

***THE CULTIVATION OF
STRAWBERRY
IN JAPAN***



MASAAKI TAKEI

**SAFE VEGETABLE PROMOTION PROJECT
IN BENGUET**

The Cultivation of Strawberry in Japan



Masaaki TAKEI

FOREWORD

Toward Year-Round Production of Safe Strawberries

In Japan, consumers purchase sweet and tasty strawberries all the year round. Berries are eaten both fresh and as processed products. Strawberry cakes and many other types of sweets are popular among young ladies and children. In the Philippines, strawberry jam and wines are marketed. But we can create additional demand for berries by producing sweets using them.

Presently in the Philippines, only winter-type strawberries are planted. We can create new all season varieties which fit growing conditions in Benguet and let the farmers grow berries all the year round.

Benguet farmers depend heavily on chemicals. But, we can grow safe and tasty strawberries to be eaten fresh by using plastic house protection.

Expanded demand for processing, all-the-year supplies and safe and tasty berries will, I am sure, contribute to larger income to Benguet farmers.

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Introduction

Japanese People love strawberries. There are lots of strawberry products in Japan.



Strawberry shortcakes



Strawberry wedding cakes



Strawberry sweets

Japanese are consuming strawberry not only fresh, but also as strawberry products such as cakes and sweets.

Chapter 1

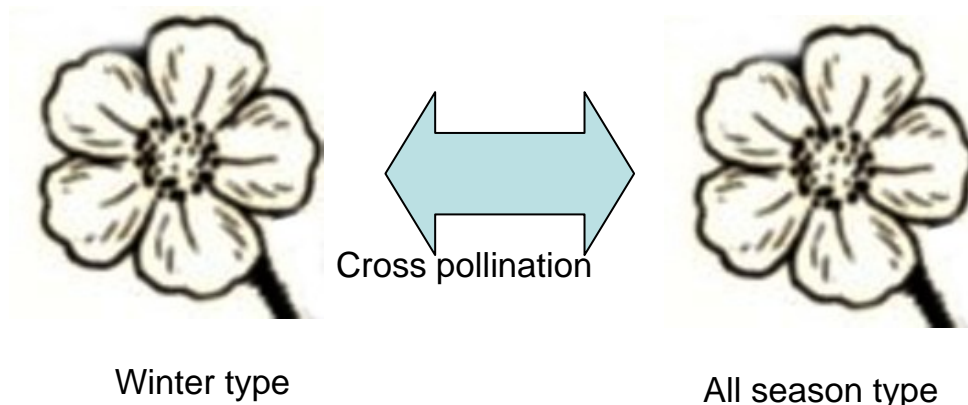
ALL SEASON VARIETIES

Usually Japanese farmers are producing strawberries from November to May. Most strawberry varieties in Japan are WINTER TYPE varieties. Hence, Japan imports strawberries in the off-season (May to November).

However, breeders, both private and public, are developing new varieties, and then the production of all-season type strawberries is increasing.

If they use all-season type strawberries, they can harvest them from June to November. During this period, the price of the strawberry is higher. The reason is limited supply. It is off-season for normal one-season or winter type varieties.

How do you develop strawberry varieties? It is through “Cross-Breeding” or “Cross-Pollination”.



Of all seeds produced by pollination, 50% are all-season type. Then, they select the plants with desired color, sugar content, sarcocarp, fragrance, size, etc.

It is easy to do cross-pollination, but it is very rare to find a new variety

you want. You must be patient to find one. In Japan, they usually say that they can find a new variety which they want from among 10,000 to 100,000 hybrid plants.

Nagano prefecture is developing new strawberry varieties which have all season characteristics. Let us see major ones

Summer Princess



(Aug~Nov)

Color: light red

Sugar content: 8.28

Sarcocarp : Soft

Fragrance : Strong

Size : a little small

Summer Engel



(Aug~Nov)

Color: dark red

Sugar content: 7.68

Sarcocarp : Soft

Fragrance : Average

Size : small

8-9



(Aug~Nov)

Color: dark red

Sugar content: 9.88

Sarcocarp : hard

Fragrance : Strong

Size : a little big

Flamenco



(Aug~Nov)

Color: light red

Sugar content: 6.52

Sarcocarp : hard

Fragrance : weak

Size : a little big

Color inside fruits of different varieties



Flamenco

8-9

**Summer
Princess**

**Summer
Angel**

Chapter 2

CULTIVATION

Section 1: Planting Beds

Strawberry production in Japan is mostly done in green houses. It is because they need to control the temperature, water and other conditions to produce higher quality strawberries.

