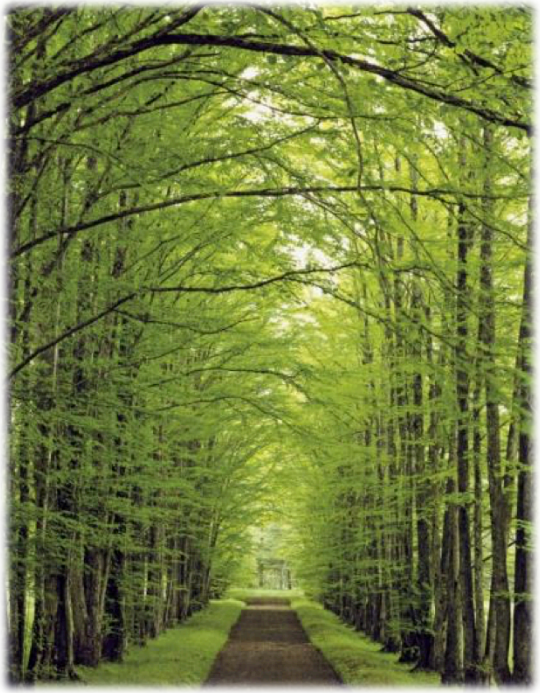
A low cost, easy to use, & powerful platform for using weather data in farm decisions

Farm Response to Changing Weather session
Maine Ag Trade Show
Maine Climate and Agriculture Network
January 17, 2019

Glen Koehler
University of Maine Cooperative Extension
Pest Management Office

1865 THE UNIVERSITY OF MAINE Cooperative Extension

Contents



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Love makes the world go ‘round

But weather makes the crops grow

The best tool you need, you already have.

Climate impacts are felt closest to home.

Farmers need timely, place-based information on their particular risks and impacts to make informed decisions.

That requires delivery systems to help users incorporate new knowledge into their decision making.

Adapted from: Ellen L. Mecray. Regional Services, Moving from R20 to R2S. October 5, 2016. Climate Diagnostics and Predictions Workshop, Orono, ME. http://www.cpc.ncep.noaa.gov/products/outreach/CDPW41/Mecray-CDPW41.pdf

Ag-Radar
*** MAINE
ME-Monmouth (UMaine Highmoor Farm)
ME-Auburn
ME-Cumberland Center
ME-Fairfield
ME-Gorham
ME-Hebron

+ many other sites

https://extension.umaine.edu/ipm/ag-radar-apple/

Or just Google
" maine apple ag-radar "

User driven,
User oriented,
User inspired,
Problem focused

Information for decision-makers

Partnerships, collaboration, can't do it alone

Environmental Intelligence

Co-production of knowledge

Actionable Science

Adapted from: Ellen L. Mecray. Regional Services, Moving from R20 to R2S. October 5, 2016. Climate Diagnostics and Predictions Workshop. Orono, ME. http://www.cpc.ncep.noaa.gov/products/outreach/CDPW41/Mecray-CDPW41.pdf

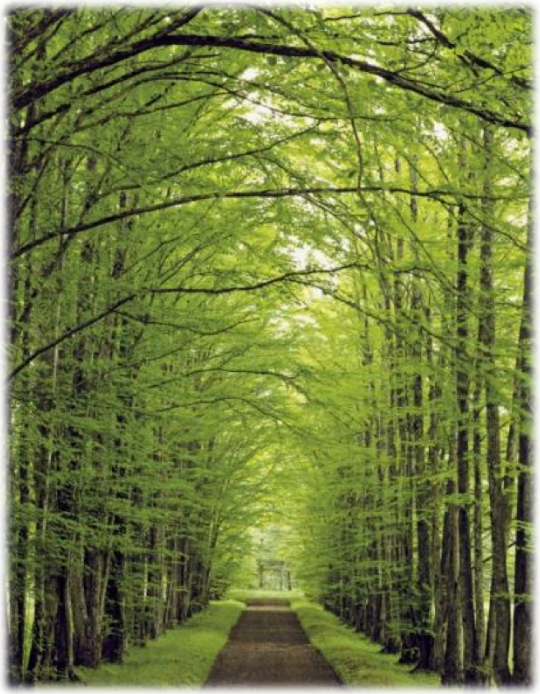
Ingredients

1) **PROs for Excel** as an automated database, presentation interface, & publication engine

2) **CONs**

3) **More PROs**

The PROs win!



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The great question

Is Excel up to the job?

↑ Pros and ↓ Cons
of using Excel instead of a database query system

- ↑ **Direct access for model definition**
  You just do it.

- ↑ **Low overhead. Off the shelf software**

- ↑ **No limits on calculation *OR* presentation options**

- ↑ **Direct access for model verification and tweaking**

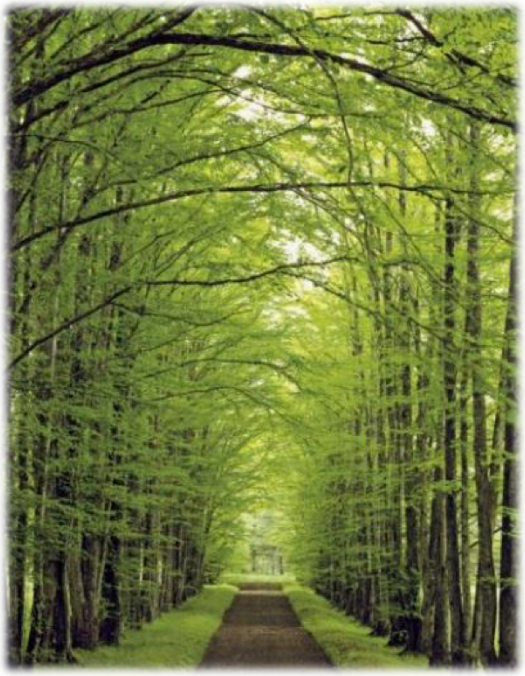
Zorba the Greek,
the original "Just Do It" guy

Recipe

1) **How it works:**
   Flow path

Data → Info → Knowledge

2) **Visual Basic for Applications**



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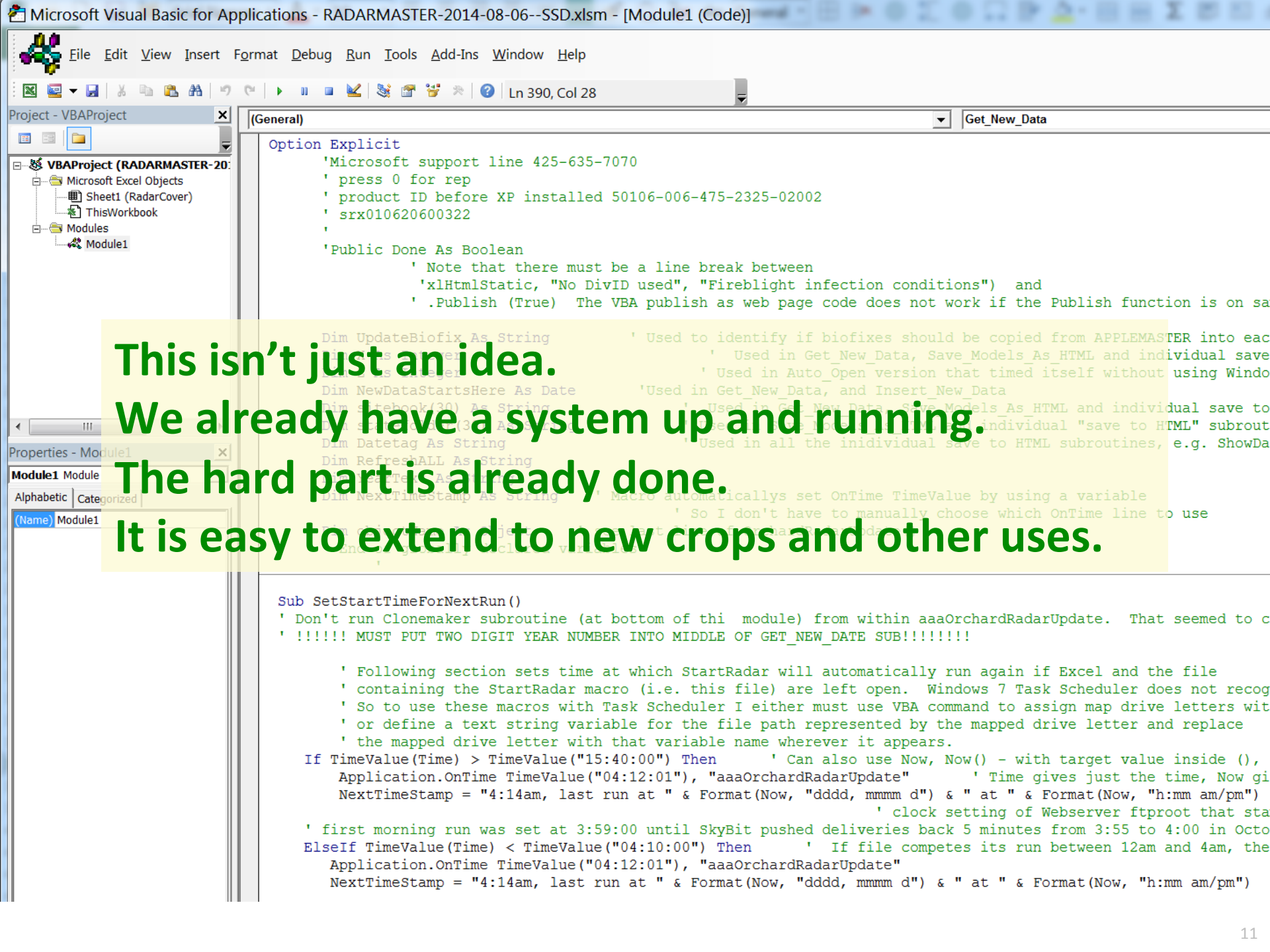
(VBA and) "**Beer is living proof**
that God loves us
and wants us to be happy"

