Flower Bud Differentiation of Satsuma Mandarin as Promoted by Soil-drenching Treatment with IAA, BA or Paclobutrazol Solution

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Summary
Adult trees of satsuma mandarin ‘Okitsu wase’ grown in the open with a leaf: fruit ratio of 15:1 were drenched in July with an aqueous solution of IAA. Meanwhile, young trees of ‘Nichinan ichigo’ grown in a plastic-house were pruned in late July and drenched in September with an aqueous solution of IAA, BA or Paclobutrazol. The treated trees initiated more fibrous roots and flower buds than did the untreated control trees. In late fall, carbohydrate content was higher in the new shoots but lower in the fibrous roots in the soil-drenched trees compared to their respective control parts. Thus, the C-N ratio in the stem of the new shoot was larger and that of the fibrous roots lower in the treated trees relative to those of the control. Another trial to ‘Nichinan ichigo’ was a soil-drenching treatment with L-proline solution in September. It promoted shallow fibrous root growth and flower bud differentiation significantly. The physiological basis for the enhanced flower bud differentiation of satsuma mandarin by soil-drenching with phytohormones and amino-acids and its possible use are discussed.

Introduction
Flower bud differentiation is essential to a stable production of satsuma mandarin which has strong alternate bearing habit (Monselise and Goldschmidt, 1982). Thinning promotes flower bud differentiation, but an optimum annual return bloom is difficult to achieve in practice. Poor incomplete thinning results in a large fruit load which inhibits flower bud differentiation (Morioka, 1988; Morioka and Yahata, 1989; Osiro et al., 1989). In plastic-house cultivation, flower bud induction is more important than it is outdoors because it does not occur sometimes on new shoots which sprout after indoor summer pruning. We can attribute the lack of flower buds on inadequate nutrition. Ringing may improve the nutrition and flower bud formation, but its effect was not always reliable while causing a considerable damage to the trees (Yamamoto, 1977; Inoue et al., 1991; Inoue and Ikoma, 1991).

In our experiment, roots of indoor and outdoor trees were drenched with a solution of several growth regulators to promote flower bud differentiation by controlling root growth. The changes in carbohydrate and nitrogen contents and the C-N ratio of the roots were analyzed to establish the optimum levels for shoots in which flower buds differentiate.

Materials and Methods

A. Outdoor experiments
Mature trees of ‘Okitsu wase’ grown in the experimental orchard of Miyazaki University were used.

Experiment A 1.
Soil-drenching with IAA solution on flower bud induction of differentially fruit-thinned trees
Eight trees whose size, vigour, and fruit load were nearly the same were selected and divided into 4 plots in the middle of June. In the first plot, the non-fruiter control, the trees were completely thinned. In the second plot, the pair of trees were thinned to a leaf: fruit ratio of 25:1, which is a standard practice for satsuma mandarin. In the third plot, two trees were thinned to a leaf: fruit ratio of 15:1 and the soil was drenched with 20 liters of 1 ppm IAA solution on June 26, July 7, and July 17. In the fourth plot, a pair of trees was.
also thinned to a leaf: fruit ratio of 15:1, but was not drenched with IAA solution.

Root growth was observed on June 13, July 25, September 26 and November 16, respectively, and samples of fibrous roots and the leaves of spring shoots were collected on each date. The samples were dried, ground and analyzed for carbohydrates using Somogyi method. The nitrogen content of the samples was determined using Kjeldahl method. The C-N ratio was calculated on each sample. At the end of January, 20 spring shoots were pruned from the two trees of each treatment and the leaves were removed. The shoots were surface-sterilized by immersing them in a dilute Topsin-M solution; the cut ends were dipped in a dilute silver thiosulphate solution for 2 hr. Then, the shoots were dipped in a dilute sucrose solution. Finally, the shoots were sprayed with a 100 ppm Benzyladenine (BA) solution and kept in a growth chamber at 30 Ž to induce their flower buds to develop. The number of flowers on each tree was counted and recorded.

Experiment A 2.

The soil-drenching effects of two concentrations of IAA on flower bud differentiation

The effect of 3.0 and 0.3 ppm IAA solutions on flower bud differentiation was examined. Nine trees of similar size, vigour, and fruit load were selected and hand-thinned on July 20 to a leaf: fruit ratio of 15:1. The 9 trees were divided into 3 groups, each consisting of 3 trees. The soil in first group (IAA-H) was drenched with 20 liters of a 3 ppm IAA solution on July 21 and again on July 31. The roots of the second group (IAA-L) were drenched with 20 liters of a 0.3 ppm IAA solution. The third group (LF-15) was drenched with 20 liters of water on the same days.