Steel frame greenhouse



Pipe greenhouse



Nowadays, strawberry production on elevated bench is getting popular among strawberry farmers.

They use several materials like coco-peat as soil /media to fill cultivation benches.



Left (coco peat)、 Right (pumice stone+peat moss)

They provide fertilizers through drip irrigation.



●A plastic water hose



- Liquid chemical fertilizer tanks (two)
- Mixing machine, Control unit
- Water tank

Some advanced farmers use computerized machines to mix fertilizer.

Section 2: Nursing Seedlings

Ground Nursery

Planting time of strawberry seedlings in the open field is end of May to middle of June.



Seedlings in pots



In Nagano Prefecture, farmers produce young seedlings in pots for the next year. Runners are planted into pots at the end of August to middle of September, which is close to the end of harvest season.



Section 3: Plant Care in Early Stage

Planting seedlings on beds

Nagano strawberry farmers plant strawberry to beds in March. Then Strawberry grows look like this picture at the end of April.

End of April



Left: plant from pot

Right: plant from ground nursery

Potted plant seedlings are faster to grow than plants from ground nursery.

Beginning of May



In the first week of May, strawberry grows like this picture.

EC of irrigation water is controlled, depending upon growing stage of strawberry, as follows:

EC: 0.2 after bloom 0.25 0.3~0.5 after fruition Temperature inside green house: < 30°C。

Leaves, Runners, Blossoms are removed

(Until 40 days after planting)



Farmers keep strawberry plants growing. Until 40 days after planting, strawberry leaves, runners and flowers are removed. Its purpose is to make strawberry grow bigger. Nutrients are supposed to be used for strawberry plant growth only, not for runners and flowers.

Why do we remove old leaves? Old leaves are less efficient in photosynthesis. They also may be infested with insects/diseases.

Middle of May



- Height : 15~20cm
(not over 30cm)
- 40days after planting,
blossoms com out.

40 days after transplanting, strawberry plants are 15-20 cm tall in good condition. From that time on, we start letting runners grow and flowers produce fruits.

3 sprouts remain

(When additional sprouts come out, cut them off)



We keep only 3 sprouts on 1 plant. If you find more sprouts, it should be removed.

Planting additional runners to bed

(End of May)



- Plant space 25cm
- The middle 12.5cm plant a runner.
- Harvest starts in September.

At the end of May, you can find growing runners. The runners are planted in between strawberry plants.

Beginning of June



Left: 20cm (normal O) Right: 30cm (large X)

At the beginning of June, strawberry plants are supposed to be 20cm tall. Not taller than that!

If you notice your strawberry plants are big, it means that nitrogen content is high in plants. You will then find leaves robust. But the plant will not bear fruits much.

Removing young berries



- **First blossom**
5-6 fruits per stem
- **Following blossoms**
3-4 fruits per stem
- **Too many fruits**
Weaken plants & reduce no of fruits.

During this period, strawberry produces many flowers. But you should remove some young berries. If the plant bears lots of fruits, it will be weak later; then produces less fruits. It ends up in decreased yield in whole season.

Section4: Fruit Bearing Period

First fruits (*End of June*)



Strawberry fruits start ripening at the end of June, which farmers start harvesting.

High temperature period (*August*)



- Strawberry plant grows well under low temperature. (15~25°C)
- Daytime < 30°C.
- Night < 20°C
- Height < 25cm
- Big blossoms come out.

Strawberry prefers low temperature, requires (15-20°C). If temperature is high (over 30 degrees celsius), pollens may die.

Pick excess young berries & leaves (*June ~ October*)



The strawberry produces fruits from June to October. During this time, you need to limit the number of young berries and leaves (thinning). By doing so, you will produce more and harvest time lasts longer.

Low temperature period(October) Bear fruit



- Pick young berries=7~8.
- Under low temperature, large fruits appear.

