Potential ability of fruit itself affecting fruit development in peaches

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Abstract This experiment was carried out to get better understanding regarding with fruit life from flower bud to ripening of fruit in peaches. Both early and late maturing fruits themselves that were grafted on the bearing shoot of mid maturity were showed remarkably characteristic growth curves in a similar pattern of individual variety. Generally the quality of each grafted fruit was markedly influenced to depend on various stocks. However maturity time of all early and late maturing fruits themselves grafted completely coincided with the characteristic maturity time of each variety without depending on different stock condition. It is evident from this experiment that the maturity of the fruit itself was controlled genetically the characters of each variety.

Introduction

It is well known that the final size of fruit depends for a large part on the number of cells already present in the ovary at anthesis.

Many developing fruits contain chloropyll and it is usually assumed that they can assimilate CO_2 in light. This phenomenon has been demonstrated with stone fruit by Kriedemann.[1] By appiying $^{14}CO_2$ to apricot fruits, it has been shown that the resulting fixed carbon is uniformly distributed through the fruit tissue. The rate of such photosynthesis is relatively low and its contribution to fruit dry weight is small.

It is believed that a large part of fruit growth is maintained with assimilation from leaves. However, we do not know exactly what the fruit needs in order to grow what compounds the plant body has to supply it. The ultimate shape and mature time in peach fruit seem to depend both on its genetic constitution and the environmental conditions under which it grow up.

This experiment was carried out to get better understanding regarding with fruit life from flower bud to ripening of fruit in peaches.

Materials and Methods

For experiment three cultivated varieties (Sunakowase : early maturing ; Okubo : mid matur ing ; and Hakuto : late maturing) and one unknown wild seedling tree that produced some small fruits of poor quality were used respectively at experimental orchard belongs to Kyoto

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Ordinarily there are three buds at node in peaches, but it can be found sometimes that fruit buds at a given node may occur numbers of one, two, or three depending the variety and tree vigor. For this experiment a single alone flower bud of both early and late maturing varieties was employed. Both one hundred flower buds which were removed from early and late varieties were grafted on each bearing shoot of both unknown seedling and mid maturing variety in late summer by using budding technique. The diameter of grafted fruit was measured at weekly intervals from full bloom until maturity. At harvest times of both early and mid varieties, each grafted fruit was examined for size and firmness. For grafted fruit quality, content of soluble solids (by refractometer) and total acid content (total titratable acidity) were obtained. In addition to content of soluble solids, sugar content of each grafted fruit was also determined quantitatively at harvest times of both early and mid varieties as described by Sweeley.[2)]

Results

The growth curves of each grafted fruits are shown in Fig. 1. Compared with matched control fruits of whole mid maturing fruit, both early and late maturing fruits themselves that were grafted on the bearing shoot of mid maturity were showed remarkably characteristic growth curves in a similar pattern of individual variety in the fruit size from full bloom until maturity. Conversely, early maturing fruit alone itself that was grafted on a bearing shoot of unknown and wild seedling was distinctly smaller than whole matched control fruit that attached tree of early mature variety.

In addition, this seedling significantly affected on the fruit L/D ratio of grafted fruit. However maturity time of all early and late maturing fruits themselves grafted completely coincided with the characteristic maturity time of each variety without depending on different

Table. 1. At harvest of early and mid varieties, the firmness, soluble solids and titratable acidity on each grafted fruit.

Combination	Diameter	Weight	Soluble solids	Titratable acidity	Firmness
Sunakowase/Seedling (early) (late)	65mm	68g	6.5%	4.8ml	1.6kg
Sunakowase/Okubo (early) (mid)	68	175	10.8	4.7	2.9
Sunakowase/Sunakowase (early) (early)	72	220	10.8	3.0	2.0
*Hakuto/Okubo (late) (mid)	58	115	10.1	8.1	2.6
*Hakuto/Sunakowase (late) (early)	58	113	10.3	7.6	2.5
*Hakuto/Hakuto (late) (late)	59	120	10.2	7.4	2.7
*Okubo/Okubo (mid) (mid)	70	240	13.0	5.5	1.3

