Parthenocarpic Fruit Growth and Development of the Peach as Influenced by Gibberellin Application

Isao Kiyokawa and Shoichi Nakagawa
College of Agriculture, University of Osaka Prefecture, Sakai, Osaka

Summary

Induction of parthenocarpy in Japanese cultivars of the peach was demonstrated. Among several growth regulators examined, GA$_3$ was only effective to induce parthenocarpic fruit in Okubo cultivar, when it was applied at a concentration of 500 or 1000 ppm at the balloon stage. Moreover, GA$_3$ was effective to induce parthenocarpic in 3 of the 6 cultivars tested, but had no effect on the remaining 3 cultivars.

It was also found that the percentage of parthenocarpic fruit set increased with increase in a concentration of GA$_3$, and higher percentages of parthenocarpic fruit set were obtained in repeated applications of GA$_3$.

No effects were obtained in the growth of parthenocarpic fruit for three concentrations of GA$_3$ when it was applied only once at the balloon stage, but pronounced effects were found in parthenocarpic fruit growth when GA$_3$ was applied repeatedly during the early stage of fruit growth, even if it was applied at a low concentration.

Fruit quality of parthenocarpic fruit induced by GA$_3$ was almost identical to those of pollinated fruit, although fruit size and weight were smaller than the pollinated fruit.

It was also shown that non-pollinated peach fruit will continue their further growth when GA$_3$ at a concentration of 1000 ppm was applied within 30 days after emasculation, but not thereafter.

Morphological observations showed that there were little or no differences in mesocarp thickness between seeded and parthenocarpic fruits, although some differences in cell number and cell size were found between them. While, tissue thickness of pits and pit cavity in the parthenocarpic fruit were smaller than those of the seeded one.

Introduction

It has been recognized that gibberellin is a principal factor in the induction of parthenocarpy in many fruit species. The first success of gibberellin-induced parthenocarpy in Prunus species has been demonstrated by Crane et al. (3) in 1960. They found that parthenocarpic fruit were induced by applications of potassium salt of GA$_3$ in aqueous solution more effectively in the peach than in the almond and apricot, but never induced in the cherry and plum.

The effects of GA$_3$ on the induction of parthenocarpy were also investigated by using J. H. Hale peach (Crane et al.)(4), and morphological development of the ovaries of GA$_3$-induced parthenocarpic in Fay Elberta peach was determined by Bradley and Crane(1).

Furthermore, Crane(5) has reported parthenocarpic fruit development as influenced by the time of GA$_3$ application in Rio Oso Gem peach. While, Jackson(9) reported that GAS' and a mixture of GA$_4$ and GA$_7$ each induced parthenocarpic fruit development in the plum.

In the above cited studies, there was a considerable variability in fruit set and development of the parthenocarpic fruit among the Prunus species and also peach cultivars, depending upon the concentrations and times of application of GA$_3$ and also on kinds of gibberellin.

The work reported here, therefore, was to determine the responses of growth and development in Japanese cultivars of peach treated with gibberellins and other growth regulators at different concentrations and at different times to induce parthenocarpy.

Morphological differences were also deter-
mined in pits and ovaries of parthenocarpic Okubo peach induced by GA₃ and those of the control.

Materials and Methods

Six Japanese cultivars of peach, *Punus persica* Sieb. et Zucc., growing under uniform condition in the orchard of University of Osaka Prefecture, Sakai, were used. Those plants were of the ages from 6 to 15 years. The cultivars used were Sunago, Nunome, and Kurakata, early-ripening cultivars; Okubo and Koyo-Hakuto, mid-season cultivars; Hakuto, late-season cultivar. Studies were conducted during the growing seasons of 1968 to 1970.

Uniform shoots in vigor were selected and flowers on them were thinned so as to have two flowers left on each shoot at the balloon stage. These flowers were emasculated and the style and petals were removed and covered with paraffin bags to prevent cross-pollination.

In 1968, several growth regulators prepared as aqueous solutions at various concentrations or as lanolin paste at 5 × 10⁻³ M were applied to the cut surface of style, adjacent ovary and calyx tissues immediately after emasculation. Some of the treated fruit were applied repeatedly at the same concentration of the agent in aqueous solution at 9 and/or 25 days after the treatment. Airol OP was used at 100 ppm in all aqueous solutions as the surfactant.