During the month of October, temperature is going down. In this period, you can harvest large fruits.

Packaging



← Packing
↓



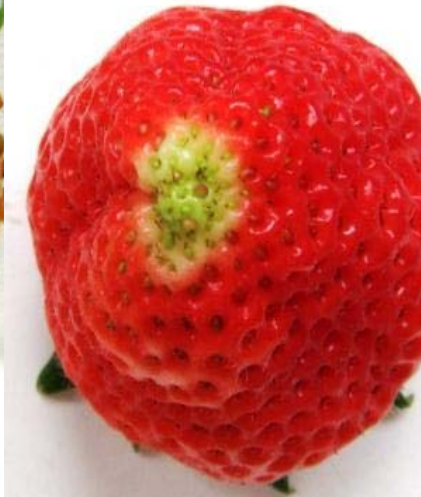
Strawberries are harvested every day. After harvesting, strawberry fruits are packed. Japanese strawberry variety is soft type. So we must be careful to handle fruits.

Section5: Controlling Plant Growth

Deformed strawberries



- High temperature
- Dry



- Oversupply of nitrogen fertilizer



- No honey bee
- Weak plants

Some strawberry fruits are deformed. It is caused by non-pollination.

High temperature kills pollens.

Wind, honey bees, and even flies carry pollen and help pollination.

If the supply of nitrogen is excessive, it will cause the green pigment in the bottom of the fruit.

