

## 사과 대목 종자의 발아에 관한 연구

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A Study on the Germination of Apple Rootstock Seed, *Malus sieboldii*.

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### Summary

The seeds of *Malus sieboldii* were collected in late fall of 1988 and stored in cold stratification condition for 15 weeks.

Growth regulators such as GA<sub>3</sub>, BA and ABA were treated to the seed to know germination capacity and seedling growth.

The results were as follows.

- 1) Higher germination was achieved in GA<sub>3</sub> and BA plots, But ABA treatment showed lower germination percentage and physiological dwarf and also induced to the secondary dormancy condition in partly.
- 2) Average length of time for germination was delayed over 2 days in ABA plot when comparing with the other plots.
- 3) Average length of plumule and radicle also was inhibited by ABA treatment. This means lower seedling vigor.
- 4) Fresh and dry weight of the seedling were higher in BA plot while ABA plot was lower and undesirable seedling was produced.

From above mentioned results, it is believed that ABA treatment to the seed induced the secondary dormancy and physiological dwarf pattern.

Therefore, utilization of BA can be produced the normal seedling, the authors believed.

### Introduction

Generally, Apple seedling production is based on the grafting with the standard rootstock such as *M. domestica*, *M. sieboldii*, *M. prunifolia* and dwarfed

rootstock EM and MM(11).

Above mentioned rootstocks and seeds can be propagated by sexual and asexual propagation method. But numerous seedling plants can be produced

by sexual propagation, while not numerous by asexual propagation because of limited vegetative parts of the individual plant.

The seeds collected from above mentioned trees are not germinated even though they are matured because of various dormancies. These seeds can be germinated and produced seedlings after dormancy breaking (12). Breaking method of seed dormancy are as follows; cold and warm stratification, scarification, chemical treatment and hormone treatment (12). Among these, hormone treatment is used commonly for the germination of apple seed (12, 13). Hormone treatment to the seed is responded variously according to the kind and period of application, Therefore, the authors studied on the seed germination and seedling growth of apple rootstock by treatment of growth promoters and exogenous abscisic acid once contained in the seed before germination to know the effect on the germination and growth pattern.

### Materials and Methods

The seeds of *M. sieboldii* was collected in late fall of 1988 and cold stratified with the sand contained moisture in naked condition without fruit flesh at the  $5 \pm 1^\circ\text{C}$  refrigerator for 15 weeks.

The seeds were sterilized with 1% NaOCl for 15 minutes and washed off with the sterilized water for several times. And the seeds were treated with 10, 50, 100 ppm GA<sub>3</sub> and 10, 20, 40 ppm of abscisic acid, benzyladenine and control. The seeds were soaked in the hormone solutions for 8 hours and 50 seeds were placed on the filter paper in the petri-dish. The dishes were placed in the incubator with dark condition at  $25 \pm 2^\circ\text{C}$ .

Moisture was supplied every day with sterilized

water in properly.

Experiment was conducted with 3 replications. Germination was checked at 10 AM. everyday. Length of plumule and radicle was measured with caliper. And fresh and dry weight of the seedling was measured with analytical balance (0.1mg – 160g). Dry weight was measured after in the dessicator recover to the room temp. from 3 hours at  $135^\circ\text{C}$  under atmospheric pressure. All of the investigation except germination percentage were conducted after 15 days have passed.

### Results and Discussion

Seed germination of the apple rootstock was shown in Table 1.

Treatment with BA and GA<sub>3</sub> plots showed the same tendency with Control plot in germination percentage.

GA<sub>3</sub> and BA plots showed higher germination percentage than the other plots. Likewise, Sinska also evidenced on the effect of GA (10). Among BA plots, 40 ppm showed higher than the other plots.

ABA plots showed lower germination percentage than the other plot, specially 40 ppm of ABA was the lowest as the result of Pieniagiek in 1973 (5). Rudnicki also showed the same tendency with the treatment of exogenous ABA to the apple seed (6, 8).

There was striking significant difference between 20 and 40 ppm ABA plot and Control plot in germination percentage (6). This result is based on the reduction of GA biosynthesis by exogenous ABA application (3, 8, 9). Higher germination percentage was shown in higher BA concentration as the result of Carlson (2). This result can be shown as Fig. 1.

Table 1. Germination percentage, energy and average length of time for germination of apple stock, *Malus sieboldii*.