In 1969, 1000 ppm of GA₃ was applied to the cut surface of the style or growing fruits 0, 9, 16, and 32 days after emasculation. Fruit from hand-pollination which were also thinned to two flowers on each shoot at the balloon stage were used as a control comparison.

For the determination of fruit set, 100 flowers in each treatment were used, and number of dropped flowers (fruit) counted at one or two weeks intervals during the growing season.

Growth curves of the treated and non-treated fruits of each cultivar have been established from the size of 20 tagged fruits samples measured at one or two weeks intervals throughout the growing season.

For the histological studies, 8 or 10 samples of parthenocarpic fruit induced by GA₃–300 ppm (triple applications 0, 9, and 25 days after bloom) and seeded fruit were collected at one or two weeks intervals and immediately fixed in FAA throughout the growing season.

The thickness of the mesocarp and the pit dimension were determined on median cheek side longisections in the basal, median and apical regions. Cell number and size were determined by freezing microtomic technique in these longisections along a radial line of each designated region of the mesocarp as illustrated in Fig. 1.

Results

I. Induction of parthenocarpy with various growth regulators. In 1968, 6-year-old Okubo peach trees were used. Various growth regulators, such as 50 ppm of indoleacetic acid (IAA–50), 50 ppm of kinetin (K–50), 500 ppm of gibberellin A₃ (GA₃–500), and 500 ppm of gibberellin A₇ (GA₇–500), were applied to the cut surface of emasculated flowers at their balloon stage.

Results obtained are shown as fruit set percentage during the growing season in Fig. 2. The application of 500 ppm of GA₃ only induced parthenocarpic fruit set, consequently, and a 19.0 per cent set of parthenocarpic mature fruit was obtained. The application of other growth regulators failed to induce parthenocarpic fruit set. All of the treated flowers abscised within 50 days after bloom.
Hand-pollination resulted in a 32.0 per cent set of normal mature fruit.

II. *Induction of parthenocarpy in several peach cultivars.* In 1969, 4 cultivars, such as Nunome, Okubo, Koyo-Hakuto and Hakuto, and in 1970, 5 cultivars, such as Sunago, Kurakata, Okubo, Koyo-Hakuto were examined. Percentages of parthenocarpic fruit set and fruit dimension induced by GA$_3$ at harvest were shown in Table 1.

In 1969, 2 cultivars, that is, Okubo and Hakuto were responsive to a single application of GA$_3$-1000 ppm at balloon stage to induce parthenocarpy, and 29.0 and 16.0 per cent set of parthenocarpic mature fruit were obtained, respectively.

In 1970, 3 cultivars, that is, Sunago, Okubo and Hakuto were also responsive to double applications of GA$_3$ at concentration of 500 ppm to induce parthenocarpy, and 73.2, 28.4 and 19.0 per cent set were obtained, respectively.

The percentages of parthenocarpic fruit set in two cultivars of Okubo and Hakuto were practically identical in both year in spite of the different way of GA$_3$ application, although fruit set percentages of parthenocarpy in both cultivars were lower than those of the fertilized fruit.

It was also noted that an increased percentage of parthenocarpic fruit set was obtained in Sunago cultivar as compared with the pollinated control in 1970. As shown in Table

![Graph showing effects of several growth regulators on the percentage of parthenocarpic fruit set.](image)

