



Enhancing Return Bloom in Apple

UNIVERSITY
of **GUELPH**

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Topics of Discussion

- Flowering
- Biennial Bearing
- Strategies to promote flowering





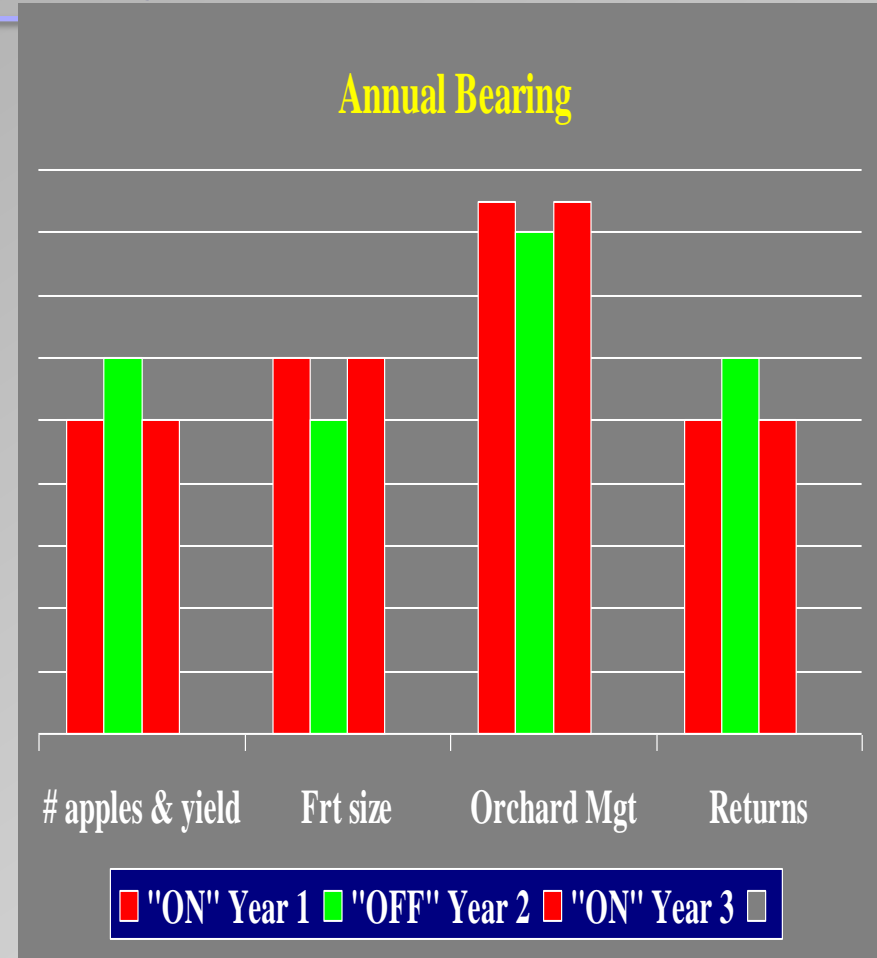
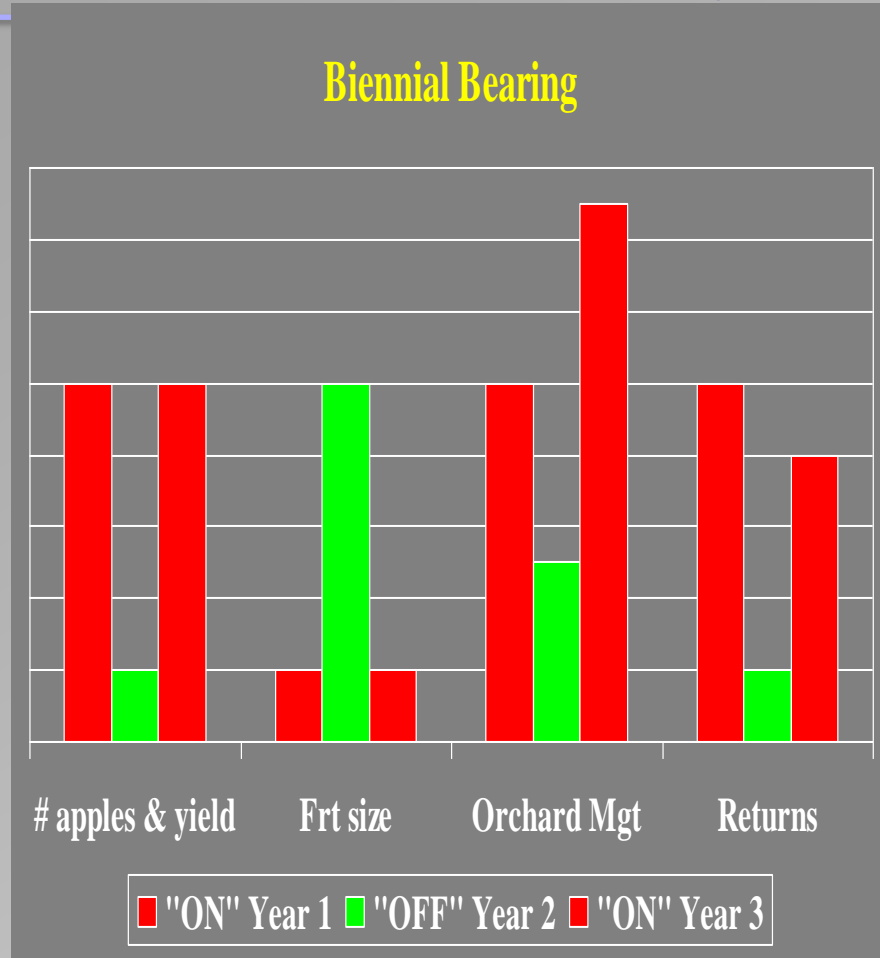
Enhancing return bloom =
regulating the flowering process