Treatment	BA			ABA			GA <sub>3</sub>			Cont.
	10	20	40	10	20	40	10	50	100	
Germination percentage(g)	80.42 <sup>abz</sup>	83.05 <sup>ab</sup>	88.45 <sup>a</sup>	75.62 <sup>b</sup>	58.01 <sup>c</sup>	47.81 <sup>b</sup>	75.33 <sup>b</sup>	77.08 <sup>ab</sup>	75.05 <sup>b</sup>	82.64 <sup>ab</sup>
Germination energy(%)	78 <sup>ab</sup>	78.54 <sup>ab</sup>	84.92 <sup>a</sup>	51.1 <sup>c</sup>	12.41 <sup>d</sup>	5.26 <sup>d</sup>	73.48 <sup>ab</sup>	69.12 <sup>b</sup>	78.49 <sup>ab</sup>	79.05 <sup>ab</sup>
Average length of time for germ.(day)	3.1 <sup>d</sup>	3.1 <sup>d</sup>	3.1 <sup>d</sup>	5.4 <sup>c</sup>	7.4 <sup>b</sup>	8.5 <sup>a</sup>	3.4 <sup>d</sup>	3.4 <sup>d</sup>	3.4 <sup>d</sup>	3.3 <sup>d</sup>

z : Mean separation within rows by Duncan's multiple range test, 5% level.

\* : Data was calculated from 50 seeds with 3 replications.

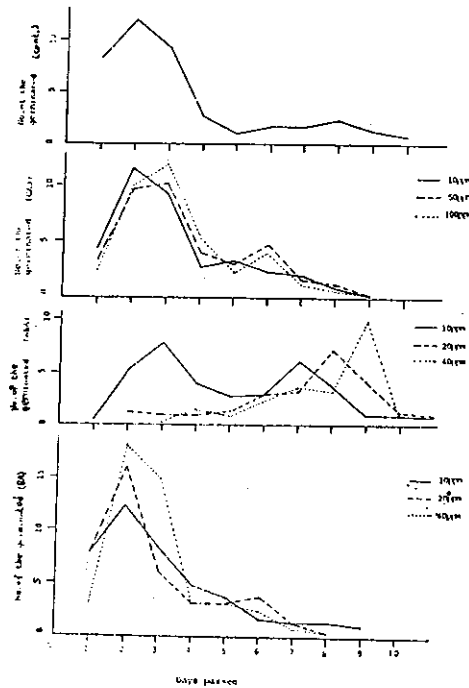


Fig. 1. Germination percentage of apple rootstock, *Malus sieboldii*.

In the germination energy, BA and GA<sub>3</sub> plots showed not significant difference with control plot but showed higher significant difference at the higher ABA plot.

Average length of time for germination also showed delayed effect for 2 days by treatment of ABA.

In average length of plumule, there were significant difference between BA and ABA as shown in Table 2.

Seedling treated with ABA 20 ppm was shorter than the other as shown in Photo. 1.

Table 2. Comparison of the seedling developed treated with growth regulators.

Treatment Concentration (ppm)	BA			ABA			GA <sub>3</sub>			Cont.
	10	20	40	10	20	40	10	50	100	
Average length of the radicle (mm)	4.0056 <sup>az</sup>	2.5445 <sup>b</sup>	1.7943 <sup>c</sup>	2.8027 <sup>b</sup>	0.4844 <sup>d</sup>	1.877 <sup>c</sup>	4.1093 <sup>a</sup>	3.7945 <sup>a</sup>	2.9868 <sup>b</sup>	4.1946 <sup>a</sup>
Average length of the plumule (mm)	3.1164 <sup>bx</sup>	2.3059 <sup>d</sup>	2.2085 <sup>d</sup>	2.2582 <sup>d</sup>	0.4963 <sup>f</sup>	1.1366 <sup>e</sup>	3.518 <sup>ab</sup>	3.4756 <sup>ab</sup>	3.729 <sup>a</sup>	2.8614 <sup>c</sup>

z : Mean separation within rows by Duncan's multiple range test, 5% level.