Table 1. Comparison of the percentage of fruit set and fruit dimension of several peach cultivars induced by application of GA$_3$ and pollination.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Treatment*</th>
<th>Number of flower</th>
<th>Fruit set (%)</th>
<th>Fruit size (mm)</th>
<th>W/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nunome</td>
<td>Pollinated, GA$_3$-1000 ppm</td>
<td>100</td>
<td>66.6</td>
<td>67.3</td>
<td>73.7</td>
</tr>
<tr>
<td>Okubo</td>
<td>Pollinated, GA$_3$-1000 ppm</td>
<td>100</td>
<td>48.9</td>
<td>73.9</td>
<td>82.0</td>
</tr>
<tr>
<td>Koyo-Hakuto</td>
<td>Pollinated, GA$_3$-1000 ppm</td>
<td>100</td>
<td>29.0</td>
<td>71.6</td>
<td>60.9</td>
</tr>
<tr>
<td>Hakuto</td>
<td>Pollinated, GA$_3$-1000 ppm</td>
<td>100</td>
<td>50.0</td>
<td>70.4</td>
<td>78.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Treatment*</th>
<th>Number of flower</th>
<th>Fruit set (%)</th>
<th>Fruit size (mm)</th>
<th>W/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunago</td>
<td>Pollinated, GA$_3$-500 ppm</td>
<td>100</td>
<td>50.0</td>
<td>76.0</td>
<td>77.4</td>
</tr>
<tr>
<td>Kurakata</td>
<td>Pollinated, GA$_3$-500 ppm</td>
<td>100</td>
<td>32.0</td>
<td>77.4</td>
<td>68.3</td>
</tr>
<tr>
<td>Koyo-Hakuto</td>
<td>Pollinated, GA$_3$-500 ppm</td>
<td>100</td>
<td>37.0</td>
<td>67.7</td>
<td>75.4</td>
</tr>
<tr>
<td>Okubo</td>
<td>Pollinated, GA$_3$-500 ppm</td>
<td>100</td>
<td>37.0</td>
<td>67.6</td>
<td>78.7</td>
</tr>
<tr>
<td>Hakuto</td>
<td>Pollinated, GA$_3$-500 ppm</td>
<td>100</td>
<td>38.6</td>
<td>66.3</td>
<td>76.7</td>
</tr>
</tbody>
</table>

* In 1969, GA$_3$ was applied once at balloon stage, while in 1970, GA$_3$ was applied twice at balloon stage and 10 days after bloom.
1, fruit set of the former was 73.2 per cent while that of the latter was 50.0 per cent.

In other cultivars, such as Nunome, Kurakata and Koyo-Hakuto, parthenocarpic fruit set could not be induced by this treatment and all of the treated fruit were abscised within 50 days after bloom.

III. Concentrations and times of application of GA₃ in the induction of parthenocarpy.

Several 14-year-old Okubo peach trees were used in this experiment in 1968. Three concentrations of GA₃, namely 300 ppm (single, double and triple), 500 ppm (single and double) and 1000 ppm (single), were applied to the emasculated flowers of Okubo peach. Results are shown in Fig. 3.

Single application of GA₃ at concentration of 300, 500 and 1000 ppm induced 6.0, 21.1 and 49.2 per cent set of parthenocarpic fruit, respectively. GA₃ in lanolin paste at 5×10⁻³ M also induced parthenocarpy, but it produced only a 10.0 per cent set of mature fruit.

Double applications of 300 or 500 ppm of GA₃ to the emasculated flowers and growing fruit 7 days after bloom resulted in 27.3 and 39.0 per cent set of mature parthenocarpic fruit, respectively.

Furthermore, triple applications of GA₃-300 ppm to the emasculated flowers and growing fruit at 7 and 23 days after bloom induced a 52.1 per cent set of mature fruit. The percentage of parthenocarpic fruit set increased with increasing the concentration of GA₃ and higher percentages of parthenocarpic fruit set were obtained with repeated applications of GA₃.

Heavy fruit drops occurred immediately after bloom and at 6 to 8 weeks after bloom in all the treated plots, as shown in Fig. 3. However, fruit drop in non-pollinated plot occurred continuously from blooming time to 7 weeks after bloom.