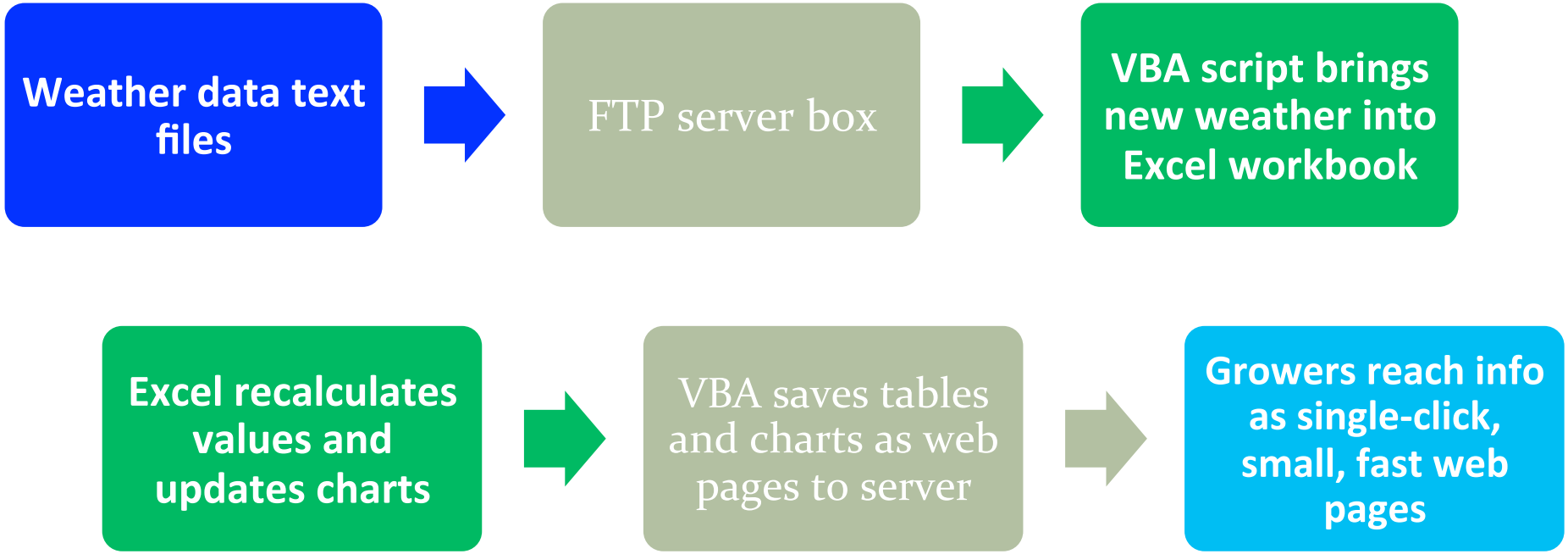
~ Ben Franklin



This isn't just an idea.
We already have a system up and running.
The hard part is already done.
It is easy to extend to new crops and other uses.

Visual Basic automation
is the special ingredient that makes it all happen

https://www.worldmarket.com



Each update cycle for 37 sites takes ~ 45 minutes

3 update cycles per day.

♣ = Primary apple orchard sites with on-farm biofix observations.
Biofixes for other sites based on estimates from nearby orchards.

*** MAINE	*** CONNECTICUT
♣ ME-Monmouth (UMaine Highmoor Farm)	♣ CT-Southington
♣ ME-Auburn	*** MASSACHUSETTS
♣ ME-Cumberland Center	♣ MA-Amherst
♣ ME-Fairfield	♣ MA-Belchertown (UMass Cold Spring Orchard)
♣ ME-Gorham	♣ MA-Belchertown (Phoenix)
♣ ME-Hebron	♣ MA-Brookfield
♣ ME-Hope	♣ MA-Deerfield
♣ ME-Levant	♣ MA-Easthampton
♣ ME-Limerick	♣ MA-Groton
♣ ME-New Gloucester	♣ MA-Leominster – halted 11/1
♣ ME-Newport	♣ MA-Northboro
♣ ME-Old Town (UMaine Rogers Farm)	♣ MA-Westhampton
♣ ME-Presque Isle	*** NEW BRUNSWICK
♣ ME-Sabbatus	♣ NB-Fredericton – halted 10/3
♣ ME-Sanford	*** NEW YORK
♣ ME-Skowhegan	♣ Private sites: Geneva and Highland
♣ ME-South Bridgton	*** RHODE ISLAND
♣ ME-Sweden	♣ RI-Greenville
♣ ME-Thorndike	♣ RI-Middletown
♣ ME-Vassalboro	*** VERMONT
	♣ VT-Cornwall
	♣ VT-Dummerston
	♣ VT-South Burlington – halted 11/1 (UVM Hort. Farm)

https://extension.umaine.edu/ipm/ag-radar-apple/

Or just Google
" maine apple ag-radar "

South Burlington VT

Apple Pest Monitoring Pocket Guide

Apple Calendar – Early season

Apple Calendar – Late season

Jump down to sections:

Scab Fire blight Flyspeck Insects & Mites Horticulture Weather archive

* CURRENT WEATHER *

3 Day Weather Chart **7 Day Weather Chart**

30 day Temperature Chart 30 day Rain Chart

Hourly Forecast Table – NEXT 10 days

Hourly Observations Table – PAST 7 days

Weather archive is at bottom of this page.

* APPLE SCAB *

Apple Scab – KEY DATES

SCAB BIOLOGY

DAILY PRIMARY SCAB Infection Chart

Comprehensive estimate of relative primary scab infection risk. Absolute risk depends on infec

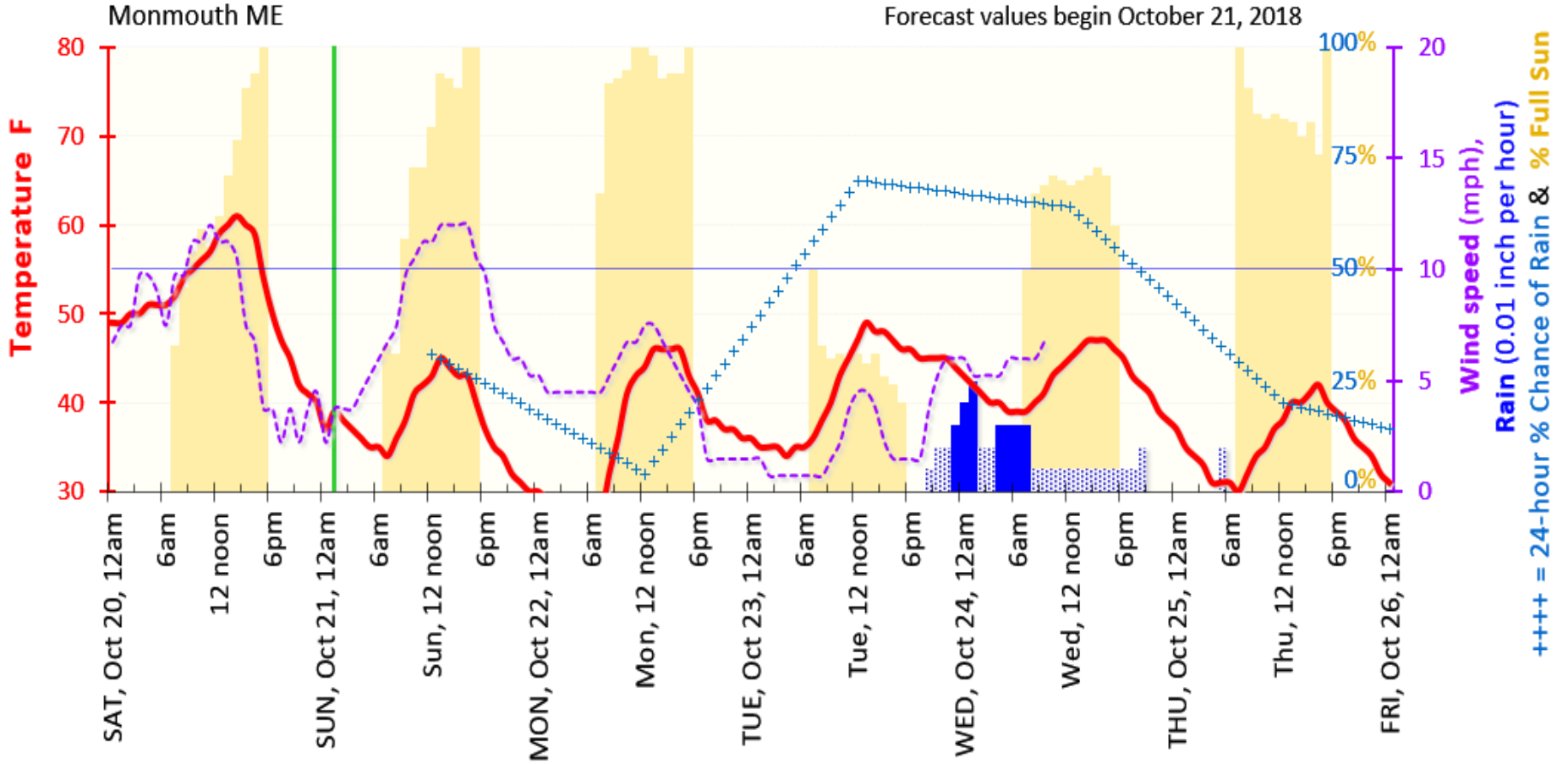
Daily primary scab infections in TABLE format

CUMULATIVE PRIMARY SCAB potential and release

Scab ascospore maturity chart – Less useful than comprehensive ratings shown above.

Scab ascospore maturity table

5 day forecast - Temperature, Rain, Wind speed, Sunlight



Vertical green line = today's date and beginning of forecast values.

