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Off-season Bloom in 'Temple' Orange Repressed by Gibberellin[1]

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Abstract. **One early treatment (late May) with 25 ppm gibberellic acid (GA_3) strongly depressed summer and fall bloom and resulting off-season fruits of 'Temple' orange (*Citrus reticulata* Blanco x C. sinensis (L.) osbeck). A late June treatment failed to repress and even tended to increase the number of off-season fruits. A repeated treatment at both dates, had a smaller effect than a single early treatment. A possible effect of a late GA application on the persistence of off-season fruitlets is suggested. Girdling of a part of scaffold branches gave a response similar to that of the early GA treatment.**

Undesirable off-season bloom is not unusual with easy peeling, mandarin-like cultivars. Such bloom produces off-season fruits growing and developing under unsuitable climatic conditions. Fruit from summer or fall bloom is usually green, rough and of inacceptable taste, at the normal harvest season. It is not marketable as fresh fruit and can at most be utilized by the juice industry. 'Temple' orange, resembling a tangor (2), often produces sizeable numbers of off-season bloom and fruits. This paper reports about an experiment to repress such feature by the use of gibberellin, which is known to inhibit flower formation in citrus (3), and of girdling.

'Temple' orange trees on sour orange (*Citrus aurantium* L.) stock, growing in medium–heavy soil, in the R. grove near Karkur in the northern section of the inland portion of the coastal belt of Israel (about 14 km from the sea) had produced considerable amounts of off-bloom during previous seasons. They were included in a randomized block experiment consisting of 5 treatments and 6 replicates of 3 trees each. Treatments were, 25 ppm GA_3 at 10 liters per tree on May 26 (at the midpoint of the drop period); the same treatment on June 26 (at the end of the drop period); the same treatment repeated on both dates; girdling of 2 of the main (3 or 4) scaffold branches on May 8; and untreated control.

A survey of bloom detected the presence of much off-season bloom in the 3rd week of July; a lesser fall flush also appeared. Fruitlets were counted on trees in October. Normal fruit was weighed (pooled values of 3 trees), counted and average fruit weight calculated at harvest in mid-February 1981. In addition, fruit from summer and fall bloom were counted separately (Table 1).

Yields in kg/tree and fruit number/tree did not show any significant differences between treatments notwithstanding different number of off-season fruits. Apparently, off-season fruit did not represent a significant burden on trees. This is cross-validated by the fact that off-bloom presented a very high percentage of fruitlet persistence, judging from a comparison of fruitlet counts in October and off-fruit harvested in February (data not presented).

Average individual fruit weight was significantly higher in trees of the late-June treatment. Since this is the first time we detected such effect of GA on fruit size, this finding should be further substantiated. The late-May treatment strongly reduced off-fruit both from summer and fall bloom, but the largest effects refer to fruits from summer bloom. We did not expect GA treatments to influence bloom occurring several months after application, but a clear effect on fall bloom can perhaps be explained through a general prevention of the inception of an off-blooming habit.

Repeated applications of GA (late May and late June) reduced the numbers of fruit resulting from both the summer and the fall bloom, but were apparently less effective (at least for fruit from summer bloom) than a single application (late May).

It is interesting that a single GA application late in June resulted in a large number of off-season fruit. A double application tends to be less effective than a single early application. The only possible explanation is an increase in set of summer bloom due to GA application at or near such bloom (late June). This suggestion is further corroborated by a significantly higher number of fruitlets (vs. the control) counted in October, as compared with the number of flowers evaluated in July, which were not different from the control.

Early May girdling significantly repressed off-season fruit. The rationale for this may be the increase in the internal activity of gibberellin-like substances in the leafy top, already shown when girdling is performed in the growing season (1, 4, 5). Such enhanced activity would inhibit flower initiation. Unfortunately, we were unable to check differences in the numbers of off-fruit on girdled and ungirdled branches. The exact timing of the early GA treatment which could become detrimental, if delayed also deserves further study.

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Table 1. Yields and average fruit weight of normal fruit at harvest (February) and evaluation of off-season blom and numbers of off-season fruitlets and fruit of 'Temple' orange trees as affected by gibberellin treatments and girdling[z].

Treatment	Normal fruit at harvest			Off-season fruit (% of control)					
	Yield (kg/tree)	Yield (no./tree)	Fruit wt(g)	Flower evaluation (July)	Fruitlet count (October)	Fruit no. at harvest (February)	(% of no. of total normal + off-bloom fruit) at harvest: Summer	Autumn	Total
Control	106ns	628ns	169 b	100[y] a	100[y] b	100[y][x] a	6.2 b	3.2 ab	9.4 b
25 ppm GA late May	116	697	167 b	35 b	24 b	25 b	1.2 c	1.3 b	2.5 c
25 ppm GA late June	108	589	183 a	80 a	108 a	139 a	9.1 a	4.1 a	13.2 a
25 ppm GA May + June	118	721	168 b	29 b	40 b	48 b	2.6 c	1.6 b	4.2 c
Girdling Early May	112	705	159 b	35 b	34 b	40 b	2.4 c	1.4 b	3.8 c

[z]Mean separation within columns by Duncan's multiple range test at 5% level; NS = nonsignificant.
[y]Statistics were calculated from actual data; here data are presented as percentages of control to permit easier comparison.
[x]Avg no. of control off-bloom fruit per tree at harvest = 67.

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