Flower bud development was observed in the middle of January by forcing the cut spring shoots from each treatment to flower as above. Root growth was observed in mid-March to examine the effect of treatments.

B. Indoor experiments

Young trees of early satsuma mandarin, 'Nichinan ichigo', were transplanted into an unwoven fabric container and buried in a ridge inside a plastic-house (Fig. 1). This planting method which is a kind of root restricting system was recently adopted to produce better quality fruits. This method promotes shallow root growth, but also restricts root system by the container size. The trees are cultured in a standard way and pruned after harvest at the end of July to encourage new growth.

Experiment B 1.

Soil-drenching effect of IAA, BA or Paclobutrazol solution on flower bud differentiation

Sixty five-year-old trees whose size, vigour, and summer flush were nearly the same were divided into 5 groups of 12 trees each. The drenching treatment was begun as follows. The first group (BA x1) was drenched on September 15 with 10 liters of a 50 ppm BA solution. The second group (BA x3) was drenched with 10 liters of a 50 ppm BA solution on September 15, October 1, and October 18. The third group (IAA) was drenched with 10 liters of a 5 ppm IAA solution on September 15. The fourth group (Paclo.) was drenched with 10 liters of a 10 ppm Paclobutrazol solution on both October 1 and October 18. The fifth group as a control was drenched with 10 liters of water on September 15.

Root growth was observed on November 4, and then the shoots and fibrous roots were sampled for chemical analysis.

Carbohydrates and nitrogen contents of the samples were determined as Experiment A 1 above. The number of flower buds on each tree was
counted on January 14, almost one month after the plastic-house was heated.

**Experiment B 2.**

**Drenching effect of BA and L-proline solution on flower bud differentiation**

Ninety five six-year-old trees whose size, vigour, and summer flush were nearly the same were selected and divided into 3 groups. The first group, consisting of 35 trees, received 10 liters of a 50 ppm BA solution on September 15. The second group of 35 trees was drenched with 10 liters of water. The third group consisting of 25 trees was drenched with 10 liters of a 50 ppm L-proline solution.

Root growth was observed on November 5; the flower buds were counted on January 15, almost one month after the plastic-house was heated.

**Results**

**A. Outdoor experiments**

**Experiment A 1.**

**Drenching effect of IAA solution on flower bud formation on differentially thinned trees**

Summer or autumn flush occurred in the non-fruited control. It was very small in the plot of LF-25 and did not occur in the plot of LF-15 and LF-15+IAA.

**Fig. 2.** Growth of the fibrous roots of satsuma mandarin trees ('Okitsu wase') which had different leaf:fruit ratio and did or did not receive a soil drenching treatment with IAA solution in July.

(Observed on September 26)

1. Non-fruited
2. LF-25
3. LF-15
4. LF-15+IAA
In the plot of LF-15, the growth of fibrous root was very poor, but that in the plot of LF-15 + IAA was comparable to that of the plot of LF-25 (Fig 2). The seasonal changes of carbohydrate content and the C-N ratio of the fibrous roots and leaves of heavily loaded satsuma mandarin trees which received or did not receive a drenching treatment of the IAA solution are shown in Table 1. In the plot of LF-15, the carbohydrate content and the C-N ratio of fibrous roots were always higher than those in the other plots with an exception of carbohydrate content on September 26. But

