Table 6. Mean minimum and maximum temperatures at Kentville[1] and Clementsvale[2] in °F.

Month	1965 Kent.	1965 Clem.	1966 Kent.	1966 Clem.	1967 Kent.	1967 Clem..	1968 Kent.	1968 Clem.	1969 Kent.	1969 Clem.
					Minimum					
April	29.2	27.3	29.2	26.9	26.2	24.2	32.8	30.4	32.0	29.9
May	39.0	37.1	39.1	36.8	37.2	35.1	38.1	34.5	40.7	38.0
June	45.8	46.1	51.2	47.8	50.0	48.3	48.7	45.1	50.8	47.9
July	54.9	49.9	54.5	49.0	60.6	57.2	57.5	52.4	54.5	49.7
Aug.	55.5	50.5	54.7	50.3	58.8	56.0	52.8	47.5	56.9	52.7
Sept.	45.3	39.2	45.0	38.5	48.7	44.6	50.5	45.9	50.2	46.9
Oct.	39.0	34.7	40.1	36.0	42.0	37.1	45.4	40.3	38.8	34.8
Nov.	28.6	26.3	36.7	32.9	32.9	30.5	30.2	27.7	35.2	32.3
					Maximum					
April	45.0	45.3	47.2	46.7	42.8	43.2	52.6	52.9	49.0	48.8
May	58.8	58.2	60.3	59.1	54.3	53.7	59.1	58.2	59.4	59.0
June	71.9	71.4	71.2	69.9	74.1	72.3	67.6	66.4	73.8	71.8
July	77.1	74.6	77.6	75.3	79.5	76.6	79.8	77.7	75.0	73.4
Aug.	75.5	73.9	76.6	73.8	77.6	75.4	73.5	71.2	76.7	74.4
Sept.	67.8	66.4	66.5	65.0	69.1	66.2	70.6	67.6	66.9	67.3
Oct.	55.4	54.6	57.5	57.0	56.9	55.9	60.4	59.7	54.5	53.8
Nov.	43.0	42.5	48.4	49.3	44.7	43.9	42.1	43.7	48.4	48.1
					Winter Minimum					
	-11	-16	-9	-15	-11	-23	-9	-10	+1	-1

[1]Applicable to Melanson.
[2]Applicable to Acaciaville and Bear River.

to 87% of the degree days occurred by September 1. Since the foregoing values are applicable to Melanson apparently lack of fruit maturation at this location was due to insufficient heat units during September.

Although vine growth of the six cultivars removed during 1967 and 1968 appeared satisfactory, Seibel 5279 was the most susceptible to winter injury. In terms of fruit maturity this cultivar was followed in order by Niagara, Seibel 10878, New York Muscat, Concord and Elvira. The ranking was the same at all locations although for any one cultivar the degree of fruit maturity was greater at Melanson than at either Bear River or Acaciaville.

On the basis of information obtained in the present investigation, the successful growth of wine cultivars in the Annapolis-Cornwallis Valley area of Nova Scotia is not feasible because of insufficient heat units, particularly during the period of fruit maturation.

Literature Cited

1. Atkinson, H. J., G. R. Giles, A. J. Maclean and J. R. Wright. 1958. Chemical methods of soil analysis. *Can. Dept. Agr. Chem. Div. Sci. Serv. Contrib.* 169 *(rev.).*
2. Bradt, O. A. 1959. The grape in Ontario. *Ont. Dept. Agr. Bull.* 487 *(rev.).*
3. Bryant, L. R., W. J. Clare and C. G. Woodbridge. 1959. Factors affecting yields of Concord grapes and petiole composition in some vineyards in the Yakima Valley. *Proc. Amer. Soc. Hort. Sci.* 73:151-155.
4. Cook, J. A., and C. V. Carlson. 1961. California vineyards respond to potash. *Better Crops with Plant Food.* 45:2-11.
5. Crowther, R. F., and O. A. Bradt. 1966. Assays of important grape varieties. *Rep. of Hort. Res.* Inst. of Ont. p. 125-129.
6. Fisher, D. V., and J. Vielvoye. 1968. Grape growing in British Columbia. *Can. Dept. Agr.,* Summerland, B. C. and *B. C. Dept. Agr.,* Kelowna, B. C.
7. Larsen, R. P., A. L. Kenworthy, H. K. Bell and S. J. Gamble. 1963. Effects of potassium and magnesium fertilizers and dolomitic lime on the nutritional status and yield of a Concord grape vineyard. *Mich. State Univ. Quart. Bull.* 45:376-386.
8. Leefe, J. S. 1961. Summary of weather records. *Can. Dept. Agr. Pub.* 1092.