* at harvest of mid variety

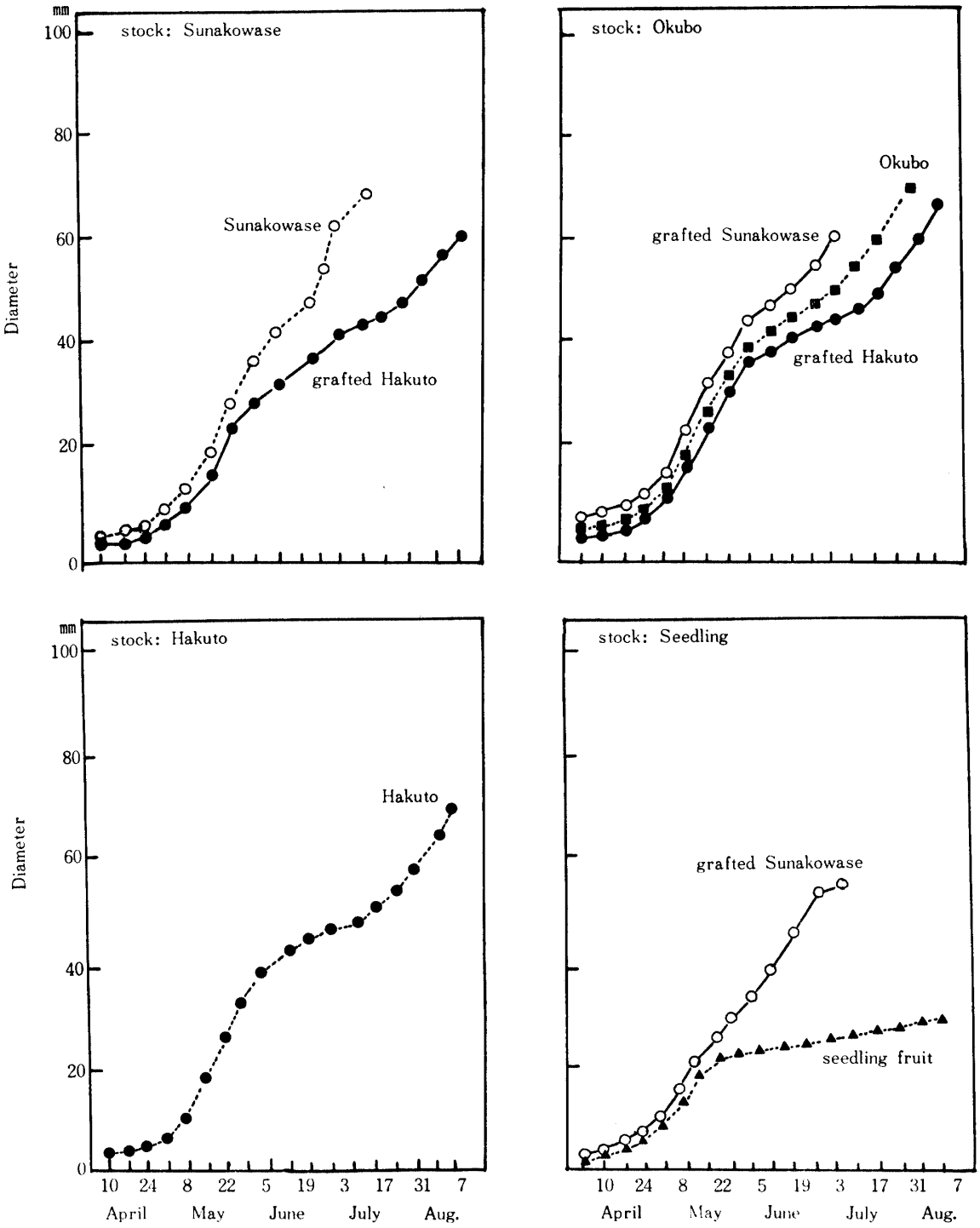

Fig. 1. The growth curves each grafted fruits as compared with non grafted fruits

stock conditions as shown in Plate 1.