<table>
<thead>
<tr>
<th>Date &amp; Plot</th>
<th>Fibrous root content (%)</th>
<th>C-N ratio</th>
<th>Leaf content (%)</th>
<th>C-N ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 13</td>
<td>26.91</td>
<td>13.37</td>
<td>25.52</td>
<td>7.79</td>
</tr>
<tr>
<td>July 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-fruiting</td>
<td>15.70</td>
<td>7.48</td>
<td>14.94</td>
<td>4.25</td>
</tr>
<tr>
<td>LF-25</td>
<td>19.60</td>
<td>9.09</td>
<td>16.40</td>
<td>4.23</td>
</tr>
<tr>
<td>LF-15</td>
<td>24.12</td>
<td>13.45</td>
<td>14.21</td>
<td>3.72</td>
</tr>
<tr>
<td>LF-15+IAA</td>
<td>16.91</td>
<td>8.95</td>
<td>16.70</td>
<td>4.23</td>
</tr>
<tr>
<td>September 26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-fruiting</td>
<td>18.60</td>
<td>8.82</td>
<td>20.78</td>
<td>7.48</td>
</tr>
<tr>
<td>LF-25</td>
<td>20.71</td>
<td>10.22</td>
<td>13.98</td>
<td>4.70</td>
</tr>
<tr>
<td>LF-15</td>
<td>18.31</td>
<td>10.66</td>
<td>12.72</td>
<td>4.65</td>
</tr>
<tr>
<td>LF-15+IAA</td>
<td>18.17</td>
<td>9.14</td>
<td>16.61</td>
<td>6.08</td>
</tr>
<tr>
<td>November 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-fruiting</td>
<td>19.86</td>
<td>9.19</td>
<td>16.30</td>
<td>5.84</td>
</tr>
<tr>
<td>LF-25</td>
<td>21.15</td>
<td>11.05</td>
<td>18.85</td>
<td>6.79</td>
</tr>
<tr>
<td>LF-15</td>
<td>22.12</td>
<td>11.67</td>
<td>16.60</td>
<td>6.19</td>
</tr>
</tbody>
</table>

* "Non-fruiting" refers to a plot in which all fruits were removed. "LF-15" or "LF-25" refers to the plots in which fruits were thinned to a leaf:fruit ratio of 15:1 or 25:1, respectively. "LF-15+IAA" refers to a plot in which trees with a leaf:fruit ratio of 15:1 had their soil drenched with an IAA solution in July.

* Mean of the three samples analyzed.

Table 2. Flower bud differentiation of satsuma mandarin trees ('Okitsu wase') which had different leaf:fruit ratio and did or did not receive a drenching treatment of IAA solution in July.

<table>
<thead>
<tr>
<th>Plot</th>
<th>Number of leaf buds per shoot</th>
<th>Number of leaf buds per shoot</th>
<th>Number of flowers per tree</th>
<th>Number of vegetative shoots per tree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>leafy</td>
<td>leafless</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-fruiting</td>
<td>4.54</td>
<td>0.92</td>
<td>1.31</td>
<td>6187</td>
</tr>
<tr>
<td>LF-25</td>
<td>3.27</td>
<td>0.40</td>
<td>1.87</td>
<td>2077</td>
</tr>
<tr>
<td>LF-15</td>
<td>1.63</td>
<td>0.25</td>
<td>3.25</td>
<td>1401</td>
</tr>
<tr>
<td>LF-15+IAA</td>
<td>3.83</td>
<td>0.50</td>
<td>2.58</td>
<td>2242</td>
</tr>
</tbody>
</table>

* The number of flower buds or leaf buds which developed on the three terminal nodes of 20 spring shoots that had sprouted in the previous growth season were counted for each plot, and the average was calculated.

* Flowers and vegetative shoots were counted and averaged on the two trees of each plot in the flowering season.
in the plot of LF-15 + IAA, carbohydrate level
and C-N ratio in the roots decreased to a level
comparable to those in the plot of LF-25. As for
leaves, both values were consistently lower in the
plot of LF-15. In the plot of LF-15 + IAA, leaf
carbohydrate and C-N ratio was comparable to
those of the plot of LF-25.

The numbers of flower buds that differentiated
on bearing satsuma mandarin trees which did or
did not receive IAA in July are shown in Table 2.
The least number of flower buds formed in the
plot of LF-15; the highest occurred in the plot of
the LF-15 + IAA, exceeding that of the plot of
LF-25. A similar tendency was found for flower
buds which opened in the spring. The number of
flower buds per tree in the plot of LF-15 + IAA
was nearly the same as that of the plot of LF-25.

Experiment A 2.

Reexamination of drenching effect of IAA solu-
tion on flower bud differentiation at two different
concentrations

The numbers of flower buds which differenti-
ated on the spring shoots excised in January and
heated in a growth chamber were significantly
higher in the drenching treatment of 3 ppm and
0.3 ppm IAA compared to the control (Table 3).
The fibrous roots grew more vigorously in the
IAA plots than did in the control.

B. Indoor experiments

Experiment B 1.

