ReTain®

PLANT GROWTH REGULATOR

VALENT®

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Products That Work, From People Who Care®

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Development History

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- 1970s: Hoffman-La Roche
  - Discovered naturally occurring product of *Streptomyces sp.*
  - Inhibits activity of ACC synthase, production of Ethylene
  - Horticultural value explored in the 70s and 80s
- 1990s: Abbott Laboratories
  - Commercial development begins
  - 1995 and 1996: Experimental Use Permits
  - 1997: Registration
- 2000 - present: Valent BioSciences, Valent USA
  - Continued expansion of label
  - Apple, Stone Fruit, Cherry, Walnut, Almond
  - Harvest management, Fruit set
  - Higher use rates, new use patterns for Apple, Pear

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VALENT®

- 20 years;

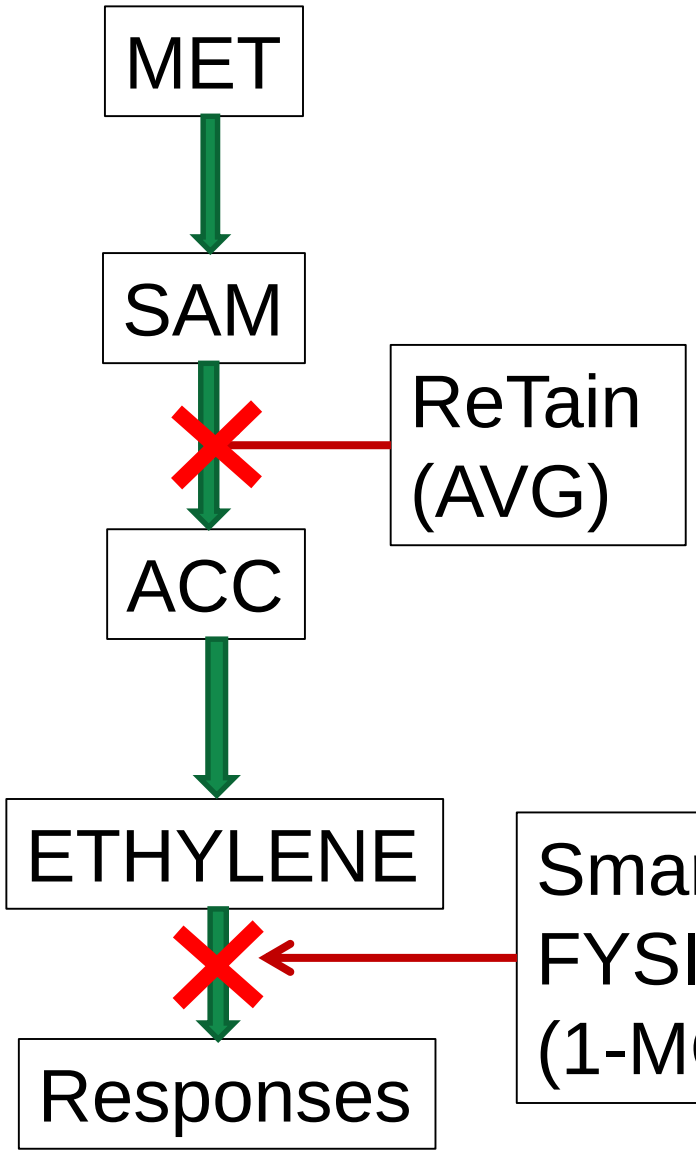
- Harvest Management:
  - Now up to 2 pouches per acre
  - Application window 30 dbh to 7 dbh
  - Ability to dial in desired responses

- Improve fruit set of Apple, Sweet Cherry, Pear
  - Delays flower senescence
  - Overcome cultivar, weather or pollinator issues

Apple Production: End of Season Realities

- Fruit are maturing
  - Softening; Starch converting to sugar
  - Color increases/intensifies
  - Increase in senescence disorders: Watercore, cracking
  - Overall fruit quality is declining
    - Options for storage and/or sales are narrowing
- Fruit are dropping from the tree; direct loss
  - Fruit on the ground = $0
- Weather is not under your control
- Labor and other resources are not unlimited
- Multiple varieties, multiplied complexity

Ethylene *and Ethylene Management…*



- **Ripening agent → color development, softening**
- **Causes leaf & fruit abscission → Thinning, harvest aid**

- **Products to REDUCE ethylene and its effects:**
  - **AVG: ACC biosynthesis inhibitor**
  - **1-MCP: Ethylene action inhibitor**
  - **Drop control, delay ripening, maintain quality, etc.**

New Developments:

- **Fruit set uses of ReTain**
- **Higher ReTain label rates for enhanced effects**