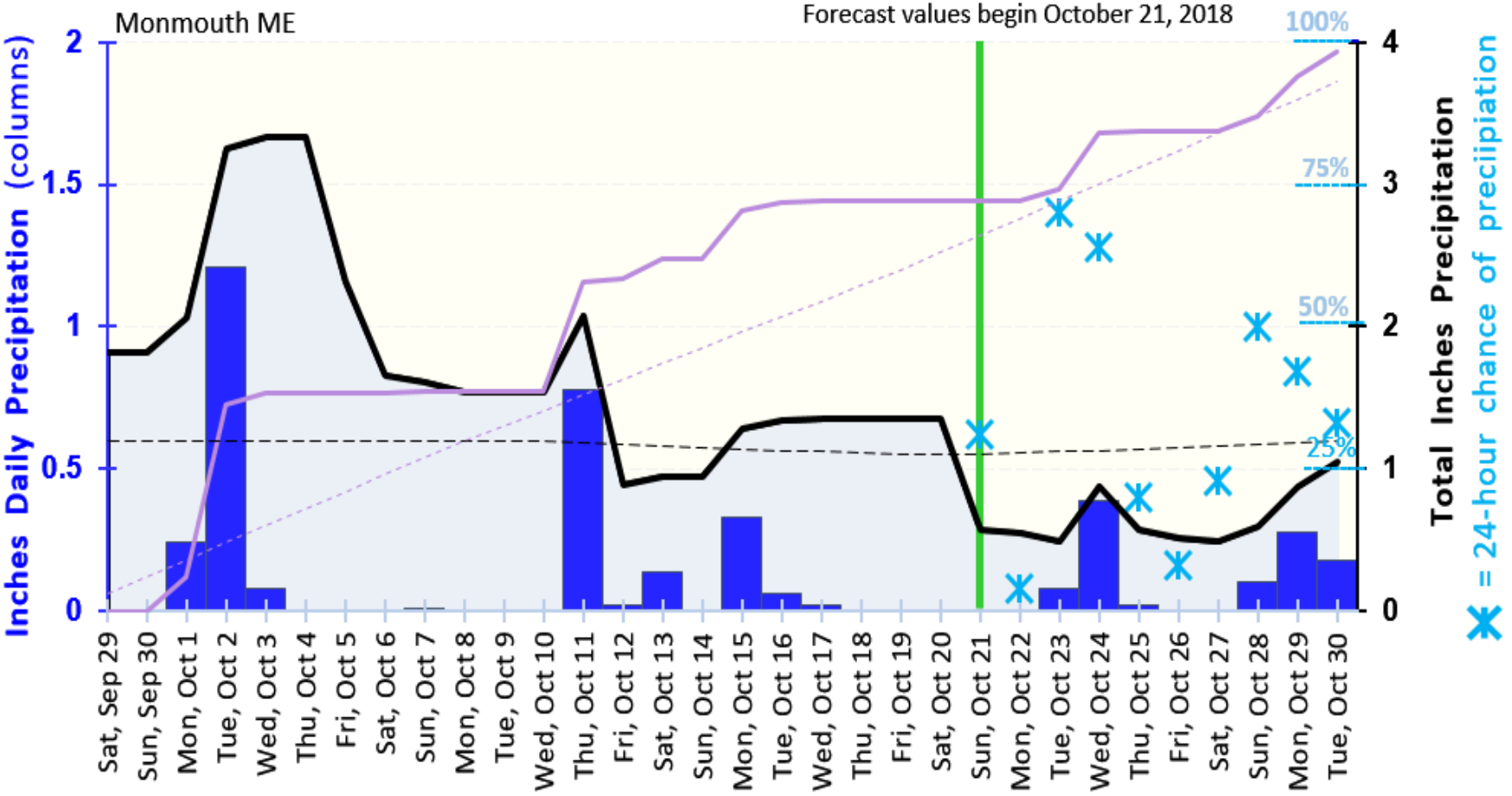
Left axis: **Red line = Average hourly temperature** at 6 feet above ground at a site with good air drainage.
Daily max & min temperatures are slightly higher & lower than the hourly average values shown on this chart.
Low temperature values on this chart are not designed for use as a frost indicator.

Right axis: **Dark blue columns = Rain amount** rain amount as 0.01 inches per hour. Blue dots = light showers.
++++ **= Chance of precipitation** in 24 hour period (12 hours before to 12 hours after marked hour).
Thin blue horizontal line is reference value showing 50% chance of rain and 10mph wind speed.
Purple dashed line = Wind speed in miles per hour for open-field at 6 feet above ground. Wind forecast ends at 72 hours.
Yellow shaded area = Percent full sunshine. Above 75% is "sunny", 50 to 75% is "cloudy", below 50% is "overcast".

Sunshine %
Rain per hour
Light showers
Temperature F
Wind speed mph
++++ 24-hour chance precip

Date and Hour (night hours shaded)	Hourly Temp. (F)	Precip. inches (blank = zero, "chance" = chance of showers)	Leaf Wetness	Rel. Humidity	Avg. Wind speed (miles per hour)	Percent of Possible Sunlight (clear sky = 100%, overcast < 60%)
Sun, Oct 21, 12:AM	37		dry	86%	2	
Sun, Oct 21, 1:AM	39		dry	78%	4	
Sun, Oct 21, 2:AM	38		dry	78%	4	
Sun, Oct 21, 3:AM	37		dry	77%	4	
Sun, Oct 21, 4:AM	36		dry	77%	5	
Sun, Oct 21, 5:AM	35		dry	76%	5	
Sun, Oct 21, 6:AM	35		dry	76%	6	
Sun, Oct 21, 7:AM	34		dry	75%	7	33%
Sun, Oct 21, 8:AM	36		dry	68%	8	31%
Sun, Oct 21, 9:AM	38		dry	61%	**10**	57%
Sun, Oct 21, 10:AM	41		dry	53%	**11**	73%
Sun, Oct 21, 11:AM	42		dry	49%	**11**	73%
Sun, Oct 21, 12:PM	43		dry	44%	**11**	**82%**
Sun, Oct 21, 1:PM	45		dry	40%	**12**	**94%**
Sun, Oct 21, 2:PM	44		dry	39%	**12**	**93%**
Sun, Oct 21, 3:PM	43		dry	39%	**12**	**91%**
Sun, Oct 21, 4:PM	43		dry	39%	**12**	**100%**
Sun, Oct 21, 5:PM	40		dry	43%	**11**	**100%**
Sun, Oct 21, 6:PM	37		dry	47%	**10**	
Sun, Oct 21, 7:PM	35		dry	52%	8	
Sun, Oct 21, 8:PM	34		dry	54%	7	
Sun, Oct 21, 9:PM	**32**		dry	55%	6	
Sun, Oct 21, 10:PM	**31**		dry	57%	6	
Sun, Oct 21, 11:PM	**30**		dry	59%	5	
Mon, Oct 22, 12:AM	**30**		dry	61%	5	
Mon, Oct 22, 1:AM	**29**		dry	62%	5	
Mon, Oct 22, 2:AM	**28**		dry	64%	5	
Mon, Oct 22, 3:AM	**27**		dry	65%	5	
Mon, Oct 22, 4:AM	**26**		dry	66%	5	
Mon, Oct 22, 5:AM	**27**		dry	66%	5	
Mon, Oct 22, 6:AM	**27**		dry	66%	5	
Mon, Oct 22, 7:AM	**27**		dry	66%	5	67%
Mon, Oct 22, 8:AM	**32**		dry	58%	5	**92%**
Mon, Oct 22, 9:AM	36		dry	50%	6	**93%**
Mon, Oct 22, 10:AM	41		dry	41%	7	**95%**
Mon, Oct 22, 11:AM	43		dry	39%	7	**100%**
Mon, Oct 22, 12:PM	44		dry	37%	8	**100%**
Mon, Oct 22, 1:PM	46		dry	34%	8	**98%**
Mon, Oct 22, 2:PM	46		dry	36%	7	**93%**
Mon, Oct 22, 3:PM	46		dry	37%	6	**94%**
Mon, Oct 22, 4:PM	46		dry	39%	5	**94%**
Mon, Oct 22, 5:PM	43		dry	46%	5	**100%**
Mon, Oct 22, 6:PM	41		dry	53%	4	
Mon, Oct 22, 7:PM	38		dry	61%	2	
Mon, Oct 22, 8:PM	38		dry	64%	2	
Mon, Oct 22, 9:PM	37		dry	67%	2	
Mon, Oct 22, 10:PM	37		dry	70%	2	
Mon, Oct 22, 11:PM	36		dry	71%	2	
Tue, Oct 23, 12:AM	36		dry	73%	2	
Tue, Oct 23, 1:AM	35		dry	75%	2	
Tue, Oct 23, 2:AM	35		dry	76%	1	
Tue, Oct 23, 3:AM	35		dry	77%	1	
Tue, Oct 23, 4:AM	34		dry	79%	1	
Tue, Oct 23, 5:AM	35		dry	79%	1	
Tue, Oct 23, 6:AM	35		dry	80%	1	
Tue, Oct 23, 7:AM	36		dry	80%	1	50%
Tue, Oct 23, 8:AM	38		dry	76%	1	33%
Tue, Oct 23, 9:AM	40		dry	72%	2	30%
Tue, Oct 23, 10:AM	43		dry	68%	2	31%
Tue, Oct 23, 11:AM	45		dry	64%	4	30%
Tue, Oct 23, 12:PM	47		dry	61%	5	31%

Daily, 10-day, & 32-day Cumulative Precipitation



Left axis: Blue columns = **Daily observed and forecast amount of precipitation.**

Right axis: **Black solid line** = Inches precipitation for 10-day period ending at final hour of marked date. **Black straight dashed line** = Climatic average inches precipitation for same 10-day period.

✱ = Forecast chance of precipitation on that day.

Purple solid line = Observed cumulative precipitation from first date to last date on chart.

Purple straight dotted line = Climatic average cumulative precipitation for those dates.

Vertical green line marks today's date and beginning of forecast values.

- Daily observed precipitation
- ✱ Forecast chance of precipitation
- Observed 10-day precipitation
- Observed 32-day cumulative precip
- Climatic average 10-day precip
- Climatic average 32-day cumulative precip

* FLYSPECK *

Background information for flyspeck estimates

Flyspeck control with **Pristine** – 21 days or 2.5" rain protection
Flyspeck – Pristine – 1stCOVER through JUNE spray dates
Flyspeck – Pristine – JULY spray dates
Flyspeck – Pristine – AUGUST-SEPT. spray dates

Flyspeck control with **Group A fungicides** (Topsin M, Flint, Sovran, captan + phosphite)
- 21 days or 2.0" rain protection
Flyspeck – Group A fungicides – 1stCOVER through JUNE spray dates
Flyspeck – Group A fungicides – JULY spray dates
Flyspeck – Group A fungicides – AUGUST-SEPT. spray dates

Flyspeck control with **Group B fungicides** (captan, ziram) - 14 days or 1.5" rain protection
Flyspeck – Group B fungicides – 1stCOVER through JUNE spray dates
Flyspeck – Group B fungicides – JULY spray dates
Flyspeck – Group B fungicides – AUGUST-SEPT. spray dates

Flyspeck Growth Hours Chart – Daily and Cumulative

Charts showing flyspeck growth potential between end of protection by final spray date and harvest
Pristine – Flyspeck growth between Final spray and harvest
Group A fungicides - Flyspeck growth between Final spray and harvest
Group B fungicides - Flyspeck growth between Final spray and harvest

* INSECTS *

INSECT DATES (CM, DWB, LAW, MPB, OFM, OBLR, RBLR, SJS, STLM, TPB, WAL)
Key life cycle and management dates

Plum Curculio – insecticide depletion Table
Plum Curculio – insecticide depletion Chart
Experimental only: Plum Curculio activity rating

Codling Moth insecticide depletion table: JUNE
Codling Moth insecticide depletion table: JULY
Codling Moth insecticide depletion table: AUGUST

Apple Maggot JULY monitoring & respray dates
Apple Maggot AUGUST monitoring & respray dates

* MITES *

European Red Mite (ERM) KEY DATES

ERM resample dates – JUNE
ERM resample dates – July&August

Mite thresholds

Fungicide guidance for Primary apple scab

Find most recent spray date in left column

Columns in same row show estimates for end of protection and start of next infection period