Why regulate flowering ?

1. Trees with low precocity (slow to bear fruit)
2. Production becomes biennial
3. Economics - trees required only 5-10% of fruit to set a commercial crop.



Schematic of production, management, profit production cycle over 3 years



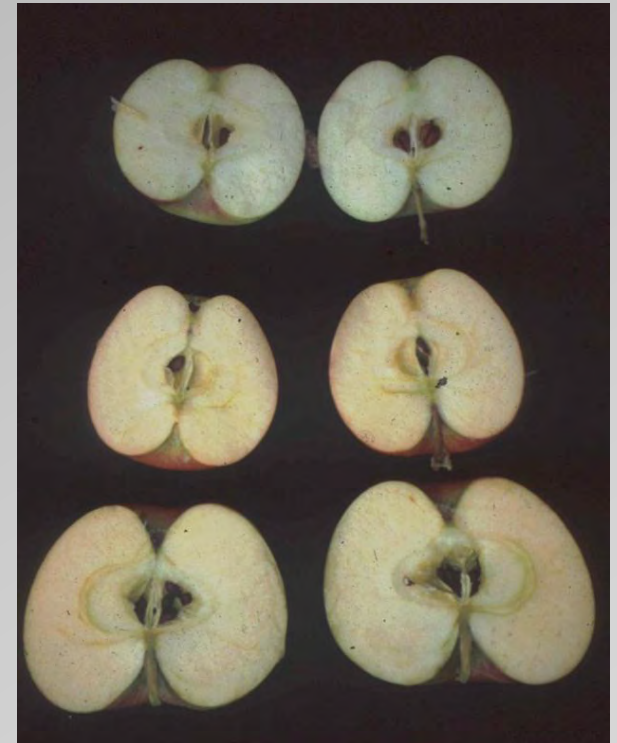
Biennial Bearing in Apples

Possible causes

- Nutrient diversion (Kraus and Kraybill)
- Floral inhibition produced by seeds (Chan and Cain, 1967)
- Bourse shoot length x seed no (Nelson and Dennis, 1999)

Hypotheses

- Seeds produce GA"s
- Seeds compete for floral promoter



Factors influencing flowering

Decrease

- excessive nitrogen
- excessive pruning
- vigorous rootstocks
- gibberellins sprays