Oversupply of water

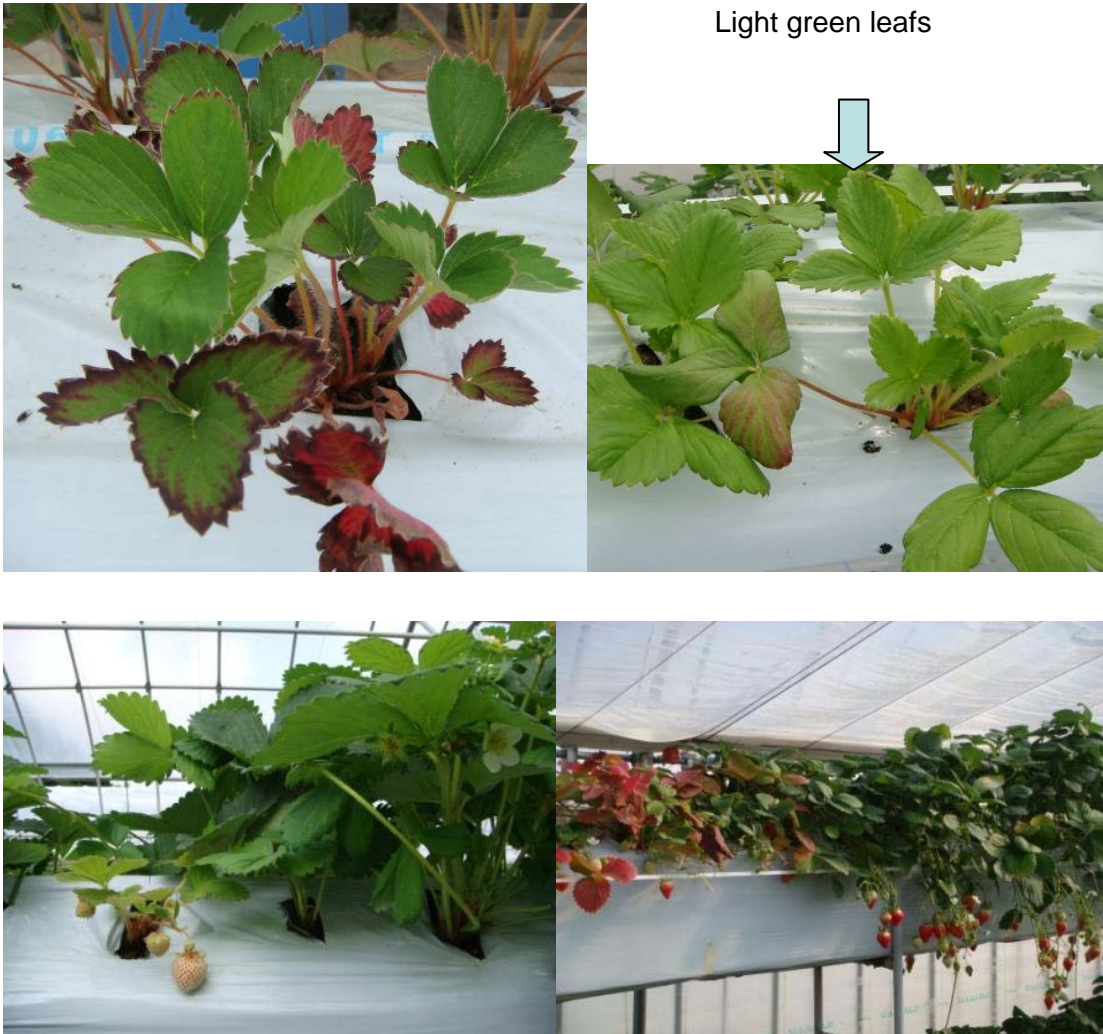


↑
Wilt



If the soil is too wet, strawberry roots will be rotten.

Shortage of water



If the supply of water is not enough for strawberry plants, certain symptoms appear. Edge of leaves become red-brown, or coloring of the leaves turns light green.

Pick excessive young berries

○

X



During harvesting time, you should remove excessive young fruits to keep harvest period longer. If the plant bears too many fruits at once, the plant transfer its nutrition to fruits. And the plant itself gets weaker and weaker.

Overproduction (*Plants become weak*)



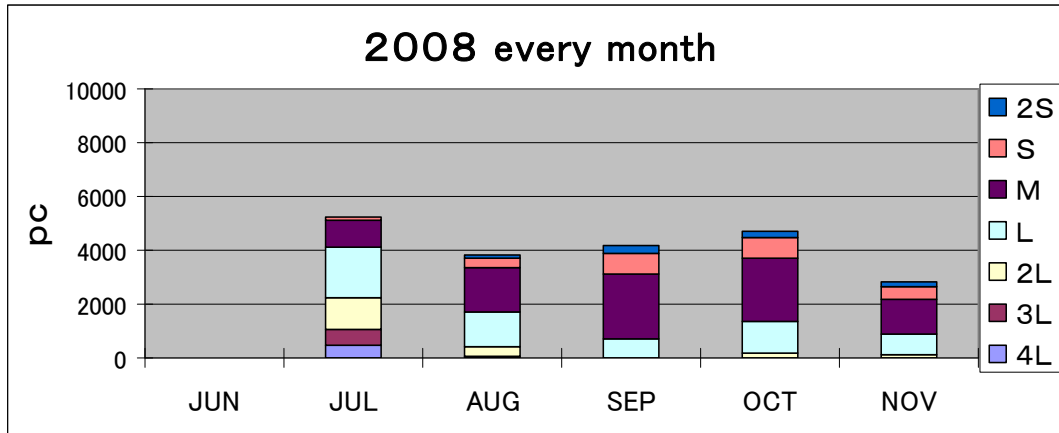
Over-harvesting

- Leaves turn red.
- Leaves droop because of aging.
- New leaves do not come out.
- New blossoms are small.

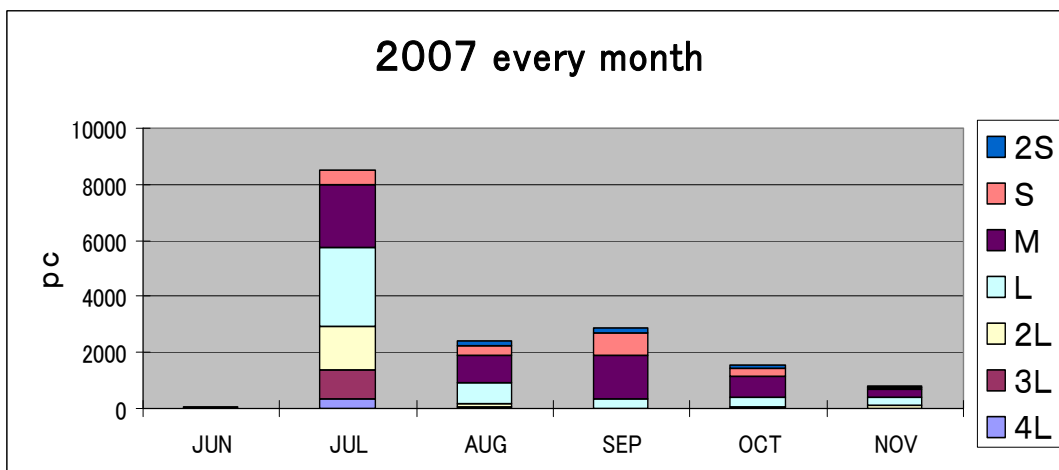
If the plant bears much fruits, strawberry it gets tired, and then shows the following reactions:

- Leaves turn red.
- Leaves droop because of aging.
- New leaves do not come out.
- New flowers are small.

Harvest from good cultivation



Harvest from bad cultivation



Above graphs show the differences of monthly yields between good and bad cultivation.

Good cultivation means that farmer maintains proper number of fruit on plant, and also proper leaves and runners.

※ Year 2008 (good)
House space=17a

Count=12,000 seedlings
Planting distance =25cm
Harvest= 20,803packs/300g
Harvest from 1 plant =520.1g

2s: 5~ 7g
S: 7~ 9g
M: 9~13g
L: 13~18g
2L: 18~23g
3L: 23~28g
4L: 28~

※ Year 2007 (bad)
House space=17a

Count=12,000 seedlings
Planting distance=25cm
Harvest= 16,181packc/300g
Harvest from 1 plant =404.5g

Chapter 3

Protection from Insects and Diseases

Directions for chemical use

● **Bactericides**

Pre-harvest: long effect

For example: copper oxychloride. polyoxins.
sodium bicarbonate.

During harvest: 1day before harvesting

For example: boscalid. iminoctadine

● **Insecticides**

Thrips and Spider Mite: regular intervals 15days

✘ Do not use the following: affect honey bees

For example : fenitrothion. trichlorfon. dichlorvos.
malathion. diazinon. permethrin.