Comparative Effects of Gibberellin and Parthenocarpy on the Shape and Maturation of Peaches[1]

G. E. Stembridge and C. E. Gambrell, Jr.
Clemson University, Clemson, S. C.

Abstract. **A 500 ppm gibberellin A_3 (GA) spray applied shortly after full bloom to unemasculated peach flowers caused some fruit to develop parthenocarpically. Nonparthenocarpic fruit sprayed with GA were similar to parthenocarpic fruit in their elongated shape and advanced maturity, and dissimilar to unsprayed control fruit. The applied GA, rather than a lack of ovule development, is therefore primarily responsible for alterations in shape and maturity of parthenocarpic peaches.**

[1] Received January 16, 1970. Technical Contribution No. 780, Department of Horticulture, South Carolina Agricultural Experiment Station.

Applications of gibberellin A_3 (GA) to emasculated peach flowers at full bloom were reported to produce parthenocarpic fruit which were elongated in shape and matured early (2, 3, 4). These fruit characteristics could have resulted from the absence of developing ovules or from the applied GA.

Crane (4) found that delaying the GA application until petal fall, when more could be absorbed, resulted in more normal development of parthenocarpic fruit, suggesting that a deficiency of gibberellin in the fruit without embryos was responsible for the modifications in fruit shape and maturity. Also, destruction of the embryo during latter stages of development has been found to accelerate the maturation of peaches (5). In contrast to this evidence favoring parthenocarpy *per se* as the casual factor, recent reports show that applied gibberellins cause an elongated shape of seeded (6, 7) as well as seedless (1) apples.

Based on our observation that GA applications to unemasculated flowers result in parthenocarpic peaches as well

Table 1. Effects of a 500 ppm GA spray applied 10 days after full bloom on the characteristics of parthenocarpic and non-parthenocarpic 'Cardinal' peaches at maturity.

Treatment	Harvest date	Fruit L/D[w]	Wt/fruit (g)	Magness-Taylor firmness[x] (lb.)	% Parthenocarpic fruit	Soluble solids %	Titratable acids[y] (ml equiv.)
Control	June 10[z]	1.01	89	12.0	0	10.5	10.5
GA	June 10[z]						
Parthenocarpic		1.05	66	13.2			
Non-parthenocarpic		1.05	72	13.2			
Composite		-	-	-	37	11.6	16.0
GA	June 19						
Parthenocarpic		1.03	74	7.6			
Non-parthenocarpic		1.02	87	8.0			
Composite		-	-	-	71	10.5	13.1
LSD 5%		.03	10	1.9	18	0.9	1.0

[w]Length - diameter ratio.

[x]Two determinations per fruit; pressure tester equipped with 5/16-inch tip.

[y]Expressed as ml of 1N NaOH required to titrate a dilute aliquot of juice to pH 8.3.

[z]Harvest of first mature fruits.

Table 2. Effects of 500 ppm GA spray applied 5 days after full bloom on the characteristics of parthenocarpic and non-parthenocarpic 'Ranger' peaches at maturity.

Treatment	Harvest date	Fruit L/D[u]	Wt/fruit (g)	Magness-Taylor firmness[v] (lb.)	% Parthenocarpic fruit	Soluble solids (%)	Total titratable acids[w] (ml equiv)
Control	July 10[x]	1.01	120	12.6	0	10.4	11.6
GA	June 30[xy]	1.09	118	11.6	—	12.1	13.3
GA	July 2						
Parthenocarpic		1.12	106	9.3			
Nonparthenocarpic		1.11	117	9.7			
Composite					50	12.3	11.9
GA	July 7[z]						
Parthenocarpic		1.17	107	10.1			
Nonparthenocarpic		1.13	111	11.4			
Composite		—	—	—	60	12.8	12.1
LSD 5%		.04	11	1.9	n.s.	0.7	n.s.