IV. Fruit size and quality of parthenocarpy

Table 2. Effects of gibberellin treatment in different concentrations and number of application on the percentage of parthenocarpic fruit set, fruit and pit dimension, fresh weight soluble solids and titratable acid of Okubo peaches.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fruit set (%)</th>
<th>Fruit size</th>
<th>Pit size</th>
<th>Fresh weight</th>
<th>Total soluble solids</th>
<th>Titratable acid (as malic)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length (mm)</td>
<td>Width (mm)</td>
<td>W/L</td>
<td>Length (mm)</td>
<td>Width (mm)</td>
<td>W/L</td>
</tr>
<tr>
<td>GA₃-300 ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 application</td>
<td>6.0</td>
<td>72.6</td>
<td>60.5</td>
<td>40.3</td>
<td>16.5</td>
<td>0.41</td>
</tr>
<tr>
<td>2 applications</td>
<td>27.3</td>
<td>74.3</td>
<td>63.6</td>
<td>38.7</td>
<td>18.8</td>
<td>0.49</td>
</tr>
<tr>
<td>3 applications</td>
<td>52.1</td>
<td>76.0</td>
<td>72.0</td>
<td>44.0</td>
<td>16.0</td>
<td>0.36</td>
</tr>
<tr>
<td>GA₃-500 ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 application</td>
<td>21.1</td>
<td>71.1</td>
<td>61.1</td>
<td>37.7</td>
<td>19.0</td>
<td>0.50</td>
</tr>
<tr>
<td>2 applications</td>
<td>39.0</td>
<td>76.6</td>
<td>69.7</td>
<td>40.5</td>
<td>17.6</td>
<td>0.43</td>
</tr>
<tr>
<td>GA₃-1000 ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 application</td>
<td>49.2</td>
<td>75.5</td>
<td>68.4</td>
<td>38.2</td>
<td>18.2</td>
<td>0.47</td>
</tr>
<tr>
<td>GA₃-lanoline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5×10⁻³ M</td>
<td>10.0</td>
<td>67.7</td>
<td>63.1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>GA₃-lanoline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5×10⁻³ M</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pollinated</td>
<td>41.3</td>
<td>72.3</td>
<td>80.7</td>
<td>35.2</td>
<td>20.2</td>
<td>0.57</td>
</tr>
<tr>
<td>Non-pollinated</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
KIYOKAWA AND NAKAGAWA: PARTHENOCARPIC FRUIT GROWTH AND DEVELOPMENT OF THE PEACH

Fruit size of parthenocarpic fruits induced by GA3 in aqueous solution was greater in length and less in width (cheek diameter) than pollinated fruits. The width: length ratio was smaller for all the parthenocarpic fruits than pollinated one (Table 2). As shown in Fig. 4, there were no differences in fruit growth among the concentrations of GA3, when GA3 was applied once at balloon stage. However, it was found that growth of parthenocarpic fruit was enhanced when GA3 was applied repeatedly during the early stage of fruit growth (Fig. 5).

Pit size of all the GA3-induced parthenocarpic fruits was greater in length and less in width than the pollinated fruits. The width: length ratio in pit was in all the parthenocarpic fruit than the pollinated one (Table 2).

Fresh weight of all the parthenocarpic fruits was smaller than the pollinated one at maturity. The soluble solids in GA3-induced

---

**Fig. 4.** Growth curves of pollinated and parthenocarpic fruits of Okubo peach induced by different concentrations of GA$_3$.

**Fig. 5.** Growth curves of parthenocarpic Okubo peach fruit as affected by number of GA$_3$-300 ppm application as compared with pollinated fruit.
Parthenocarpic fruit were almost equal to those in the seeded one. However, the titratable acid in parthenocarpic fruit was greater than the pollinated one. There was a trend of increase in acidity with increasing the concentration of GA₃ or the repeat of application.

V. Parthenocarpic fruit

Table 3. Effects of GA₃-1000 ppm applied at different times on the percentage of parthenocarpic set, fruit size, fresh weight and soluble solids of Okubo peaches as compared with pollinated fruit.

<table>
<thead>
<tr>
<th>Time of GA₃ application</th>
<th>Fruit set (%)</th>
<th>Fruit size (mm)</th>
<th>Fresh weight (g)</th>
<th>Total soluble solids (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 days before bloom</td>
<td>29.0</td>
<td>71.6</td>
<td>60.9</td>
<td>0.85</td>
</tr>
<tr>
<td>14 days after bloom</td>
<td>49.0</td>
<td>73.9</td>
<td>69.8</td>
<td>0.93</td>
</tr>
<tr>
<td>30 days after bloom</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pollinated</td>
<td>48.0</td>
<td>73.9</td>
<td>82.0</td>
<td>1.10</td>
</tr>
<tr>
<td>Non-pollinated</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Fig. 6. Growth curves of Okubo peach fruit as affected by time of GA₃-1000 ppm application as compared with pollinated fruit.

Fig. 7. Changes in tissue thickness of the mesocarp of seeded and GA₃-induced parthenocarpic Okubo peach fruits.
set and development as affected by the time of GA₃ application. Approximately 200 flowers prepared for this experiment were emasculated and covered with paper bags at balloon stage, 2 days before full bloom. They were divided into groups, consisting of 50 flowers or fruit to which GA₃-1000 ppm in aqueous solution was applied two days before full bloom, immediately after emasculation, and 14 and 30 days after full bloom, respectively. Another group was made as a non-pollinated control.

