/l	5.4
	(Sigma B8387)	0.5ml/l	5.4
PCP[x]	86% granule	7.5g/l	8.2
		5.0g/l	8.0
Hand pruning (Water control)	—	—	6.9

[z] 3-(2-(3,5 dimethyl-2-oxycyclohexyl)-2-hydroxyethyl)-glutarimide
[y] 2-sec-Butyl-4,6-Dinitro-phenol
[x] pentachloro-phenol monohydrate, sodium salt

RESULTS

As there was no statistical difference in panicle killing effect and degree of injury between the two concentrations used in each chemical treatment, the data shown in Table 2,3 and 4 were the results of the low concentration sprays. It took 6 to 11 days for 5-7 cm panicles to wither after the chemical spraying treatments and 15 to 22 more days for new panicles to emerge (Table 2). Dinoseb and hand pruning took significantly shorter time both in the killing of apical panicles and initiation of axillary panicles (Table 2). Destruction of panicles of 15 cm in length had a similar trend, but the periods required for panicle killing and bud initiation in 15-cm panicles were both longer than the 5-7 cm panicles (Table 2).

With the exception of hand pruning, all three chemicals caused burning injury to some extent on the leaves or stems of the treated shoots. The percentages of injured leaves or branches differed either among chemicals or srpaying dates (Table 3). Cycloheximide spraying caused 50% of the leaves severely burned in the February spray. However, there were only 5% of the leaves injured in the January treatment. Similar results were also found in dinoseb and PCP treatments. Cycloheximide and dinoseb were destructive both to panicles and leaves, whereas PCP caused petiole burning. About fifty percent out of all the treated shoots for all three chemicals were successful in axillary panicle formation (Table 4).

There was no difference, in terms of subsequent growth and development, between the axillary panicles induced either by hand or chemical pruning.

Table 2. Days required for killing and initiation of axillary buds under different panicle-pruning treatments

Treatments	Killing of apical panicales		Initiation of axillary panicales[z]	
	5-7cm	15cm	5-7cm	15cm
Cycloheximide	9.5a[y]	10.7a	21.7a	30.5a
Dinoseb	6.5b	7.7b	16.0bc	21.9bc
PCP	10.5a	11.2a	18.7ab	32.3a
Hand pruning+water	0.0c	0.0c	15.0bc	17.7c

[z] records taken when axillary bud is 0.5 cm long.
[y] mean separation in columns by Duncan's multiple range test, $P=0.05$.

Table 3. Percent and position injured following chemical-pruning treatments

Treatments	Dates	% injured shoots	Position
Cyloheximide	Jan 29	5 e[z]	leaves next to or
	Feb 11	50 a	under the panicales treated
Dinoseb	Jan 29	10 cd	leaves and petioles
	Feb 11	40 ab	next to or under the panicles treated
PCP	Jan 29	10 cd	petiole next to or
	Feb 11	40 ab	under the panicales treated
Hand pruning	Jan 29	0 f	—
+water	Feb 11	0 f	—

[z] mean separation in columns by Duncan's multiple range test, $P=0.05$ (percentages were transformed into degrees of angle before statistical analysis).

Table 4. Effect of chemical, treatment date and panicle length pruned on the emerging percentage of axillary panicle in 'Haden' mango

Treatment	January 29th		Feburary 11th	
	5-7cm	15cm	5-7cm	15cm
Cycloheximide	48b[z]	44b	44b	44b
Dinoseb	52b	40b	56b	48b
PCP	52b	48b	48b	44b
Hand pruning	96a	92a	92a	88a

[z] mean separation in columns by Duncan's multiple range test, $P=0.05$.

DISCUSSION

There was a distinct difference between the 5-7 cm and the 15 cm panicles in their abilities to induce axillary panicles (Table 2). A similar result was reported by Shu[17], when the quantity of axillary panicles formed was closely related to the age of mango branches.

This can be explained either by the difference of the nutrient status or the physiological activities of the branches under the panicles treated, *i. e.* the longer the panicles has grown, the less active and/or less nutrients can the branches supply to the new growth.

Although Pal and Chadha[13] had a parallel consequence, the initiation of new flower buds in this study took substantially more days than that of the results of Reece *et al.*[14,15], Shen and Huang[16], Shu[17] as well as Shu and Sheen[18]. The result together with the low percentage in the initiation of the axillary flowers may be due to the physiological condition differences of the plants *per se* and the blocking effect of the dried panicles on the treated branches. Chemicals for stimulating and increasing the sprouting and growth of axillary buds have been widely used in apple[8], citrus[11] and macadamia[2]. The experiment, however, failed to expedite the growth of new flower buds using BA (2,000 ppm, sprayed after flower withering, data not shown). To realize the actual reason, more research is needed.

Among the three chemicals used in the present study, only cycloheximide is an ethylene inducer[3] and abscission accelerator in the harvest of some fruits, such as Valencia orange [1] and olive[6]. In apple, however, Edgerton[4] found that undesirable leaf abscission and injuries were usually associate with the normal fruit abscission when using this chemical.

Dinoseb and PCP, sometimes used as herbicides, were grouped as a kind of desiccant by Nickell[12]. In Israel, dinoseb, named as Pri-Gdal, has been used successfully in destroying inflorescences and increasing yield without any side-effect on the leaves[5,7]. In our experiment, however, dinoseb caused severe injury on the leaves and petioles under the panicales treated (Table 3). PCP as well as cycloheximide, with their pH value higher than 8.0 (Table 1), may have acted as a caustic burner on mango plants. To try to answer this question, sodium hydroxide and sodium chloride solution with pH value higher than 11 were sprayed on mango plants. Surprisingly, neither panicles nor leaves were found to be of any harm (data not shown). The mechanism of the deblossoming effects of these chemicals needs to be explored.

The rain showered one hour after spraying on January 29 lessened the undesirable injury on mango plants to a great extent, but had the same panicle pruning effect. Report on favorable water potential was required by cycloheximide to be effective in harvest aiding as well as high relative humidity (80%) reduced leaf injury by Hartman *et al.*[6] may well explain the phenomena. In addition, sufficient water rinses after spraying to wash out the remaining chemicals could be another answer.

Temperature is the other important factor for mango axillary panicle induction. As Shu and Sheen[18] indicated that the temperature after pruning should be low and long enough for an adundant axillary flower production. As many factors may involve in the fruit setting and the subsequent development in mango, investigation on the fruiting of those axillary panicles induced after chemical pruning was not executed.

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摘 要

檬果（*Mangifera indica* L.）摘去頂花穗誘引腋花穗的形成，在本省實際利用上有兩個方向：一是調節產期，增加收益；一是避開天災（如寒害），確保生產。由於人工摘穗在實際操作上相當費工，本研究以藥劑於元月底與二月中旬兩次摧花來誘引腋花穗。結果爲以 dinoseb, PCP 與 cycloheximide 處理頂花穗後，十天左右可使頂花穗枯萎，部分枝條在處理後二至四週後可長出腋花芽，但部分枝條則未長出，成功率約50%，但部分葉片或葉柄有藥害產生。花穗較長者處理後長出腋花芽所需時間較久，不同日期兩次摧花間沒有差異。暫訂噴用的濃度爲：cycloheximide 0.25 g/l; dinoseb 0.5 ml/l; PCP 7.5 g/l。

關鍵詞：檬果、腋花穗、藥劑修剪、誘引。

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