[u]Length - diameter ratio.

[v]Two determinations per fruit; pressure tester equipped with 5/16-inch tip.

[w]Expressed as ml of IN NaOH required to titrate a dilute aliquot of juice to pH8.3.

[x]Harvest of first mature fruits.

[y]Composite sample. The pits were not examined for the presence of seed.

[z]The latest maturing fruit on the tree were harvested.

as those with embryos, an experiment was initiated to determine whether the unusual characteristics of parthenocarpic peaches result from a lack of ovule development or from the applied GA.

A spray of 500 ppm GA[2] was applied to runoff (3 gal/tree) to 4 mature trees of both the 'Cardinal' and 'Ranger' varieties on April 8, 1969, which was 10 and 5 days, respectively, after full bloom. None of the flowers had been emasculated. Four untreated trees of each variety served as controls.

The leaf-fruit ratios were equalized by hand thinning in early May. A sample of 30 fruits was taken from each tree when the first fruit were mature. An additional sample was taken of later-maturing fruit to determine if the percentage of parthenocarpic fruits varied with the date of maturity. Since the pits from the first harvest of treated 'Ranger' fruit were inadvertantly destroyed before they were examined for ovule development, 3 harvests were made of this variety.

Soluble solids and titratable acids were determined for each sample. Each individual fruit was weighed, its length and cheek diameter measured, and its firmness determined. Each pit was cracked and examined for ovule

In both varieties, GA caused moderate leaf chlorosis for several weeks after treatment, and a slight chlorosis persisted until harvest. Internode elongation was increased somewhat in the new growth for several weeks after treatment, but total vegetative growth was about the same as that of the control trees.

development. Pits containing developed ovules were classified as nonparthenocarpic, and those with no ovule development were classified as parthenocarpic. The average fruit size, shape, and firmness were then computed for each type of fruit.

'Cardinal'. Many of the GA-treated fruit were parthenocarpic, and this percentage was greater in the

2 Potassium gibberellate, donated by Merck and Co., Rahway, N. J.

later-maturing fruit (Table 1). Parthenocarpic peaches were somewhat smaller than nonparthenocarpic peaches sprayed with GA, but the lack of ovule development had little effect on fruit shape or firmness. The GA-treated fruit, both parthenocarpic and nonparthenocarpic, were smaller and more elongated than control fruits harvested on the same date (Table 1). The maturation of 'Cardinal' peaches was not accelerated by GA.

'Ranger'. About half of the 'Ranger' peaches sprayed with GA were parthenocarpic, and this percentage varied only slightly with maturity date (Table 2). As with the 'Cardinal' variety, nonparthenocarpic 'Ranger' peaches harvested from trees sprayed with GA were similar in shape and firmness to the parthenocarpic peaches from the same trees. The GA-treated fruits were more elongated than unsprayed control fruits, and matured about 10 days earlier, as indicated by the date of first harvest (Table 2).

In both varieties the applied GA tended to increase both titratable acids and soluble solids in the mature fruit. Comparisons of parthenocarpic and nonparthenocarpic fruits given the same GA application indicate that the lack of ovule development had relatively little effect on fruit shape or maturity in either variety (Tables 1 and 2). The failure of the early harvests to have a higher proportion of parthenocarpic fruits than the later harvests also indicates that maturity was not accelerated by a lack of developing ovules.

These results indicate that the advanced maturity and elongated shape previously noted in parthenocarpic peaches (2, 3, 4) should not be ascribed to the absence of developing ovules, but rather to the applied GA. The increase in length-diameter ratio of nonparthenocarpic peaches as a result of GA treatment parallels a similar response in apples (6, 7).

The varietal difference in the effect of GA on fruit maturation may be related to the season of ripening. A preliminary experiment indicated that the maturation of late-season varieties was accelerated by GA to a greater extent than that of early-season varieties, such as 'Cardinal'.

Our data also suggest varietal differences in the extent of alteration of fruit shape by GA, since the shape of 'Cardinal' fruit was affected much less than that of 'Ranger'. This difference could, however, be due to the stage of development at the time of GA application.