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Biological responses

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- Ethylene production reduced
- Starch to sugar conversion slowed
- **Fruit softening slowed**
- **Fruit drop reduced/delayed**
- Watercore reduced/delayed
- **Cracking reduced/delayed**
- Internal bleeding reduced/delayed
- Greasiness reduced/delayed
- Delays background color shift (e.g., Gala)
- Delays red color development in some varieties

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Practical Impacts - 1

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- Harvest management:
  - Promotes orderly harvest of large acreage of single varieties by treating portions of the crop with different rates/timings of ReTain, delaying maturity and subsequent harvest of those blocks, allowing growers to harvest fruit of optimum quality over longer periods
  - In PYO situations: extend the availability of popular varieties over more weekends
- Labor management:
  - More efficient use of smaller crews to harvest fruit at optimum quality
  - ReTain can help eliminate the “crunch periods” for more orderly harvest.

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Practical Impacts - 2

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- Maintenance of fruit quality (firmness, watercore, greasiness, etc.)
- Protection of yield through drop control
- Increased fruit size due to harvest delay (→ incr. yield)
- Improved fruit color due to harvest delay (→ impr. packout)
- Preconditions fruit to optimize response to postharvest 1-MCP (SmartFresh, FYSIUM) by keeping ethylene levels in check, resulting in more uniform response across all fruit

Using ReTain

Products That Work, From People Who Care®

ReTain Use Basics

- 4 -1 weeks before normal harvest; 7 day PHI
- 1 - 2 pouches per acre
- Single or split applications
- Spray volume = 100 gpa
- OS Surfactant – e.g., Silwet L-77
  - 6 - 12 oz/100 gal
- pH 6-8
- Slow drying conditions; early AM ideal
- Apply to cool fruit only
- May be combined with PoMaxa / Fruitone L as tank mix or program

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2 Pouch Use Rate

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- **New Use Pattern:**
  - **2 pouch maximum**
  - **One or two applications**
    - **28 DBH**
    - **28 DBH + 7 DBH**
  - **Extended drop control**
  - **Extended delay in maturity**
  - **More time for color, size**
  - **Reduction in watercore, cracking**

Supplemental Label

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PLANT GROWTH REGULATOR
SOLUBLE POWDER

EPA Reg. No. 73049-45

(For Use In: AK, AL, AR, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV and WY Only)

RETAIN® PLANT GROWTH REGULATOR SOLUBLE POWDER
FOR USE ON APPLE AND PEAR
FOR HARVEST MANAGEMENT AND IMPROVED FRUIT QUALITY

This supplemental labeling expired on March 11, 2018 and must not be used or distributed after this date

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

THIS LABELING MUST BE IN THE POSSESSION OF THE USER AT THE TIME OF APPLICATION. READ THE LABEL AFFIXED TO THE CONTAINER FOR RETAIN® PLANT GROWTH REGULATOR SOLUBLE POWDER BEFORE APPLYING. USE OF RETAIN® PLANT GROWTH REGULATOR SOLUBLE POWDER ACCORDING TO THIS LABELING IS SUBJECT TO THE USE PRECAUTIONS AND LIMITATIONS IMPOSED BY THE LABEL AFFIXED TO THE CONTAINER FOR RETAIN® PLANT GROWTH REGULATOR SOLUBLE POWDER.

APPLE AND PEAR – FOR HARVEST MANAGEMENT AND IMPROVEMENT OF FRUIT QUALITY

CROP	OBJECTIVE / BENEFIT:	APPLICATION TIMING/ USE INSTRUCTIONS
Apple	**Single Application:** Depending on cultivar, orchard conditions, application timing, and grower objectives, one or more of the following benefits will be associated with ReTain • Delayed fruit maturity • Improved harvest management • Reduced preharvest fruit drop • Additional time for increase in fruit size	**Single Pick Harvest:** Apply one to two pouches of ReTain per acre 21 to 28 days prior to the anticipated beginning of the normal harvest period of untreated fruit. ReTain applied 21 to 28 days before harvest will delay the harvest period up to 7 to 10 days. Applications made either too early or too late will significantly reduce the efficacy of the product.

Source: Phil Schwallier, 2017 Mid Atlantic Fruit and Veg Conf.

ReTain Characteristics

- **Dose Dependent**
  - The more applied, the more impact.
- **Time Dependent**
  - 30 DBH is the maximum impact.
- **Variety Sensitive**
  - Gala, Honeycrisp, Jonagold
- **Cropload Dependent**

ReTain: Gala and Honeycrisp

- Situation: Some growers not using ReTain or using only low rates (1/4 – 1/3) on Gala and Honeycrisp due to color drag.