Drenching effect of IAA, BA or Paclobutrazol
solution on flower bud differentiation

The growth of the fibrous roots in plots treated
with growth regulators was more vigorous than it
was in the control (Fig. 3). New shoots did not
sprout out on trees of the soil-drenched plots as
the season advanced. The carbohydrate content
and C-N ratio of the stems and leaves of summer
shoots, and fibrous roots for the plots which re-
ceived the drenching treatment are shown in Table
4. The stems from the growth regulator-treated
plots had a higher carbohydrate content than in
the control. The growth regulators depressed the
carbohydrate content of the restricted fibrous
roots. Thus, the carbohydrate content was higher
in the control than it was in the treated plots. In
leaves and fibrous roots which grew outside of a
container, the growth regulators had no effect.

The C-N ratio in the stems from the treated
plots was higher than that of the control. The C-N
ratio was lower in the treated fibrous roots grown
inside a container compared to the control. In
leaves and fibrous roots which grew outside a con-
tainer, no appreciable difference existed between
the C-N ratios of the control and the treated plots.

In the BA × 1 and Paclo. plots, the number of
flower buds per tree was twice that of the control
(Table 5). In BA × 3 plot and IAA plot, about 1.5
more flowers differentiated than did the control.

Experiment B 2.

Drenching effect of BA and L-proline solution
on flower bud differentiation

Autumn flush was very few on the soil-drenched
plots. The growth of fibrous roots in BA or
L-proline treated plot was stimulated (Fig. 4). The
number of flower buds in the BA or L-proline plot
was 1.5 times larger than that of the control
(Table 6).

Discussion

In discussing the drenching effect of growth reg-

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Table 3. Flower bud differentiation of satsuma mandarin trees ('Okitsu wase') which had a leaf:fruit ratio
of 15:1 and did or did not receive a soil drenching treatment of IAA solution.

<table>
<thead>
<tr>
<th>Plot</th>
<th>Number of leafy flower buds per shoot</th>
<th>Number of leafless flower buds per shoot</th>
<th>Total number of flower buds per shoot</th>
<th>Number of leaf buds per shoot</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF-15+IAA-H</td>
<td>11.9a</td>
<td>5.7</td>
<td>17.6a</td>
<td>9.0</td>
</tr>
<tr>
<td>LF-15+IAA-L</td>
<td>8.9ab</td>
<td>2.5</td>
<td>8.9ab</td>
<td>18.8</td>
</tr>
<tr>
<td>LF-15(control)</td>
<td>5.5b</td>
<td>1.5</td>
<td>7.0b</td>
<td>21.6</td>
</tr>
</tbody>
</table>

* The number of flower buds or leaf buds which developed after a heating treatment were counted for each
plot on the terminal 10 nodes of 30 spring shoots that had sprouted in the previous growth season, and the
average was calculated.

* Different letters within columns indicate significance at 5% level using Duncan's multiple range test.
Fig. 3. Growth of the fibrous roots of plastic-house-cultivated satsuma mandarin trees ('Nichinan ichigo') which received a soil drenching treatment with plant growth regulators.

1. Control
2. IAA
3. BA × 1
4. Paclobutrazol

Table 4. Carbohydrate content and C-N ratio of the summer shoots and fibrous roots of young satsuma mandarin trees ('Nichinan ichigo') in late fall that were pruned in August and drenched in September with a plant growth regulator.

<table>
<thead>
<tr>
<th>Date &amp; Plot</th>
<th>Stems of the summer shoots</th>
<th>Leaves of the summer shoots</th>
<th>Fibrous roots inside a container</th>
<th>Fibrous roots outside a container</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C-(^{\gamma}) content (%)</td>
<td>C-N ratio</td>
<td>C-(^{\gamma}) content (%)</td>
<td>C-N ratio</td>
</tr>
<tr>
<td>September 15 Control</td>
<td>20.58*</td>
<td>18.88</td>
<td>21.40</td>
<td>7.70</td>
</tr>
<tr>
<td>November 4</td>
<td>Control(^{*})</td>
<td>21.68</td>
<td>16.68</td>
<td>32.61</td>
</tr>
<tr>
<td></td>
<td>BA (1)</td>
<td>28.39</td>
<td>22.53</td>
<td>26.98</td>
</tr>
<tr>
<td></td>
<td>BA (3)</td>
<td>26.52</td>
<td>21.56</td>
<td>31.30</td>
</tr>
<tr>
<td></td>
<td>IAA</td>
<td>29.51</td>
<td>22.70</td>
<td>35.58</td>
</tr>
</tbody>
</table>

* Control: drenched once with water; BA(1): drenched once with a BA solution; BA(3): drenched three times with a BA solution; IAA: drenched once with an IAA solution; Paclo.: drenched twice with a Paclobutrazol solution.
\(^{\gamma}\) Total carbohydrates.
\(*\) Average of the three samples.
Table 5. Flower bud differentiation in plastic-house-cultivated satsuma mandarin trees ('Nichinan ichigo') that were pruned in August and drenched in September with a plant growth regulator.