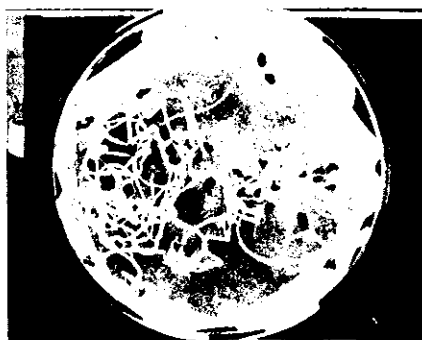
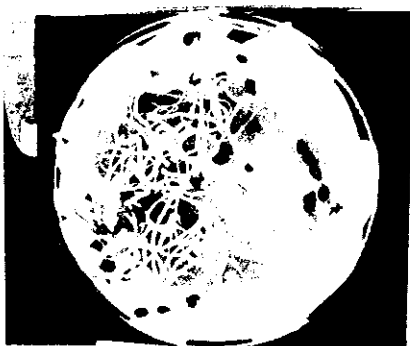


Photo. 1. Seedling developed by treatment of GA<sub>3</sub>, BA and ABA.(From left to right)

The seedling treated with ABA induced secondary dormancy and that dwarfed seedling as the result of Abott in 1969(1. 4).

In average length of radicle, GA<sub>3</sub>plot showed striking effect on the elongation but ABA 20 ppm

also showed the shortest length than the other plots.

Fresh weight of the seedling produced by BA treatment showed higher weight while light in weight by ABA treatment as shown in Table 3.

Table 3. Fresh and dry weight of the seedling devekioed after 14 days from germination.

Treatment	BA			ABA			GA <sub>3</sub>			Cont.
	10	20	40	10	20	40	10	50	100	
Concentration (ppm)										
Fresh weight (mg)	1290 <sup>abz</sup>	1163.3 <sup>ab</sup>	1483.3 <sup>ab</sup>	1053.3 <sup>ab</sup>	433.3 <sup>c</sup>	539.7 <sup>c</sup>	1176.7 <sup>ab</sup>	1246.7 <sup>ab</sup>	1306.7 <sup>ab</sup>	1296.7 <sup>ab</sup>
Dry weight(mg)	170 <sup>ab</sup>	156.7 <sup>ab</sup>	220 <sup>a</sup>	196.7 <sup>a</sup>	120 <sup>bc</sup>	69.7 <sup>c</sup>	113.3 <sup>bc</sup>	123.3 <sup>bc</sup>	193.3 <sup>a</sup>	173.3 <sup>ab</sup>
Moisture percentage(%)	87.76 <sup>a</sup>	86.15 <sup>a</sup>	85.11 <sup>ab</sup>	80.89 <sup>ab</sup>	72.48 <sup>c</sup>	85.32 <sup>ab</sup>	90.96 <sup>a</sup>	90.38 <sup>a</sup>	84.27 <sup>ab</sup>	86.6 <sup>a</sup>

z : Mean separation within rows by Duncan's multiple range test, 5% level.

This means lower seedling vigor, the authors believed.

Dry weight of the seedling produced by treatment of BA 40 ppm, ABA 10 ppm and GA<sub>3</sub>100 ppm were higher than Control plot but ABA 40 ppm showed the most light in dry weight.

Moisture content were higher in BA and GA<sub>3</sub>plot than ABA plot. Among these, ABA 20 ppm plot was the lowest in moisture content.

### 적 요

일반적으로 사과나무의 일반 대목용으로 많이 이용되고 있는 삼엽해당(Malus sieboldii)의 종자를 1988년 11월에 경북대학교 부속 농장에서 채취하여 15주 동안 습기 있는 모래에 층적 처리후 발아와 그후의 생육상을 알기 위하여 GA<sub>3</sub>, BA와 ABA를 처리하여 다음과 같은 결과를 얻었다.

1. 처리구중에 GA<sub>3</sub>, BA구는 발아율이 높았고 ABA처리구는 낮았으며 ABA처리가 다시 종자를 휴면상태로 유도시키던지, 정상적인 묘가 되지 못하였다.
2. 평균 발아기간 역시 ABA를 처리한 구들은 다른구에 비하여 2일 이상 지연되었다.
3. 평균 유아와 유근의 길이는 ABA 20ppm 처리구가 가장 불량하였다. 이는 묘의 세력이 약하다는 것을 나타내며 불량묘가 생산되었다.
4. 생성된 묘의 생체중과 건물중의 비교에서 BA 처리 구들이 비교적 묘의 무게가 무거웠고 ABA처리구는 가벼워서 비정상적인 묘를 형성하였다.

이상의 결과를 종합하면 휴면이 타파된 종자에 ABA를 외적으로 처리하면 다시 휴면상태가 되며 또 발아가 되어도 생리적인 왜화 상태를 나타낸다. 그래서 묘의 건전한 생장을 위해서는 BA가 우수

하다고 인정되어 진다.

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