- Growers are not realizing the full benefits on fruit quality and harvest management at such low rates or if not used at all

- Significance: Volumes of Gala and Honeycrisp are steadily increasing and harvest management tools and fruit quality retention is becoming evermore important

ReTain Label: Multiple Pick Variety Use

Origins: ENZA era in New Zealand

"To improve the fruit quality and color development storage potential of later picked apples (2nd, 3rd, 4th picks) **apply one pouch of ReTain per acre, one to two weeks prior to the anticipated and beginning of the normal harvest** period of untreated fruit for the current season.

ReTain applied one to two weeks before harvest typically will not delay the start of the harvest (1st pick), but will help control the maturation rate of the later picks."

2017-2018 Demo Program Goals

- Objective:

  Demonstrate the benefits of ReTain without color drag when applied 7 - 10 days prior to harvest on Gala and Honeycrisp

- Execution:

  worked with growers, packing house fieldmen and distributor reps to run on farm demos and monitor the results.

- 2017: Good coloring year. Demo program showed ReTain was effective when applied closer to harvest on Gala and Honeycrisp (less color drag).
- 2018: Poor coloring year. Effects were less dramatic, but 1 WBH timing generally worked as expected – less impact on color, maintaining quality of later harvests

Northern Orchards - Peru NY

Gala ReTain demo

ReTain full rate 4 weeks before harvest

ReTain full rate 2 weeks before harvest

ReTain: Gala -- Kon, NCSU

Drop control:

- **333 g @ 1 WBH or split apps totaling 333 or 666 g provided best control of drop**

Maturity and quality:

- **Best maintained by higher rates and/or timings closer to harvest**
- **167 g @ 4 WBH consistently weakest option**
- **Induced cracking reduced even when apps are as close as 1 WBH**

ReTain: Fruit Firmness

Table 2. Effect of rate, timing and application number of aminoethoxyvinylglycine (AVG) on firmness of 'Imperial Gala' apples in 2018.

Rate	Timing	No. Applications	Firmness (lb.) H0	Firmness (lb.) H2
Control		--	15.9	12.7
167 g/A	4 WBH	1	15.9	13.0
333 g/A	4 WBH	1	16.6	14.6
167 g/A	1 WBH	1	16.7	14.4
333 g/A	1 WBH	1	16.5	15.7
167 g/A	4 + 1 WBH	2	16.7	15.1
333 g/A	4 + 1 WBH	2	16.5	15.2
		Significance		
		Control vs. AVG	0.0752	**0.0003**
		167 vs. 333 g/A	0.6249	**0.0099**
		1 WBH vs. 4 WBH	0.2386	**0.0082**
		1 app vs. 2 app	0.5038	0.0670

P(f). Bold p-values are ≤0.05.

Kon, NC

ReTain: Starch Index

Table 3. Effect of rate, timing and application number of aminoethoxyvinylglycine (AVG) on starch rating of 'Imperial Gala' apples in 2018.

Rate	Timing	No. Applications	Starch rating (1-8) H0	Starch rating (1-8) H2
Control		--	6.8	7.8
167 g/A	4 WBH	1	6.0	7.6
333 g/A	4 WBH	1	5.1	7.1
167 g/A	1 WBH	1	5.4	7.1
333 g/A	1 WBH	1	6.3	6.4
167 g/A	4 + 1 WBH	2	5.0	6.6
333 g/A	4 + 1 WBH	2	4.9	6.3
		Significance		
		Control vs. AVG	**0.0045**	**0.0087**
		167 vs. 333 g/A	0.9871	0.0669
		1 WBH vs. 4 WBH	0.4891	**0.0373**
		1 app vs. 2 app	**0.0465**	**0.0289**

P(f). Bold p-values are <0.05.

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ReTain: Surfactant-induced cracking

Table 4. Effect of rate, timing and application number of aminoethoxyvinylglycine (AVG) on surfactant induced stem end splitting of 'Imperial Gala' apples in 2018.

Rate	Timing	No. Applications	Stem end splits (% of total) H0	Stem end splits (% of total) H2
Control		--	17	67
167 g/A	4 WBH	1	10	55
333 g/A	4 WBH	1	2	25
167 g/A	1 WBH	1	5	33
333 g/A	1 WBH	1	3	20
167 g/A	4 + 1 WBH	2	2	28
333 g/A	4 + 1 WBH	2	2	25
		Significance		
		Control vs. AVG	**0.0029**	**<.0001**
		167 vs. 333 g/A	0.2767	**0.0156**
		1 WBH vs. 4 WBH	0.6547	0.0840
		1 app vs. 2 app	0.3047	0.3115

P(f). Bold p-values are ≤0.05.

Kon, NC

Thank You for your time and attention!

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