Percentage of fruit set and fruit size at maturity were shown in Table 3. Parthenocarpic fruit set could be induced by application of GA₃ immediately after emasculation and 14 days after bloom, and 29.0 and 49.0 of the treated fruit developed to mature parthenocarpic fruit, respectively. Non-pollinated control fruit and GA₃ applied fruit at 30 days after bloom abscised within 50 days after bloom. Fruit set of open-pollinated fruit was 48.0 per cent at maturity.

Width of the parthenocarpic fruit was smaller than that of the pollinated one at maturity, although length of the parthenocarpic fruit was as same as that of the pollinated one. It was also found that width of parthenocarpic fruit applied GA₃ at 14
days after bloom were greater than that of parthenocarpic fruit applied GA₃ immediately after emasculation.

Growth curves of the parthenocarpic fruits and seeded fruits were shown in Fig. 6. It was noticed that fruit growth in length was more enhanced and that in width was more retarded in the parthenocarpic fruit than the seeded one, and this tendency was remarkable in the parthenocarpic fruit when GA₃ was applied at an earlier stage of fruit growth.

VI. Morphology of seeded and GA₃-induced parthenocarpic peach fruits. As shown in Fig. 7, mesocarp thickness in GA₃-induced parthenocarpic fruit increased rapidly in early stage of the fruit growth as compared with the seeded fruit. However, in advanced stage of the fruit growth, mesocarp thickness in seeded fruit increased more rapidly than that in parthenocarpic fruit. At maturity there were little or no differences in mesocarp thickness between seeded and parthenocarpic fruits. It was noticed that mesocarp thickness in parthenocarpic fruit increased showing almost the same pattern as in seeded fruit.

Changes in cell number and cell size in these longisections along a radial line of three regions of the mesocarp are shown in Fig. 8 and Fig. 9.

Cell number in each designated region of the parthenocarpic fruit increased more rapidly as compared with the seeded fruit. However, cell division in the mesocarp of partheno-
fruit. In the median region, no marked difference was noted in cell number of the mesocarp between the seeded and parthenocarpic fruits.

Cell enlargement in the mesocarp of GA_3-induced parthenocarpic fruit was enhanced in both apical and basal regions in comparison with the seeded fruit, especially in apical region, although there was no difference in cell size of the median region.

Pit growth of GA_3-induced parthenocarpic and seeded fruits was also examined during their growing season. Results are shown in Fig. 10 to 12. Pit sizes both in parthenocarpic and seeded fruits attained their maximum at 9 weeks after bloom. Pit length in parthenocarpic fruit was greater and both in width and thickness were smaller than the seeded fruit (Fig. 10). Tissue thickness of pits in parthenocarpic fruit increased more rapidly in both apical and basal regions and became greater than the seeded one. In median region, however, pit tissues of parthenocarpic fruit were inferior to the seeded one in thickness (Fig. 11). It was also found that pit cavity of parthenocarpic fruit was very narrow in comparison with that of the seeded one because of lacking of seed development (Fig. 12).

**Discussion**

In the present study, it was found that GA_3 was only effective agent to induce parthenocarpic in Japanese cultivars of the peach and other growth regulators, such as indoleacetic acid, kinetin and GA_7, did not work effectively to induce parthenocarpic fruit set. Furthermore, it is very important to be noted that there were some differences in the response to GA_3 among several Japanese cultivars of the peach tested; that is, GA_3 was effective on Sunago, Okubo and Hakuto but not on Nunome, Kurakata and Koyo–Hakuto to induce parthenocarpic. Recently, Kotob and Schwabe(10) carried out growth hormone experiments in Cox’s Orange Pippin apples, showing possibility of getting normal sized parthenocarpic fruit if mixture of indole–type auxin, gibberellin and synthetic cytokinin is applied simultaneously. They proposed that of the three hormones needed for fruit set in Cox’s apple, the indole hormone would seem to be needed to prevent abscission, while kinins may be concerned mainly with cell division of the cortical tissues and cell enlargement may in turn be related to the gibberellin level. This may be true generally in fruit set and development. Three hormones may be in need of fruit set and growth and these hormones might be produced endogenously in ovaries when pistiles were fertilized, or naturally producing parthenocarpic fruit. In such a case as parthenocarpy was induced by applying GA_3 at the flowering stage, auxin and cytokinin might have been produced endogenously in their ovaries.