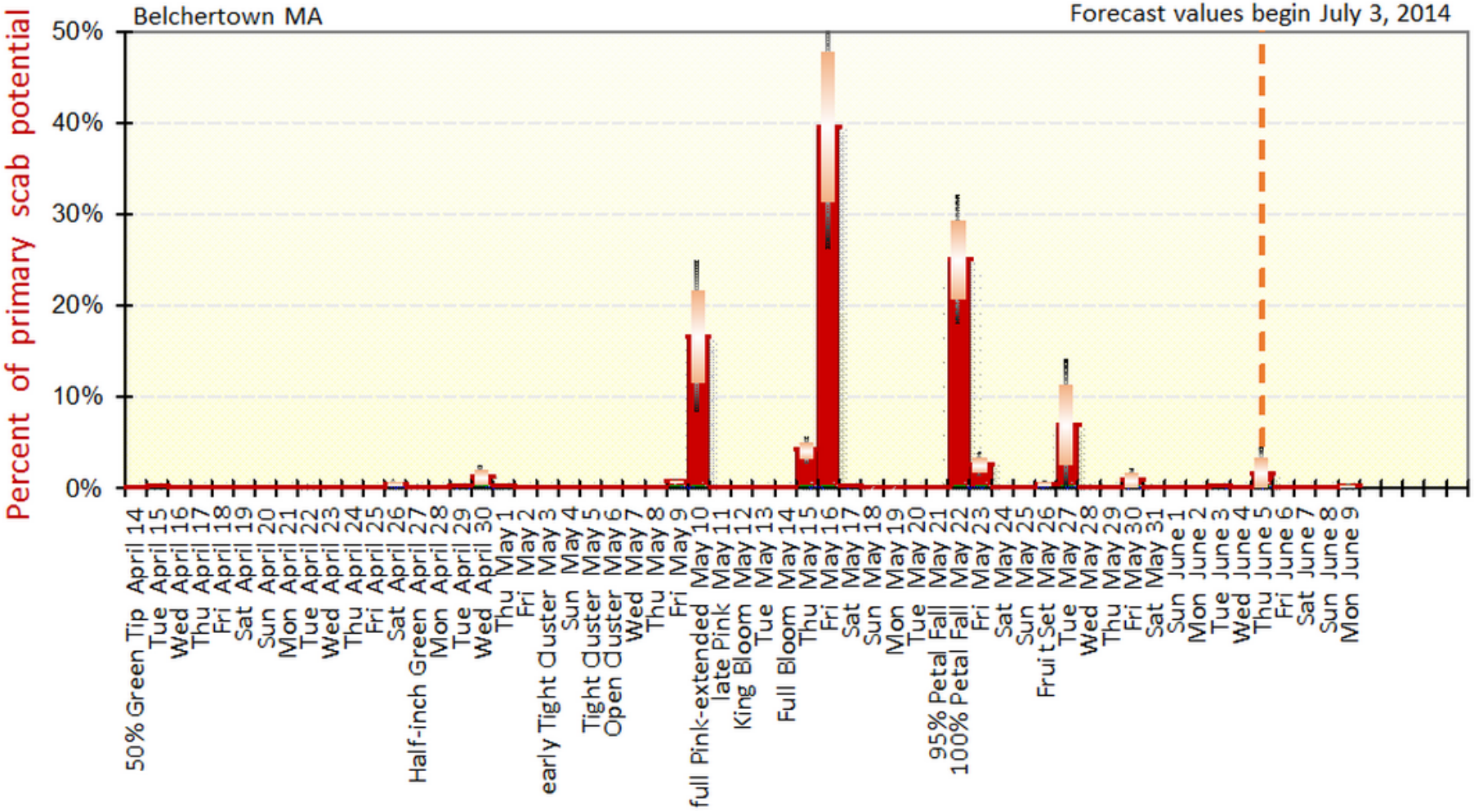
'Protectant fungicide' Respray Dates for Scab Suppression

Background Information for this page
Return to Apple list for Belchertown MA

Weather data for Belchertown MA. Forecast values begin July 3, 2014
Final primary scab infection period starts and ascospores depleted on: Thursday, June 5, 5AM.

Full-dose 'Protectant' fungicide (captan, mancozeb, SDHI, Syllit) SPRAY DATE 6am application time assumed	**Inches Rain**	END of Protectant fungicide residue protection & limiting factor	**DEADLINE for next Pre-Infection Application** This is the start time for the next infection period that has rain after fungicide depletion time.	**Deadline for post-infection fungicide** to reach back to start time of subsequent infection period (1 col. to left), or back to depletion time of previous fungicide spray (2 cols. to left), whichever is later. Assumes no scab resistance.
Sat, April 19	0	April 24, 3PM rapid growth	**Sat, April 26, 1am**	Tue, Apr 29, 1AM
Sun, April 20	0	April 25, 3PM rapid growth	**Sat, April 26, 1am**	Tue, Apr 29, 1AM
Mon, April 21	0	April 26, 5PM rapid growth	**Sat, April 26, 1am**	Tue, Apr 29, 5PM If application is after deadline, lesions may start showing May 14.
Tue, April 22	0.03	April 29, 6AM 7 days normal growth	**Sat, April 26, 1am**	Fri, May 2, 6AM
Wed, April 23	0.22	April 30, 5PM rain removal	**Tue, April 29, 11pm**	Sat, May 3, 5PM

Daily primary scab infection potential as % of yearly total



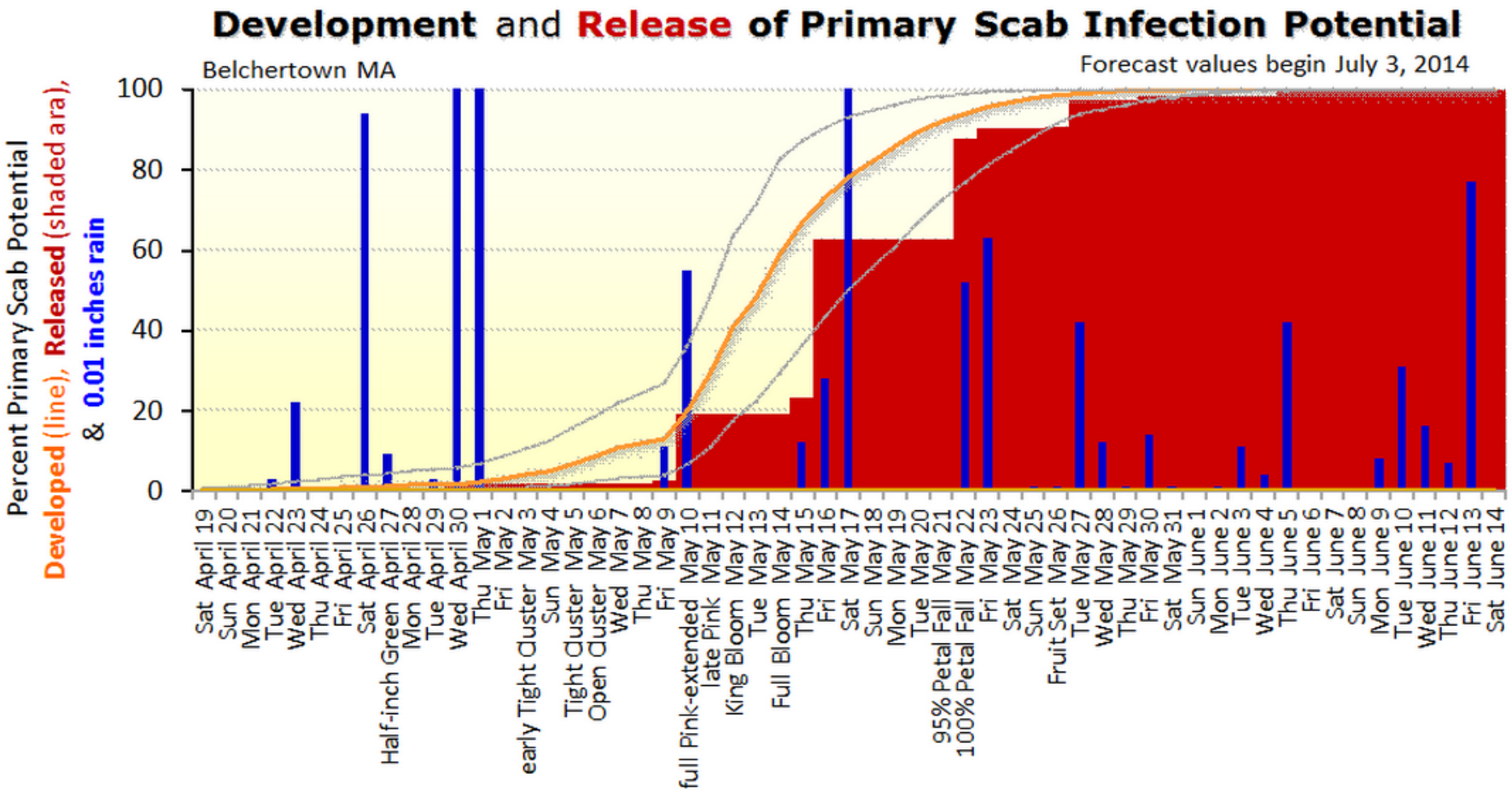
Top of wide red bar shows best estimate of primary scab ascospore infection potential.

White-to-light red shaded narrow boxes overlaid on red bars show range expected to contain the true value most of the time (68% confidence interval). Vertical black bars show wider range of 90% confidence interval.

Vertical green line = today's date. Vertical dotted green line = end of forecast range.

Vertical orange dotted line = date of final siginificant primary scab infection period (estimated 99+% cumulative spore release, and 95% chance of at least 95% cumulative spore release).

Infection potential rating is for scab ascospores (i.e. primary scab) only. Uncontrolled infections can produce secondary scab spores that magnify infection risk beyond what is indicated by this chart 9-17 days (depending on temperatures) after the infection period.



Blue columns show 100ths of inch rain for each date.

Rising thick orange line = cumulative primary scab infection potential developed by that date.

Rising thin gray lines with triangle markers = 90% high and low error bar values for estimate of cumulative infection potential developed, but not necessarily released, by each date.

Solid red area under orange line shows estimated cumulative percent primary scab infection potential released by end of that date. The red area is below the maroon line unless a warm soaking daytime rain allows full expression of infection potential.

Vertical green line = today's date and beginning of forecast values. Vertical dotted green line = end of forecast range.

Note: This is a relative, not absolute, measure of scab infection severity. The number of scab ascospores per square meter of orchard is not included in these ratings. A high scab block can have 300,000 times more spores than a very low scab block. In high scab blocks even a small portion of the year's scab potential can cause significant infection! This chart represents risk from primary spore releases only. Secondary spore production from earlier uncontrolled infections can magnify infection potential.