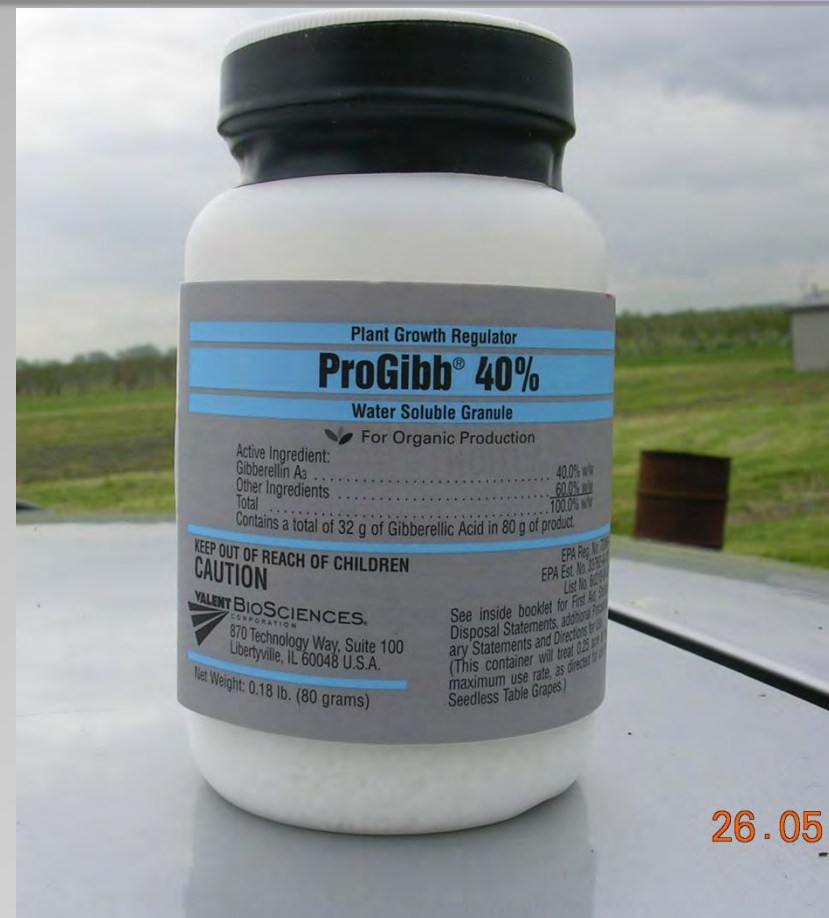
Increase

- branch bending
- branch ringing
- dwarf rootstocks
- fruit thinning
- Plant bioregulators (NAA, Ethephon)

Gibberellic Acid can be used to Selectively Inhibit Flowering

- GA_3 - stone fruit
- GA_{4+7} - pome fruit

Concept: reduce or prevent flower initiation, thereby minimizing the requirement for chemical and hand thinning



Flower Initiation

Definition: the first discernable change from a vegetative bud to a floral primordium

Flower Development: occurs from initiation to flowering the following season. Many floral parts are developed by harvest

Trigger: hormones, biochemical processes, environment (light, temperature, day length)

Period of Initiation

| | |
|--------------|---------------------------|
| Apple | Early Summer (June, July) |
| Peach | Mid Summer |
| Sweet Cherry | July (after harvest) |

Plant Bioregulators

Plant hormones that increase flowering in temperate tree fruit

- Ethephon
- NAA
- others



Application Details – Bearing Details

NAA:

Rate: 4 ppm

3-4 sprays starting in early
July, 7 day intervals

Ethrel:

Rate: 150 ppm

Timing: as above



Ethrel responses by cultivar

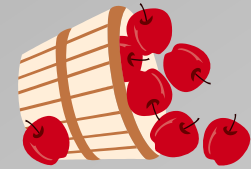
| | <u>Non Bearing</u> | | | <u>Bearing</u> | | | |
|---------------------------|--------------------|----------|--------|----------------|--------|--------|--------|
| | N. Spy 1 | N. Spy 2 | J.Gold | Fuji 1 | Fuji 2 | Empire | J.Gold |
| Tree | | | | | | | |
| Return bloom | ↑ | ↑ | ↑ | X | ↑ | ↑ | X |
| Crop Load (year applied) | - | - | X | ↓ | X | ↓ | X |
| Yield (year applied) | - | - | X | X | - | ↓ | - |
| Shoot Growth (yr applied) | - | X | ↓ | X | X | X | X |
| Fruit Quality | | | | | | | |
| Fruit size | - | - | - | ↑ | - | ↑ | X |
| Firmness | - | - | - | ↓ | - | X | X |
| Soluble Solids | - | - | - | ↑ | - | X | X |
| Starch Index | - | - | - | ? | - | X | ? |
| Percent Red | - | - | - | ↑ | - | X | X |
| Colour by Instrument | - | - | - | ↑ | - | X | X |

X – no sign. effect ↑ Sign. Increase ↓ Sign. - Not measured

Summary of Experimental Results with Ethrel

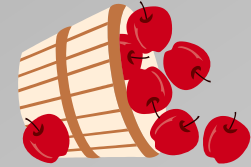
| Cultivar | Bearing | Non-Bearing |
|--------------|-------------------|---------------|
| Northern Spy | ? Further Testing | ✓ 1x 1500 ppm |
| Empire | ✓ 2x 150 ppm | ? |
| Fuji | ✓ 3x 300 ppm | ✓ 1x 1500 ppm |
| Jonagold | X (3 x 150 ppm) | X 1x 1000 ppm |