It may be also supposed that endogenous auxin or cytokinin would be increased or activated by gibberellin application. Kuraishi and Muir(11) reported that gibberellin treatment caused an increase in cliff usible auxin from the stem apex of dwarf pea.

On the other hand, we should interpret adequately the reason of different responses to GA_3 in inducing parthenocarpic among several cultivars of the peach. As early as 1963, Bukovac(2) pointed out that fruit set and growth were induced differently among several cultivars of the apple, using GA_4 as a parthenocarpic stimulus. Dennis, Jr.(7) also reported that GA_3 was effective in increasing fruit set in 2 of the 6 clones tested, but had no effect on the remaining 4, although GA_7 and GA_4 were more active than GA_3 in inducing fruit set in the 2 responsive clones. There may
be some relationship between endogenous gibberellin and induction of parthenocarpy by means of exogenous gibberellin application. Dennis, Jr., and Nitsch(6) identified the presence of GA4 and GA7 in immature Golden Delicious seeds. In the peach, Ogawa(12) extracted GA-like substances from young seeds of Hakuto peach. However, he could not identify them as GA3. Jackson(8) reported that the most active compound in shoot tips of the peach may be GA4 and GA3 but in seeds the most active compound did not resemble any of known gibberellins. Recently, Yamaguchi et al.(13) isolated GA32 from immature seeds (of several cultivars) of the peach. These facts suggested that the same gibberellin which was produced in the fruit might be most effective to induce parthenocarpy. It may be also explained that in the responsive cultivars to GA3 in inducing parthenocarpy, they have or produce some enzymes being able to convert GA3 to GA32 in the peach fruit, but in the non-responsive cultivars they do not have or produce such enzymes. However, we can't say whether GA3 is effective directly or GA3 is only active after converting itself to GA32, unless we do ascertain actually whether GA32 is effective to induce parthenocarpy in the peach or not.

While, it was found from the present study that the higher the concentration of GA3 applied or the more the application of GA3 repeated, the better fruit set was obtained. However, no effect was observed in fruit growth even various concentrations of GA3 if it was applied at the flowering stage, although considerable increase in fruit growth was found when GA3 was applied repeatedly during the early stage of fruit growth. These facts indicate that a high concentration of gibberellin may concern a physiological role in young ovaries at the early stage of fruit setting. Moreover, continuous supply of gibberellin will be needed for the fruit growth during young fruit growing period. This was also shown by the fact that non-pollinated peach fruit will continue their further growth by GA3 application within 30 days after bloom, but not thereafter.

Morphological observations showed that parthenocarpic peach fruit induced by GA3 were somewhat oblong, and this is the reason why pit cavity is narrower because of the absence of seed, while no influence was found in the thickness of the mesocarp.

**Literature Cited**

モモの単為結果および果実の肥大におよぼすジペレリンの影響

清 川 薫 雄・中 川 昌 一
（大阪府立大学 農学部）

摘 要

植物生長調節物質によるモモの単為結果誘起について、布目早生、砂子早生、倉方早生、大久保、高陽白桃、白桃の6品種を用いて調査した。

モモ大久保の単為結果はGA₃によってのみ誘起され、GA₃、IAA、カイネチン、IAAとカイネチンの混合、の各処理では誘起されなかった。

さらに、GA₃による単為結果誘起に品種間差異が認められ、調査した6品種のうち砂子早生、大久保、白桃の3品種はGA₃により単為結果が誘起され、残りの品種では誘起されなかった。

GA₃による単為結果率はGA₃の処理濃度が高いほど、また処理の回数が多いほど高かった。単為結果の果実肥大におよぼすGA₃の影響は処理回数が多くなるほど大であったが、処理濃度による差異は顕著でなかった。

GA₃により単為結果した果実は収穫時の果実重量および果実径において有種子果より劣つたが、他の形質は有種子果と変わらなかった。

GA₃の処理時期の差異がモモ大久保の単為結果誘起におよぼす影響をみた結果、除雄後30日以内にGA₃を与える必要があった。

GA₃により単為結果した果実は中果皮の厚さは有種子果と変わらなかったが、細胞層数および細胞径において差異が認められた。また、核の大きさ、核の組織の厚さおよび内腔の大きさでは有種子果より劣つた。