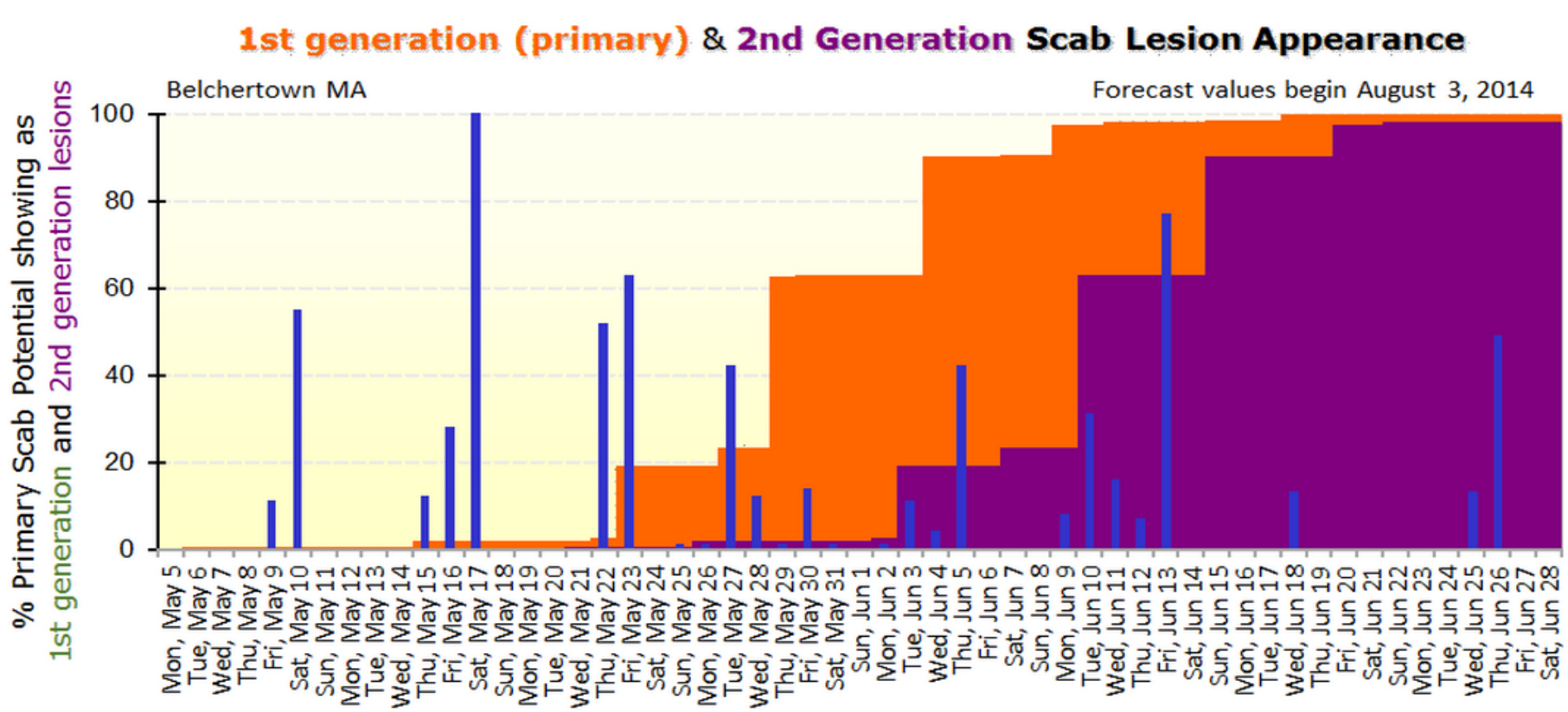
Apple scab: Primary infection period ratings

Background Information for this page
Return to Apple list for Belchertown MA

Weather data for Belchertown MA. Forecast values begin July 3, 2014

These ratings are **relative** because they do not account for scab spore population density, which is the **MOST** important factor determining absolute infection risk. Estimates also do not account for any secondary scab spores that might be present from earlier uncontrolled primary scab infection periods.

Date	Observed & Forecast Inches Rain	McIntosh bud stage	1 in 20 chance that daily value is equal or less than	Portion of Annual Primary Scab Infection Potential on this day (cumulative scab infection potential in parentheses)	1 in 20 chance that daily value is more than
Mon, April 28	0				
Tue, April 29	0.03				< 1
Wed, April 30	1.30		0	**1%** (2%)	2%
Thu, May 1	1.12		0	< 1 (2%)	< 1
Fri, May 2	0				
Sat, May 3	0	early Tight Cluster			
Sun, May 4	0				
Mon, May 5	0	Tight Cluster			
Tue, May 6	0	Open Cluster			
Wed, May 7	0				
Thu, May 8	0				
Fri, May 9	0.11		< 1	< 1 (2%)	< 1
Sat, May 10	0.55	full Pink-extended	8%	**17%** (19%)	25%
Sun, May 11	0	late Pink			
Mon, May 12	0	King Bloom			
Tue, May 13	0				
Wed, May 14	0	Full Bloom			



Orange area shows the percent primary scab infection potential from which early-developing 1st generation lesions have had time to begin appearing. Absence of visible scab infections after 100% of primary scab potential has had time to begin appearing as 1st generation lesions is good news, but it is not conclusive verification of successful scab control. Light infestation of 1st generation lesions can be difficult to detect. Infections delayed but not killed by fungicide application, or by partial resistance of older leaves, may appear later.

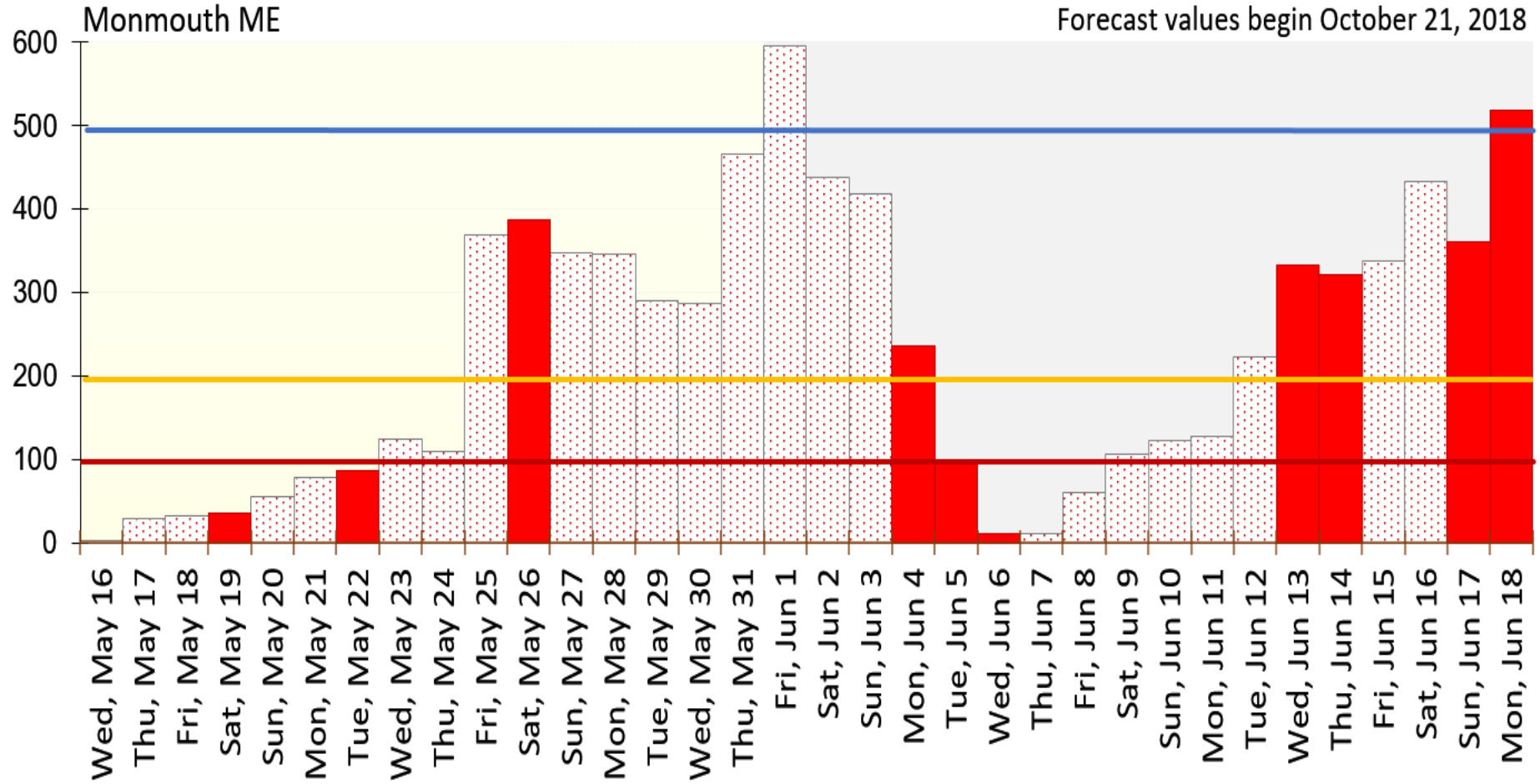
Purple area shows the percent primary scab infection potential from which early-developing 2nd generation lesions have had time to begin appearing. Absence of visible scab after 90-100% of primary scab infection potential has had time to begin appearing as 2nd generation lesions indicates that primary scab control was successful. However, scab scouting should continue to detect later emerging lesions.

Blue columns show 100ths of inch rain for each date.

Vertical green line = today's date and beginning of forecast values. Vertical dotted green line = end of forecast range.

Open blossom dates for common apple cultivars. "Date" is from 8am to 8am the next day, not midnight to midnight.	**Cumulative Heat Units** (single day units) **Inches Rain, & Leaf Wet Hours** 8am to 8am next day	**I - No active FB within one mile of the orchard in last two years**	**II - FB active within one mile of orchard in last two years, but not this year**	**III - Fire blight currently active within one mile of orchard.**
possible early cultivar King Bloom: May 16	3 HU (3) 0.0", 8 hrs	Low (lack of heat)	Low (lack of heat)	Unlikely (lack of heat)
McIntosh King Bloom: Thu, May 17	29 HU (26) 0.0", 3 hrs	Low (lack of heat)	Low (lack of heat)	Unlikely (lack of heat)
Fri, May 18	33 HU (4) 0.0", 0 hrs	Very low (lack of heat & wetting)	Low (lack of heat & wetting)	Unlikely (lack of heat & wetting)
Sat, May 19	36 HU (3) 0.35", 15 hrs	Low (lack of heat)	Low (lack of heat)	Unlikely (lack of heat)
Sun, May 20	56 HU (23) 0.0", 8 hrs	Low (lack of heat)	Low (lack of heat)	Caution (if wetting)
Mon, May 21	78 HU (48) 0.0", 0 hrs	Very low (lack of heat & wetting)	Low (lack of heat & wetting)	Caution (if wetting)
Tue, May 22	86 HU (12) 0.01", 10 hrs	Low (lack of heat)	Low (lack of heat)	Caution
Wed, May 23	125 HU (42) 0.0", 5 hrs	Low (lack of heat)	Caution (dew risk)	**HIGH (Dew risk)**
Thu, May 24	109 HU (7) 0.0", 6 hrs	Low (lack of heat)	Caution (dew risk)	**HIGH (Dew risk)**
Fri, May 25	368 HU (307) 0.0", 0 hrs	Caution (if wetting)	**Extreme! (if wetting)**	**Exceptional! (if wetting)**
McIntosh 95% Petal Fall on Sat, May 26	387 HU (30) 0.21", 22 hrs	Caution	**EXTREME!**	**EXCEPTIONAL!**

Fire blight heat units vs. High infection risk thresholds



Rough guess at date to clean apple maggot fly traps and count from zero to compare against threshold for respray decision.