<table>
<thead>
<tr>
<th>Plot</th>
<th>Number of leafy flower buds per tree</th>
<th>Number of leafless flower buds per tree</th>
<th>Total number of flower buds per tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>47.3</td>
<td>152.3</td>
<td>199.7</td>
</tr>
<tr>
<td>BA × 1</td>
<td>76.0</td>
<td>347.7</td>
<td>423.7</td>
</tr>
<tr>
<td>BA × 3</td>
<td>64.0</td>
<td>271.3</td>
<td>335.3</td>
</tr>
<tr>
<td>IAA</td>
<td>105.7</td>
<td>186.7</td>
<td>292.3</td>
</tr>
<tr>
<td>Paclo.</td>
<td>60.7</td>
<td>424.3</td>
<td>485.0</td>
</tr>
</tbody>
</table>

Control: drenched once with water; BA × 1: drenched once with a BA solution; BA × 3: drenched three times with a BA solution; IAA: drenched once with an IAA solution; Paclo: drenched once with a Paclobutrazol solution.

Average of the three trees.

Table 6. Flower bud differentiation in plastic-house-cultivated satsuma mandarin trees ('Nichinan ichigo') that were pruned in August and soil-drenched in September with a BA or L-proline solution.

<table>
<thead>
<tr>
<th>Plot</th>
<th>Number of leafy flower buds per tree</th>
<th>Number of leafless flower buds per tree</th>
<th>Total number of flower buds per tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>101.7</td>
<td>262.3b</td>
<td>364.0b</td>
</tr>
<tr>
<td>BA</td>
<td>111.4</td>
<td>390.7a</td>
<td>502.1a</td>
</tr>
<tr>
<td>L-proline</td>
<td>106.7</td>
<td>394.5a</td>
<td>501.2a</td>
</tr>
</tbody>
</table>

Control: drenched once with water; BA: drenched with a BA solution; L-proline: drenched once with a L-proline solution.

Different letters within columns indicate significance at 1% level using Duncan's multiple range test.

Among the growth regulators applied, IAA is surely known to stimulate rooting, and some papers actually reported the good effect of auxin or auxin relatives treatment for rooting of satsuma mandarin (Ono et al., 1987; Yamashita and Matsu da, 1977). Therefore, an increase of fibrous roots observed in this treatment is much convincing. The importance of fibrous roots for dry matter production of satsuma mandarin is already suggested (Ono et al., 1986; Ono 1987). Fibrous roots increased by a drenching treatment of IAA solution may have resulted in a larger quantity of cytokinins, which were translocated to leaves to activate photosynthesis. Then, the carbohydrate content might be increased in shoots and could favor flower bud formation in shoots. Simul-
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Fig. 4. Growth of the fibrous roots of plastic-house-cultivated satsuma mandarin trees ('Nichinan ichigo') which received a soil drenching treatment with a BA or L-proline solution.

1. Control
2. BA
3. L-proline

As for the role of BA, it may have stimulated root growth (Yamazaki et al., 1989) by being easily absorbed through the rough surface of fibrous roots or middle-sized roots (Tanimoto, 1988). The BA might be retransported to the top together with the endogenous cytokinins produced in the roots; the BA then might stimulate photosynthesis in the leaves. The large carbohydrate accumulation would then promote flower bud development.