Literature Cited

1. Bukovac, M. J. 1963. Induction of parthenocarpic growth of apple fruits with gibberellins A3 and A4. *Bot. Gaz.* 124:191-195.
2. Crane, J. C., P. E. Primer, and R. C. Campbell. 1960. Gibberellin-induced parthenocarpy in *Prunus. Proc. Amer. Soc. Hort. Sci.* 75:129-137.
3. Crane J. C., C. A. Rebeiz, and R. C. Campbell. 1961. Gibberellin-induced parthenocarpy in the J. H. Hale peach and the probable cause of button production. *Proc. Amer. Soc. Hort. Sci.* 78:111-118.
4. Crane, J. C. 1963. Parthenocarpic peach development as influenced by time of gibberellin application. *Proc. Amer. Soc. Hort. Sci.* 83:240-247.
5. Tukey, H. B. 1963. Development of cherry and peach fruits as affected by destruction of the embryo. *Bot. Gaz.* 98:1-24.
6. Westwood, M. N., and H. O. Bjornstad. 1968. Effects of gibberellin A3 on fruit shape and subsequent seed dormancy of apple. *HortScience* 3:19-20.
7. Williams, M. W., and E. A. Stahly. 1969. Effect of cytokinins and gibberellins on shape of 'Delicious' apple fruits. *J. Amer. Soc. Hort. Sci.* 94:17-18.

Effects of Gibberellin and Alar Sprays upon Fruit Set, Seed Development, and Flowering of 'Bartlett' Pear[1]

F. G. Dennis, Jr.,[2] L. J. Edgerton, and K. G. Parker
New York State Agricultural Experiment Station, Geneva, and Cornell University, Ithaca, New York

Abstract. **Spray applications of gibberellic acid (GA3) were tested for their effects in increasing fruit set when applied during bloom in two commercial pear orchards in which cross-pollination was limited. No beneficial effects were obtained, and flower bud formation was inhibited at concentrations of 20 to 100 ppm. In one year, the inhibitory effect of GA3 upon flowering was partially offset by spraying with 500 or 1000 ppm of succinic acid, 2,2-dimethylhydrazide (Alar) at petal fall.**

In most pear producing districts of California, 'Bartlett' sets commercial crops of parthenocarpic fruits, making cross-pollination unnecessary (3); in New York, other varieties are required as pollen sources. Cross-pollination is a potential source of infection by fire-blight bacteria (*Erwinia amylovora*) in the eastern United States, thus the growing of solid blocks of 'Bartlett' might reduce the spread of this important disease.

Gibberellin sprays have been used successfully in Europe to increase fruit-set of pears when the developing ovules were killed by frosts or when pollinating conditions were unsatisfactory (6,8,9,11,12,13). Tests of gibberellin on 'Bartlett' in California indicated limited commercial benefit, coupled with severe inhibition of flowering (4). In this case, however, controls set good crops of fruit.

Our objectives were to: (a) determine the effects of gibberellin on fruit set and development of 'Bartlett' pears under conditions of limited cross-pollination; and (b) determine if sprays of succinic acid 2,2-dimethylhydrazide (Alar) applied at petal fall would counteract the inhibitory effects of GA upon flower bud formation. The promotive effects of Alar on flowering of 'Bartlett' and 'Anjou' pears had previously been reported (1,5).

A solid block of 'Bartlett' pears planted in 1957 was used in 1964, 1965 and 1968 (Orchard A). The trees were growing in sod near Hamlin, New York, and had produced very few fruits prior to 1964, despite heavy blooms. In 1964, the trees bore an average of 28 lb. of fruit. No other pear varieties were present within a radius of 200 yards, and no bees were introduced for pollination. A second block of mature 'Bartlett' trees near Oswego, New York, also in sod, was used in 1965 (Orchard B), and bloom was light to moderate. 'Bosc' trees were interplanted as pollenizers, but they had fruited heavily in 1964, and bore very few flowers in 1965. Bouquets of 'Clapp's Favorite' and colonies of bees were placed in the

[1]Received for publication December 10, 1969. Approved by the Director of the New York Agricultural Experiment Station for publication as Journal Paper No. 1619. The authors thank Merck and Co. for supplying KGA3, and U.S. Rubber for Alar. The assistance of Mrs. Lareta Millerd, Miss Chi-li Kiang, and Mr. Calvin Adams, is gratefully acknowledged.

[2]Present address: Department of Horticulture, Michigan State University, East Lansing.