Product names in red letters have "Good" rating vs. apple maggot.

Product names in blue letters have a "Fair" rating.

Apple Maggot Emergence after Depletion for Respray Timing

Full-dose Apple Maggot insecticide application date	Estimated % cumulative apple maggot trap captures	Inches Rain	Imidan 1.5" rain days 1-7, 1.0" rain days 8-14.	Assail 1.0" rain days 1-14.	Pyrethroids 1.0" rain days 1-10.	Delegate, Sevin 2.0" rain days 1-6, 0.5" rain day 7-10.	Avaunt, Exirel 1.0" rain days 1-6, 0.5" rain day 7-10.
Wed, August 1	22%	0.44	August 8, Wed	August 4, Sat	August 4, Sat	August 7, Tue	August 4, Sat
Thu, August 2	25%	0	August 9, Thu	August 4, Sat	August 4, Sat	August 8, Wed	August 4, Sat
Fri, August 3	28%	0.37	August 10, Fri	August 9, Thu	August 9, Thu	August 9, Thu	August 9, Thu
Sat, August 4	30%	0.8	August 14, Tue	August 14, Tue	August 14, Tue	August 13, Mon	August 13, Mon
Sun, August 5	32%	0	August 14, Tue	August 14, Tue	August 14, Tue	August 13, Mon	August 13, Mon
Mon, August 6	35%	0	August 14, Tue	August 14, Tue	August 14, Tue	August 13, Mon	August 13, Mon
Tue, August 7	38%	0.07	August 14, Tue	August 14, Tue	August 14, Tue	August 13, Mon	August 13, Mon
Wed, August 8	40%	0.02	August 15, Wed	August 14, Tue	August 14, Tue	August 14, Tue	August 14, Tue
Thu, August 9	43%	0.58	August 18, Sat	August 18, Sat	August 18, Sat	August 17, Fri	August 17, Fri

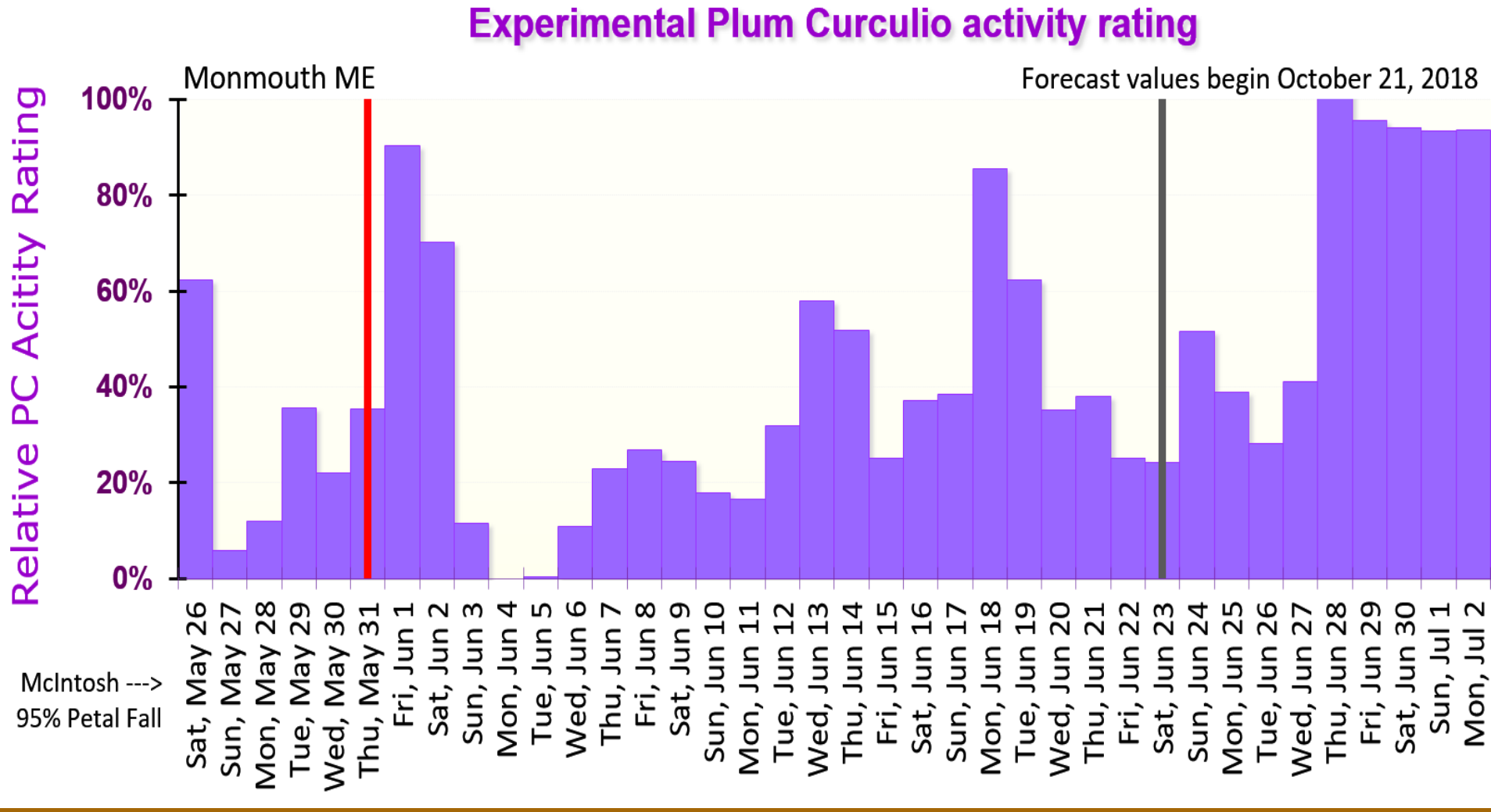
Key Dates for European Red Mites

Estimated hatch date of overwintered European red mite (ERM) eggs
and decline in efficacy of suppression by prebloom oil is
Saturday, May 12

Optimum monitoring period for 1st generation ERM:
Saturday, May 26 (Petal Fall)
to Saturday, June 2 (early adults ready to lay eggs for 2nd generation)

Optimum monitoring period for 2nd generation ERM:
Friday, June 22 (nymphs hatched)
to Friday, June 29 (egglaying starts for 3rd generation)

Optimum monitoring period for 3rd ERM generation is:
Thursday, July 5 (nymphs hatched)
to Saturday, July 14 (egglaying starts for 4th generation)


Experimental Plum Curculio activity rating
Monmouth ME
Forecast values begin October 21, 2018
Relative PC Acitity Rating
100%
80%
60%
40%
20%
0%
McIntosh --->
95% Petal Fall
Sat, May 26
Sun, May 27
Mon, May 28
Tue, May 29
Wed, May 30
Thu, May 31
Fri, Jun 1
Sat, Jun 2
Sun, Jun 3
Mon, Jun 4
Tue, Jun 5
Wed, Jun 6
Thu, Jun 7
Fri, Jun 8
Sat, Jun 9
Sun, Jun 10
Mon, Jun 11
Tue, Jun 12
Wed, Jun 13
Thu, Jun 14
Fri, Jun 15
Sat, Jun 16
Sun, Jun 17
Mon, Jun 18
Tue, Jun 19
Wed, Jun 20
Thu, Jun 21
Fri, Jun 22
Sat, Jun 23
Sun, Jun 24
Mon, Jun 25
Tue, Jun 26
Wed, Jun 27
Thu, Jun 28
Fri, Jun 29
Sat, Jun 30
Sun, Jul 1
Mon, Jul 2

Apple Maggot (AM)

Rough estimate for first apple maggot fly trap capture: Friday, July 13.

Estimated 5% AM adult emergence: July 25.

Estimated date for 50% adult AM emergence & trap captures: August 13, Monday
Peak weekly AM trap captures: August 19, Sunday
98% adult AM emergence & trap captures: September 6, Thursday
AM emergence and cumulative trap catch dates are only general guidelines
because local soil type and soil moisture conditions that affect emergence are not included in the calculation.

Borers - Roundheaded Appletree Borer (RAB) & Dogwood Borer

RAB adult emergence begins: June 8. Peak emergence: June 24.

RAB egglaying begins: June 18. Peak egglaying period roughly: July 7 to July 24.

First RAB eggs hatch roughly: July 3. Peak hatch roughly: July 22 to August 13.

First Dogwood borer egg hatch roughly: July 6. Peak hatch roughly: August 11.

Codling Moth (CM)

1st generation, estimated first sustained trap catch biofix date: May 27, Sunday.
Codling moth development as of Sunday, October 21:
2nd gen. generation adult emergence at 98% and 2nd gen. generation egg hatch at 91.3704066593409%.