fenvalerate. methomyl

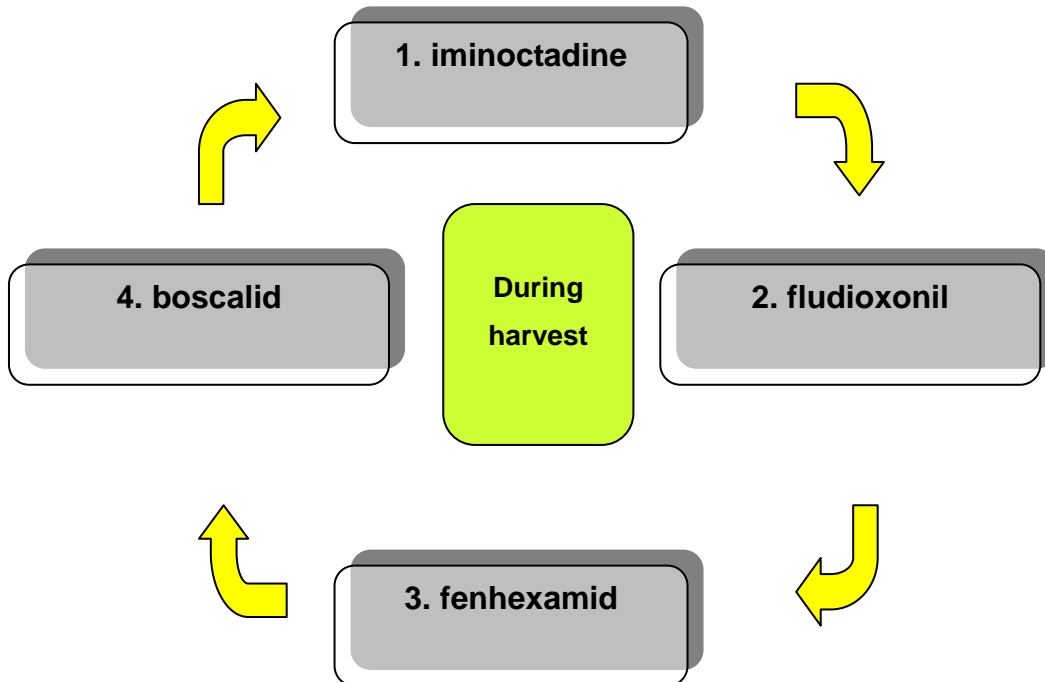
Gray mold



Cause: high humidity

Cure: fresh air into greenhouse & cut off old leaves

Gray mold prevention

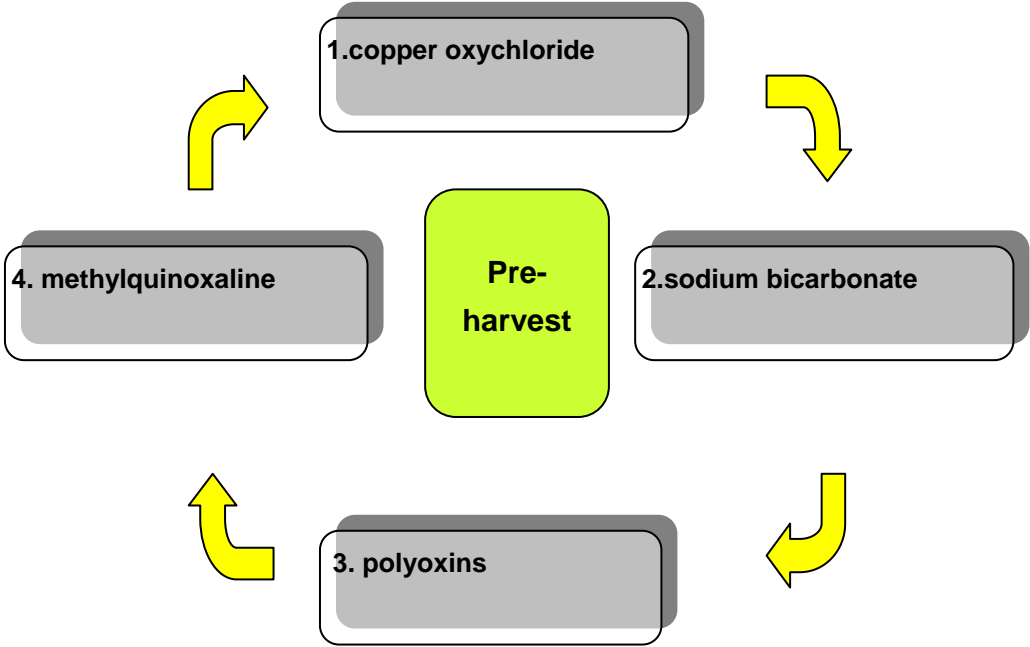


Powdery mildew

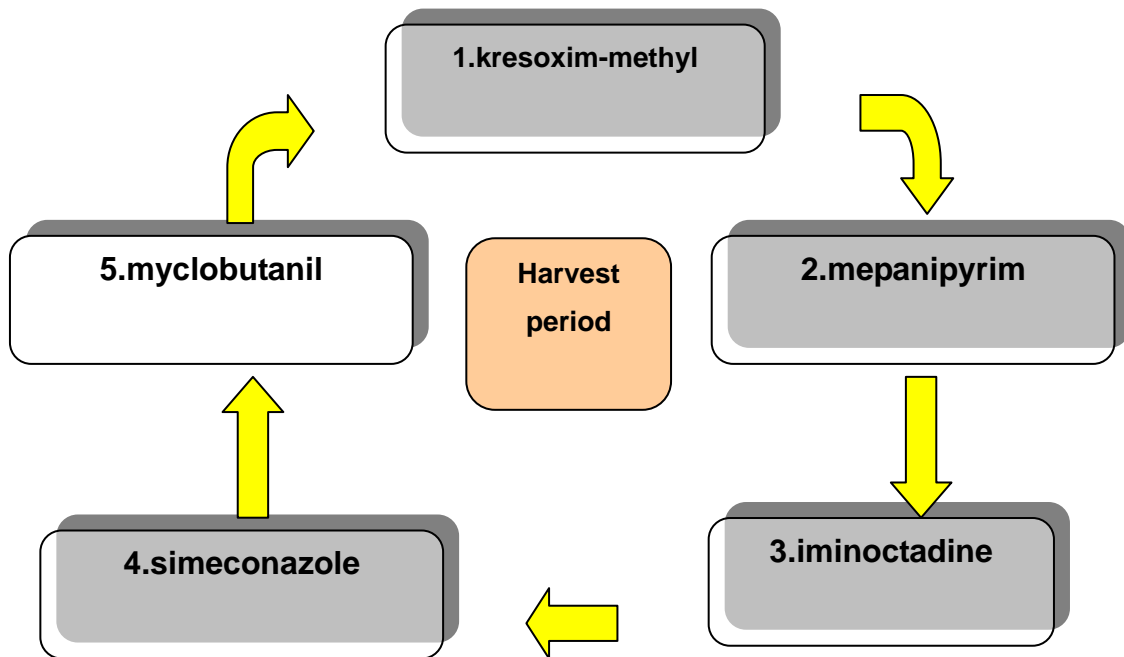


Cause: dry
Cure: cut off affected laves.

Powdery mildew prevention 1



Powdery mildew prevention 2



Verticillium wilt



Cause: Soil-borne infection.