At harvest of each variety, the firmness, soluble solids and titratable acidity on each grafted fruit are given in Table 1. Generally the quality of each grafted fruit was markedly influenced to depend on various stocks. The most influence on grafted fruit quality was the difference in soluble solids in early maturing fruit that had been grafted on the shoot of unknown seedling. The changes in the content of sugars between grafted and non grafted fruits among four

Table. 2. The changes in the content of sugars between grafted and non grafted fruits among four varieties at early and mid maturing times.

per 100g fresh weight

Combination	Fructose	Glucose	Sorbitol	Myo-inositol	Sucrose
Sunakowase/Seedling (early) (late)	520mg	620mg	150mg	50mg	2240mg
Seedling fruit/Seedling (late) (late)	140	780	600	320	1920
Sunakowase/Okubo (early) (mid)	620	680	200	50	4320
Okubo/Okubo (mid) (mid)	1390	1580	1040	150	2980
Sunakowase/Sunakowase (early) (early)	670	770	130	380	4450
Hakuto/Hakuto (late) (late)	2300	1800	500	200	1100
*Okubo/Okubo (mid) (mid)	290	260	20	20	7125
*Hakuto/Okubo (late) (mid)	500	240	150	20	4350
*Hakuto/Hakuto (late) (late)	350	280	130	20	4120

* at mid maturing time

varieties at early and mid maturing times are shown in Table 2. Each peach fruit contained four kinds of sugar, such as fructose, glucose, sugar-alcohol and sucrose among four varieties. In comparison with non grafted Sunakowase fruit, sucrose content in grafted Sunakowase fruit on seedling was distinctly low. However sucrose content of all other grafted fruits was relatively similar to content of non grafted and individual variety.

Discussion

It is clear that active competition exists between developing fruit and developing leaves and that situation is constantly changed at a corresponding stage. Kriedemann[1] demonstrated that developing peach fruit at early apparently competed successfuly for available nutrients with newly expanding foliage. Similar competitive effects can be demonstrated between the fruits themselves. On the other hand, climatic factors, such as light and temperature, have numerous effects upon fruit growth. Burg[3] has also presented evidence for the occurrence of a natural inhibiter in mango trees. A similar situation probably exists in a avocado fruit in which the climacteric rise and ripening do not occur while the fruit remains attached to the tree. (Biale[4]) Therefore, it is very interesting to get more knowledge about how potential ability of fruit itself affects fruit maturity and quality such as sugar and organic acids. As a matter of course the ultimate shape and size of fruit appears to be controlled with the genetic factors and the environmental condition.

It is evident from this experiment that the maturity of the fruit itself was controlled genetically the characters of each variety without depending on assimilation from leaves in the various peaches. However, the quality such as sugar and organic acids was affected remarkably by various stocks condition.