As for Paclobutrazol, Kawase and Suzuki (1988) observed that more flower buds differentiated on satsuma mandarin trees when sprayed in the fall and winter. Okuda et al. (1994) applied Paclobutrazol into soil in October at a dosage of 500 or 1000 mg per potted plant and found a significant promotion of flowering in the following season accompanied by a considerable inhibition of vegetative growth. They suggested a possible alteration in carbohydrates partitioning in the treated trees, but they did not discuss the direct effects of Paclobutrazol on flower bud differentiation in the same season of application. After being absorbed by the roots and translocated to the top, Paclobutrazol must have inhibited GA synthesis in the shoots or leaves, thus lowering the GA level. This inhibition of GA synthesis may have favored flower bud differentiation in the treated trees. According to Goldschmidt et al. (1985), a GA spray in mid autumn seems to deny a good effect of high carbohydrate level in the shoot which can be brought about by girdling in early autumn. Similar explanation was offered by Takagi et al. (1989) who investigated the seasonal changes of GA-like substances in spring shoots of satsuma mandarin trees. In November, the GA-like activity in leafy inflorescence shoots was higher than that in vegetative shoots. Early fruit thinning in May or June caused lower levels of GA-like activity in leafy inflorescence shoots than did late thinning in August or non-thinning. They proposed that GA concentration just before morphological flower bud differentiation plays a regulatory role in flower bud formation.

Proline was as effective as BA on flower bud differentiation of satsuma mandarin. What role proline plays in the reproductive physiology of a plant still remains obscure. Kato et al. (1985) who fed labelled proline to the leaves of satsuma mandarin trees in autumn and followed its movement found that leaves could synthesize proline preferentially and supply it to other organs and tissues. While investigating the effects of air and soil temperatures in autumn on flower induction and
some physiological responses of satsuma mandarin, Poerwant and Inoue (1990) reported that a possible correlation exists between the proline content of leaves and the number of flowers produced. Thus, proline may produce some specific proteins essential to flower bud differentiation. Using electrophoretic-gel analysis, Murai et al. (1992) observed that gels of NaCl-soluble protein extracts from leaf and bark samples from non-bearing spring shoots of 'Kawano Natsudaidai' had more bands with stronger staining intensity than did comparable samples from bearing shoots. With respect to the salt soluble proteins, more emphasis should be placed on the specific proteins in the buds. The results of the electrophoretic analysis will probably explain the function of proline. The effect of proline on flower bud differentiation may be proved in an in vitro culture of excised buds of satsuma mandarin, through which some valuable data to discuss about are already accumulated (Garcia-Luis, 1993).

The discussion so far can be summarized as follows.

1. Carbohydrate content and C-N ratio should be focused on the fibrous roots and stems in consideration of reproductive physiology of satsuma mandarin trees. Possibly, the fibrous roots could produce some kinds of growth regulators which might be involved in the flowering of satsuma mandarin trees.

2. Soil-drenching with growth regulators is more effective than a foliar spray treatment, because absorption through the root surface seems to be faster than that through leaf surface. It would replace the tedious ringing or strangulation (Nakajima et al., 1989) used traditionally to induce flower bud differentiation. Proline or cytokinins could be good candidates for the drenching treatment because it is cheaper than chilling the soil which was recently suggested for a plastic-house culture of satsuma mandarins (Poerwant et al., 1989; Poerwant and Inoue, 1990 a, 1990 b).

Literature Cited


Ono, S. 1987. Effects of soil water and feeder root


IAA, ベンジルアデニン, パクロブトラゾール水溶液の土壤灌注処理による ウンシュウミカンの花芽分化の促進

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摘 要

摘果を行って葉果比15の着果負担をかけた露地植えの‘興津早生’ ウンシュウミカンの果実に, インドール酢酸水溶液を7月に土壤灌漑した。また, 収穫後の7月に夏せん定を行ったハウス植えの‘日南一号’ ウンシュウミカンの若木を対象として, インドール酢酸, ベンジルアデニン, パクロブトラゾールの水溶液を9月に灌漑した。その結果, 灌漑処理を行った木では, 土壌表層における細根の生育が良好となり, 新梢の花芽分化が優れた。晚秋における新梢（茎）の炭水化物含量率をみると, 灌漑処理樹は無処理樹よりも高い数値を示し, 逆に細根については, 前者が後者よりも低い数値を示した。また, 処理樹では新梢（茎）のC-N率が無処理樹のそれよりも高く, 細根では逆に, 処理樹のC-N率が無処理樹のC-N率よりも低かった。以上の実験とは別に, 夏せん定を行ったハウス植えの‘日南一号’ ウンシュウミカン若木に, プロリン水溶液を9月に灌漑したところ, 細根の生育は良好となり, 新梢の花芽分化も優れた。これらの結果について生理学的考察を加え, 植物生長調節物質やアミノ酸水溶液の灌漑処理の実用化について, その可能性を論じた。