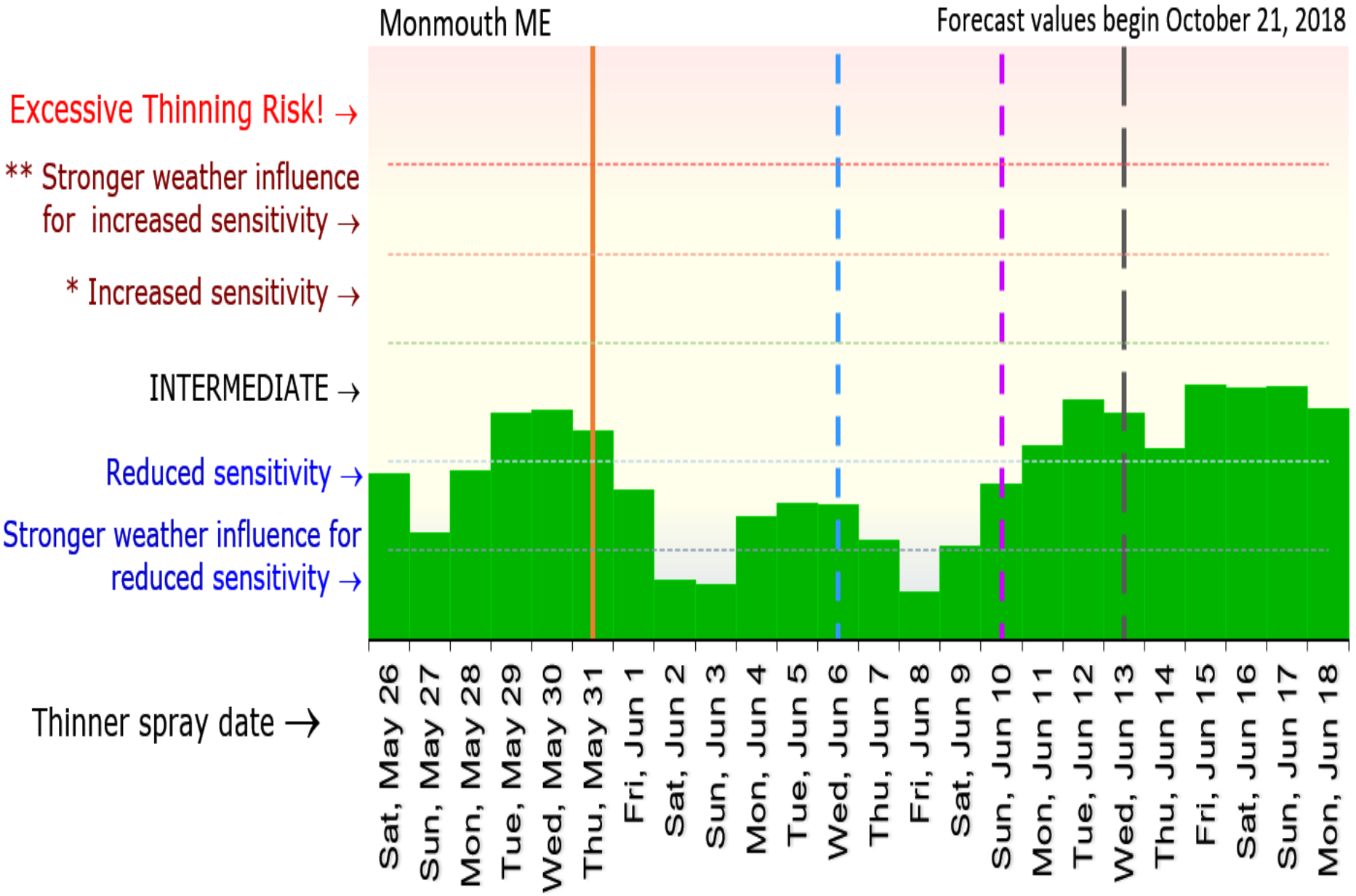
Insecticide targetted against plum curculio and apple maggot may also prevent codling moth damage.
If targetted codling moth control is needed, key management dates are shown below.

Optimum date to apply RIMON or ESTEEM ovicide/larvicide Insect Growth Regulator (IGR) is shortly before CM egglaying begins (100 CM degree days after start of 1st gen. flight): June 8. Friday.
For INTREPID IGR, the optimum first application timing is just before first hatch (150-200 DD): June 13 to June 16.

Date	Early Season Biological Events and Management Activities
Before bud break	**Check tractor and sprayer** for needed repairs. Replace worn nozzles, weak hoses, damaged or blocked filters, and inaccurate pressure gauges. Check for tank leaks, adequate agitation and pump function. Check commonly used dosage calculations. Review safety guidelines, check safety equipment. **Calibrate** sprayers, test spray pattern, test pH of spray water source.
April 27, Fri	McIntosh trees at 50% **Green Tip** (observed) Where **copper** deficient, foliar application recommended at green tip to 1/4" green. Later application can cause leaf burn and possibly lead to fruit russetting from residue. If monitoring **tarnished plant bug**, traps should be set by now or as soon as possible. If using traps to monitor **leafminers**, traps should be set by now or as soon as possible. **Cutworm** defoliation of emerging buds can be a problem on young trees as early as green tip, especially where there is high ground cover growth near the trees.
May 2, Wed	McIntosh trees at **Half-Inch Green** Beginning of optimum time window for oil application to smother European red mite eggs before they hatch. More than 3 **thrips** per fruit bud can decrease fruit set. Effective timing for Lorsban trunk application to get season-long suppression of **insect borers**.
May 3, Thu	First primary scab infection period on or after Half Inch Green. Infection risk increases as green tissue expands.

Date	Late Season Biological Events and Management Activities
July 7, Sat	**Plum curculio** egglaying begins natural decline. If using Surround repellence instead of insecticide mortality to prevent PC damage, coverage should be maintained from Petal fall until at least this date.
June 29, Fri	Start of 2nd generation **Spotted tentiform leafminer** flight
July 4, Wed	**Glyphosate (Roundup) herbicide** application more than 45 days after full bloom to soil around apple trees with root suckers, especially young trees, poses increased risk of damage from systemic uptake through root suckers into the trunk and root system. Apple trees without root suckers may also become more sensitive to trunk contact by glyphosate with late season application, especially trees under drought or other stress.
July 1, Sun	**Japanese beetle adults** begin feeding on foliage (rough guess). Honeycrisp apples seem to be one of their favorite foods.
July 13, Fri	Date by which 2nd generation lesions from the final primary scab infection period have had time to begin appearing. Finding fewer than 5 leaves with fresh lesions per 100 fruit clusters and vegetative shoots after this date indicates that scab control has been successful. Finding more than 5 leaves with fresh scab lesions per 100 clusters/shoots at this time in a commercial orchard suggests that fungicide selection and spray intervals need to be adjusted to suppress spore production, and to protect fruit and foliage for at least 4 weeks until active scab lesions exhaust their supply of spores.
July 3, Tue	If using pheromone traps to estimate populations and time treatment for **Oriental fruit moth** larvae, time to set traps. First trap capture expected in 7 days.
July 5, Thu	Where preventive control of small **Obliquebanded leafroller** larvae is needed, date for first application of Assail, Calypso, Intrepid, SpinTor, a Bt product, or other insecticide effective against OBLR.

Weather Influence on Apple Sensitivity to Chemical Thinners



"Background" links also serve as reference pages for monitoring guidelines, thresholds etc.

Example below shows early season mite thresholds

Presence/Absence Chart for Threshold of 1 mite per leaf or 30% of leaves infested

Petal fall to June 1 in NY, Petal fall to June 15 in Maine.

Collect sample leaves from middle of fruit clusters.

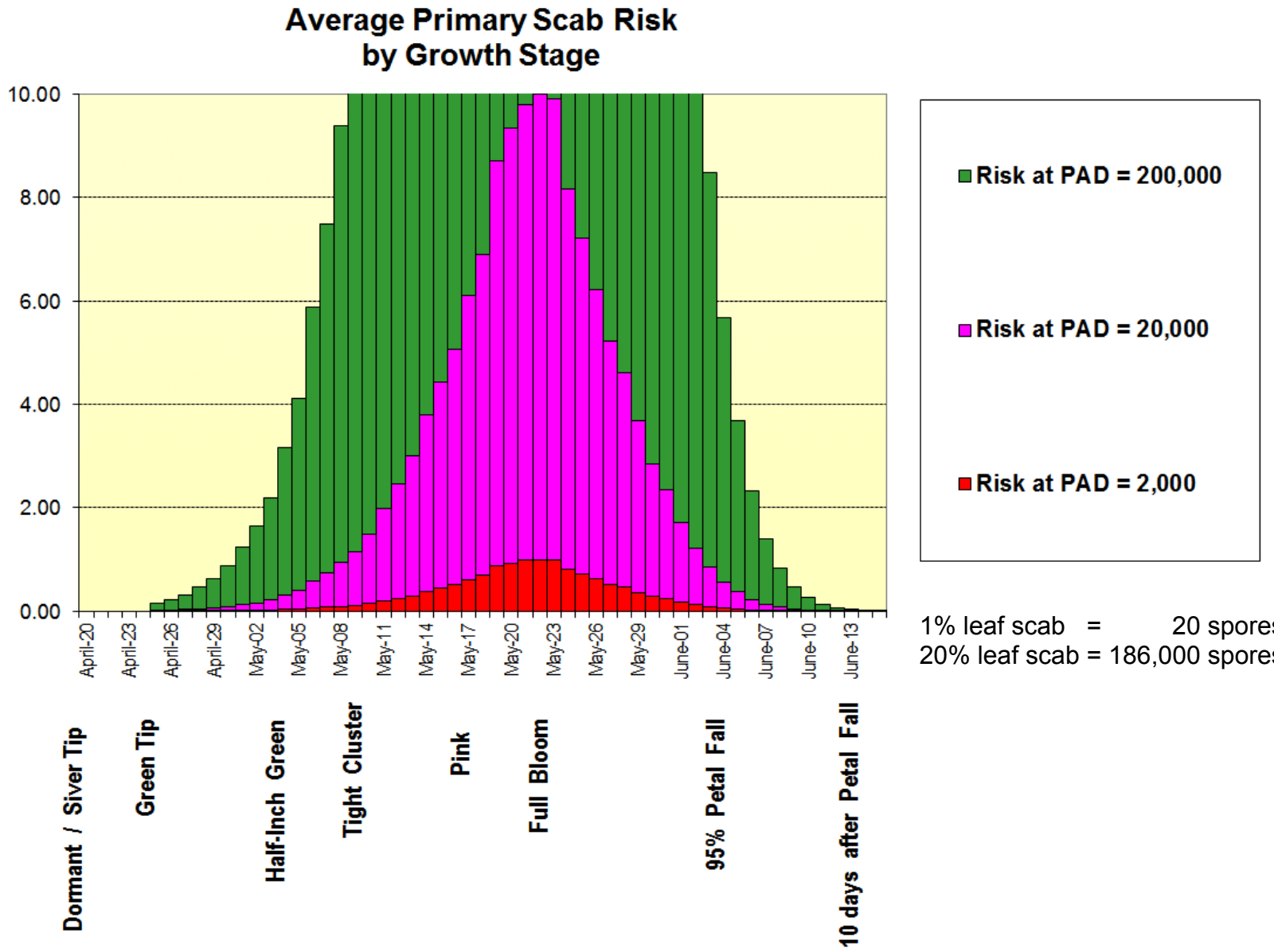
(Stop limits on this chart for samples of 40-80 leaves are not directly from NY recommendations but are extrapolated from charts for higher thresholds)

Number of leaves examined	column 1: not used for early season samples	column 2: if number of infested leaves is < or = to value in this column, then mites are estimated to be BELOW threshold	column 3: if number of infested leaves is = or greater than value in this column, then mites are estimated to be ABOVE threshold
40	--	6	24
60	--	11	30
80	--	16	30
100	--	29	30

Forecasting

photo by mharrsch

Models can provide unexpected insight



1% leaf scab = 20 spores/sq. ft.
20% leaf scab = 186,000 spores/sq. ft.

Shocking revelation!

Farm management is less than perfect!