References

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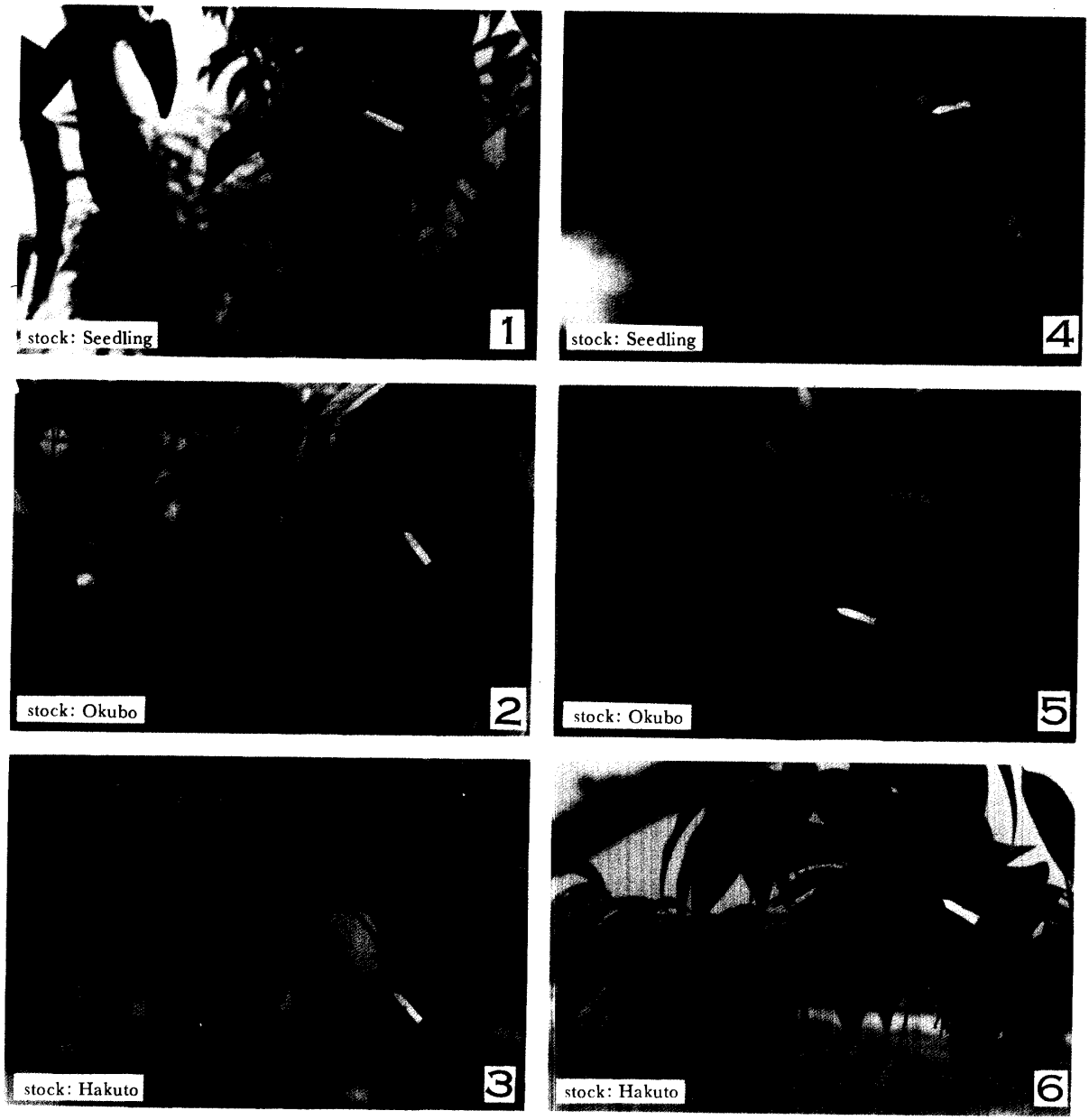
2) Sweeley, C. C and Ronald Bentley, M. Makita and W. W. Wells (1963) : J. Amer. Chem. Soc, **85**, 2497
3) Burb, S. P. and Burg, E. A. (1965) : Science, **148**, 1190
4) Biale, J. B. (1960) : Adv. Fd. Res, **10**, 293

要旨・熟期の異なる品種の花芽を芽接することにより，これら芽接した品種の果実生育がどのような影響を受けるかを調べた。その結果，総合的に判断すると，果実の熟期は，樹体の栄養状態によって規制されると考えた場合，芽接した砂子早生および白桃の果実の熟期は，養分の供給を受ける大久保の熟期に近づくものと考えられたが，このような現象は認められなかった。したがって，果実の熟期は果実そのものの要因によって決定されるものと推定された。しかし，果実の大きさ，精含量などは着生している樹体の栄養状態により，大きく影響を受けると考えられた。



Each arrow indicates grafted fruit. photographs No. 1～No. 4 are Sunakowase (early maturing variety). Potographs No. 5～No. 6 are Hakuto (late maturing variety)

Plate 1. The characteristic maturity time of all early and late maturing fruits themselves as compared with non grafted fruits