Summary



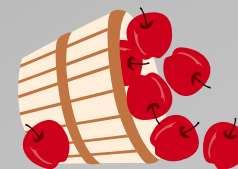
- Ethrel sprays can effectively increase return bloom

Summary



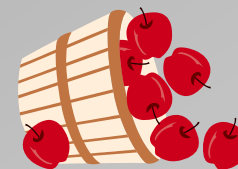
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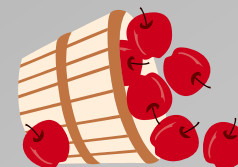
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Summary



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- „Jonagold“ did not respond to Ethrel

Summary



- Ethrel sprays can increase return bloom
- Higher rates can be used on non-bearing trees with a single application
- Ethrel can reduce tree (shoot) growth
- „Jonagold“ did not respond to Ethrel
- Sprays of 4 x 4 ppm NAA improved the bloom of „Empire“

Precautions

Non Bearing Trees

- Do not use on weak trees
- Excessive fruiting could stunt the tree and cause alternate bearing

Bearing Trees

- Can cause fruit thinning if applied very close to bloom (before June Drop)
- Use at lower concentration (< 500 mg per litre)
- Apply Ethrel in “ON” year of biennial cycle. Applications in “OFF” year may contribute towards biennial bearing

Costs?

Based on 1000 litres per hectare
(100 US Gallons/acre) & excluding
machinery costs



Ethrel: \$12 (150 ppm), \$80 (1000 ppm)

NAA : \$27/ha (4 ppm)

Based on: Fruitone N: \$118/567 grams, Ethrel: \$189/10 Litres

- Fruitone N registered in Washington
- Biennial Bearing
- Strategies to promote flowering

AMVAC™
AGRICULTURAL
BULLETIN

**SPECIAL LOCAL NEED
 24(c) LABELING**

Fruitone N™

PLANT GROWTH REGULATOR FOR
 PROMOTING RETURN BLOOM ON
 CERTAIN LOW-BEARING AND
 ALTERNATE BEARING APPLE VARIETIES

**SUPPLEMENTAL LABELING
 FOR DISTRIBUTION AND USE ONLY WITHIN THE STATE OF WASHINGTON**

Fruitone N™

EPA REG. NO. 5481-427

EPA SLN NO. WA-050004

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Follow all applicable directions, restrictions, Worker Protection Standard requirements, and precautions on the EPA registered label. This label must be in possession of the user at the time of pesticide application.

Apply FRUITONE N 42-60 days after full bloom to promote return bloom on certain apple varieties to optimize fruit production from year to year by counteracting alternate bearing tendencies.

ONLY apply FRUITONE N after the potential for additional fruit thinning is minimal. Observe all use rates and varietal recommendations because tree response can vary from location to location. Always consult with your local pomologist or AMVAC representative prior to implementing a return bloom program to determine use rates and spray schedule recommendations.

IMPORTANT PRECAUTIONS AND SPECIAL CONDITIONS OF USE

FRUITONE N is an auxin plant hormone and the response of apple trees to an application of this growth regulator can vary among varieties and year to year. Fruit size and firmness in certain sensitive varieties may be affected. Higher rates of FRUITONE N (>5-15 ppm) when applied between 42-60 post bloom to promote return of bloom may result in crop injury, including but not limited to leaf yellowing, reduced fruit quality, smaller fruit, and/or yield loss. READ AND UNDERSTAND THESE SPECIAL CONDITIONS OF USE BEFORE USING THIS PRODUCT. AMVAC Chemical Corporation makes FRUITONE N available for use in the manner described in this Section 24(c) labeling on the basis that, in the sole opinion of the user, the benefits or utility derived from the use of FRUITONE N on apples outweigh the potential risk of crop injury or loss. If these Special Conditions of Use are not acceptable, the unopened product may be returned to the seller for a refund or used for a different labeled use in accordance with the label affixed to the product container. These Special Conditions of Use are specified by AMVAC Chemical Corporation and not the US EPA or the State of Washington.

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Further Reading and Future Research

Further Research

- Honeycrisp, bearing trees (ongoing)
- Northern Spy



www.plant.uoguelph.ca/treefruit
Search “return bloom”



Okanagan Packinghouse Fieldmen's Group 2010 Conference Feb 18, 2010