Cure: disinfect soil with **chloropicrin**

Phytophthora rot



Causes: continuous rainy days, soil-borne infection.

Cure: disinfect soil with **chloropicrin**

Aphids



Carry Viruses

Chemicals used: pymetrozine. flonicamid.
nitenpyram. imidacloprid.

acetamiprid

thiacloprid.

Virus



- Plant loses strength.
- Harvest is reduced.

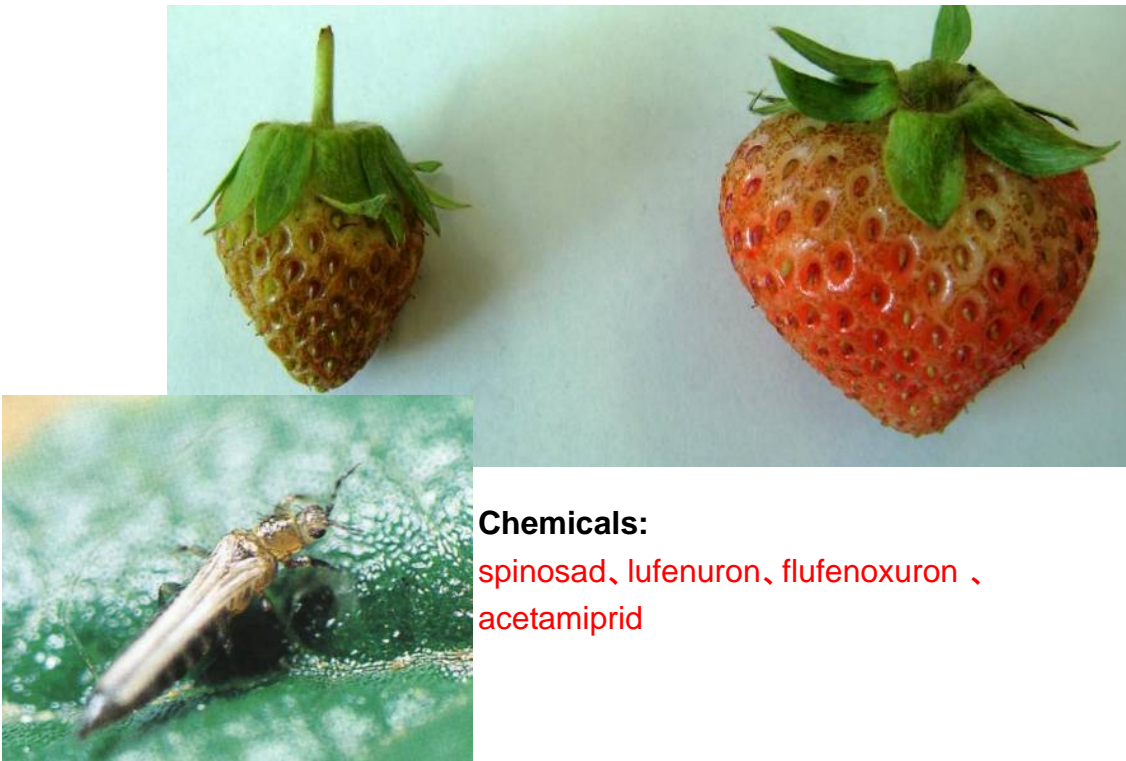
Greenhouse whitefly



Chemicals:

acetamiprid, thiacloprid , pymetrozine

Thrips



Chemicals:

spinosad, lufenuron, flufenoxuron ,
acetamiprid

Spider Mites

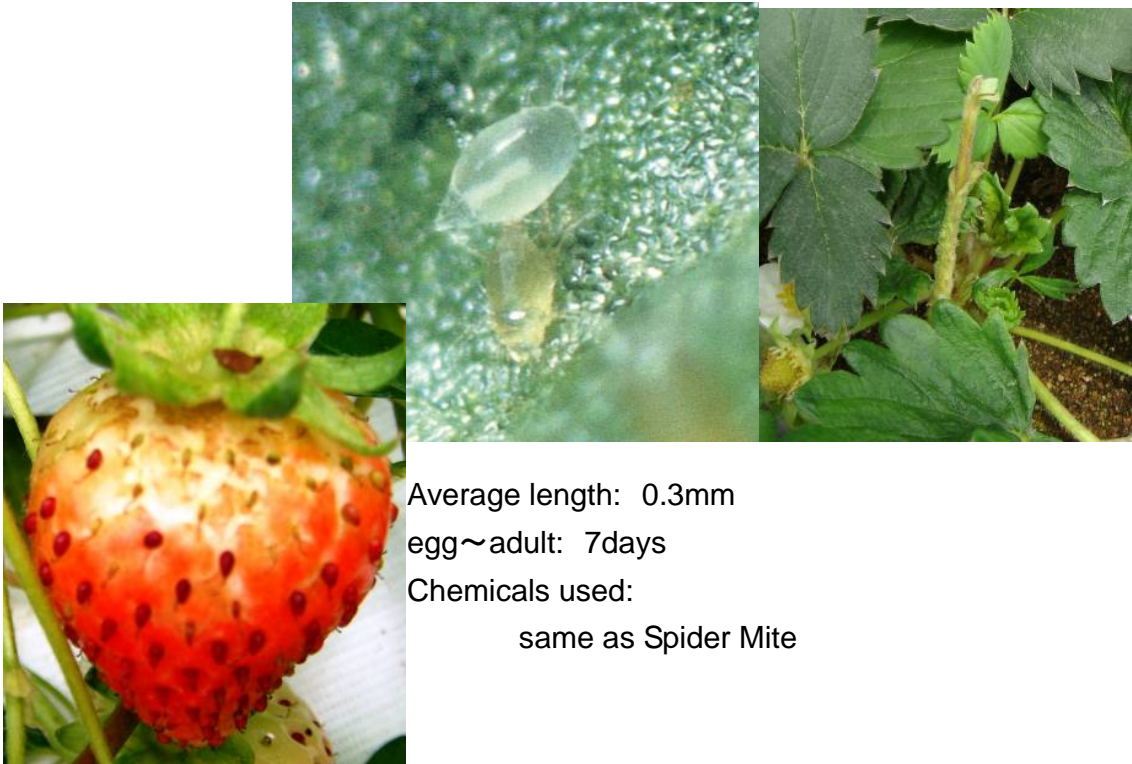


Average length: 0.5~0.7mm
egg~adult: 10days.

Spider Mite prevention

- ① **milbemectin**...end of March-in early-April
- ② **emamectin**... end of April
- ③ **chlorfenapyr**... end of May
- ④ **cyflumetofen**... end of June
- ⑤ **acequinocyl**... end of July
- ⑥ **bifenazate**... mid-August
- ⑦ **fenbutatin oxide+etoxazole**... early-Sep.
- ⑧ **milbemectin**... end of Sep.

Tarsonemid mites



Average length: 0.3mm
egg~adult: 7days
Chemicals used:
same as Spider Mite

Nematode



Average length: 0.7~0.9mm
Chemicals: **carbosulfan**, **fosthiazate**

Hornet



Use strawberry juice to attract/ capture hornets

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