Different fungicides,
Different equipment,
Different trees, ….same old decision process

Using Pest Forecasts to Enhance IPM

- **Models are reference tools, not the "Truth"**

- **They are there to help, not to dictate**
  'Hammers don't build houses, and models don't make decisions' ~ Tim Smith, Washington State Univ.

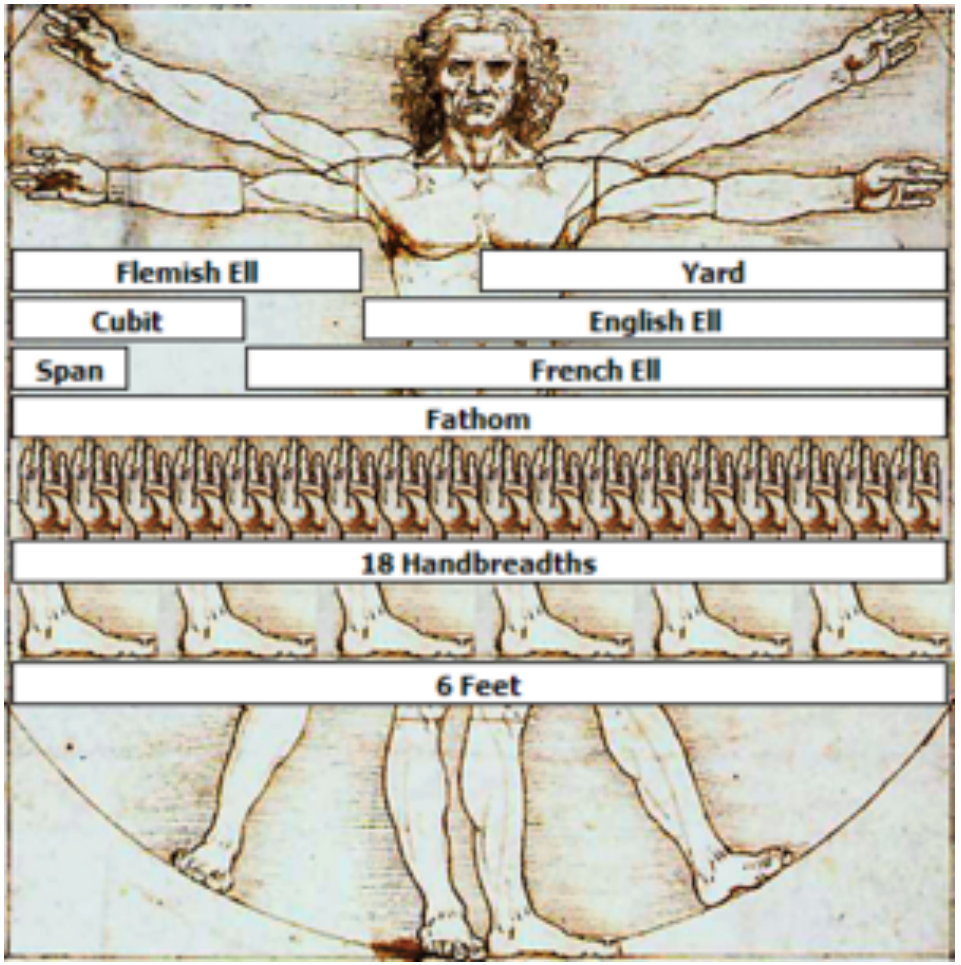
- **Current system provides guidance for timing and typical pest pressure.**
  Adding on-farm observations would allow site-specific absolute estimates.

Personalized Decision Support

Future agricultural adaptation will occur in a decision environment characterized by high complexity and the increasing pace and intensity of climatic change. ~ USDA, 2012

Image Credit: Samsung Corp. investor update http://aod.teletogether.com/sec/20131106/eng_view.asp

"If you can't measure it, you can't manage it."



→ **"If you measure it,**
You *can* manage it better."

Combining grower records with site specific models
= Customized Farm-specific Guidance

Fusion Power

Farm specific guidance
increases capacity for
Farm management
Documentation

Context for farm management records

Examples: **Needs Justification** for use of irrigation water,
fertilizer & pesticide applications.

Records of time and resource inputs
combined with demonstrated need improves:

Evaluation – Diagnose why problems occurred.

Planning – A foundation to build on for next year.

Farm specific guidance
increases capacity for
Farm management
Measurement

Example: Pesticide optimization

- Part 1. **Effective** "**Protected** when needed"
  (number of days needing protection that actually had it, 0 - 100%)

- Part 2. **Efficient** "**Only** when needed"
  (number of days with pesticide residue that actually needed it, 0 - 100%)

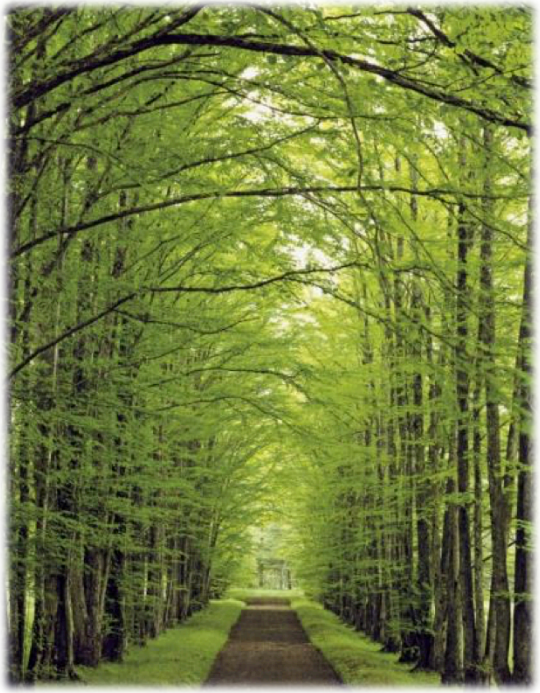
Effective % X **Efficient %**
= Optimization Score

Can be compared between different years, farms, crops.

Provides a way to track performance,
and a measurable goal to aim for.

Key Points

- Excel provides database, analysis, presentation, & publishing.
- Visual Basic (VBA) automation.
- **Clear guidance** in text and graphic formats.
- **Many applications** for farm decisions
  - Creates new **insights**
  - Increase farm **management capacity**



Wikimedia commons

Leftover slides

Leftover slides

* HORTICULTURE *

McIntosh BUD STAGES

Thinning Weather Chart

Thinning weather table

Rough estimate of McIntosh HARVEST dates (estimates begin after Full bloom).

Preharvest weather influence on Storability, Drop, Color, and Scald risk

* WEATHER archive *

Weather data – APRIL

Weather data – MAY

Weather data – JUNE

Weather data – JULY

Weather data – AUGUST

Weather data – SEPTEMBER

Degree day accumulation

Degree days – April

Degree days – May

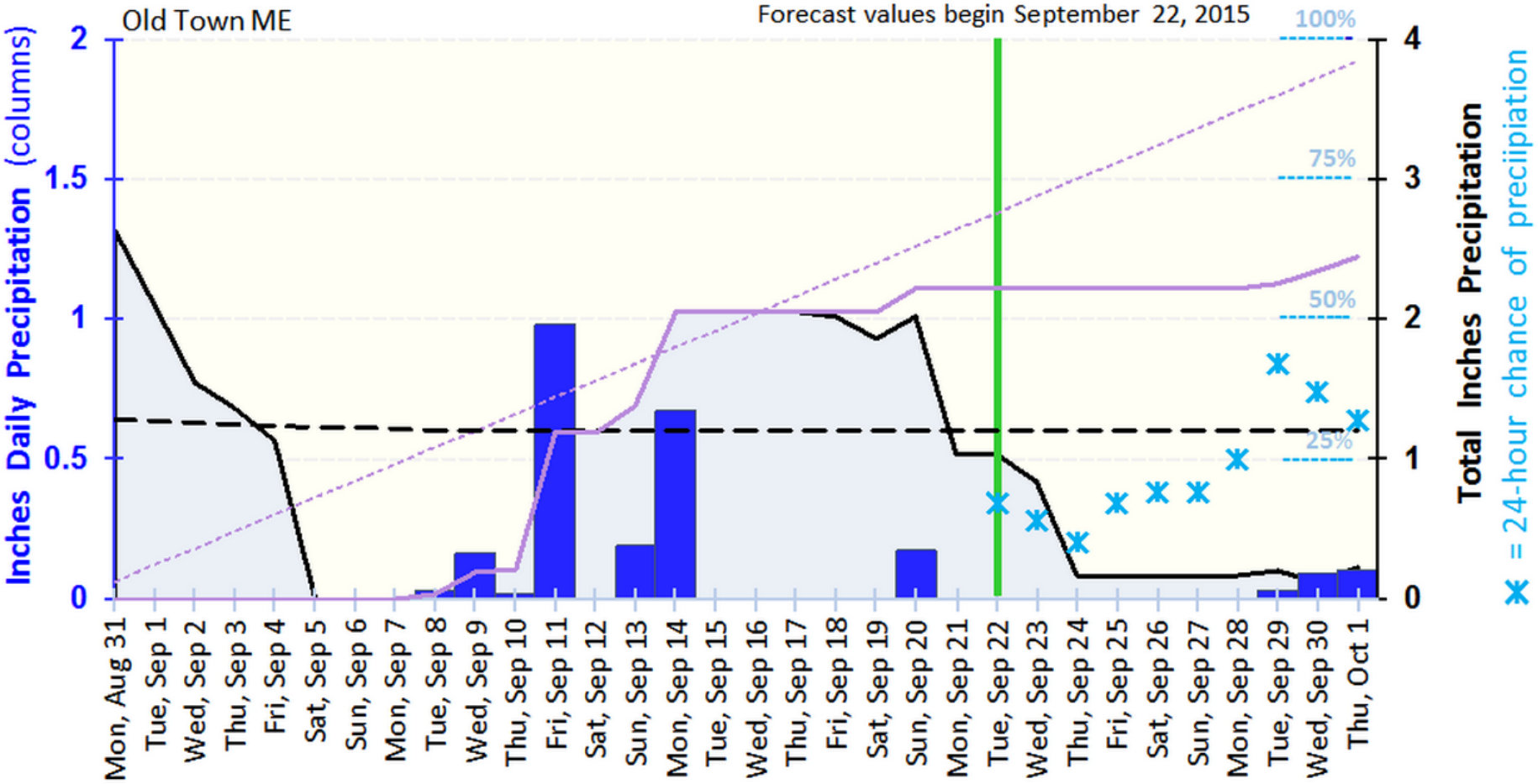
Degree days – June

Degree days – July

Degree days – August

Degree days – September

Daily and Cumulative Precipitation



Left axis: Blue columns = **Daily observed and forecast amount of precipitation.**

Right axis: Black solid line and light blue shading = Cumulative observed or forecast inches precipitation for 10-day period ending at final hour of marked date.

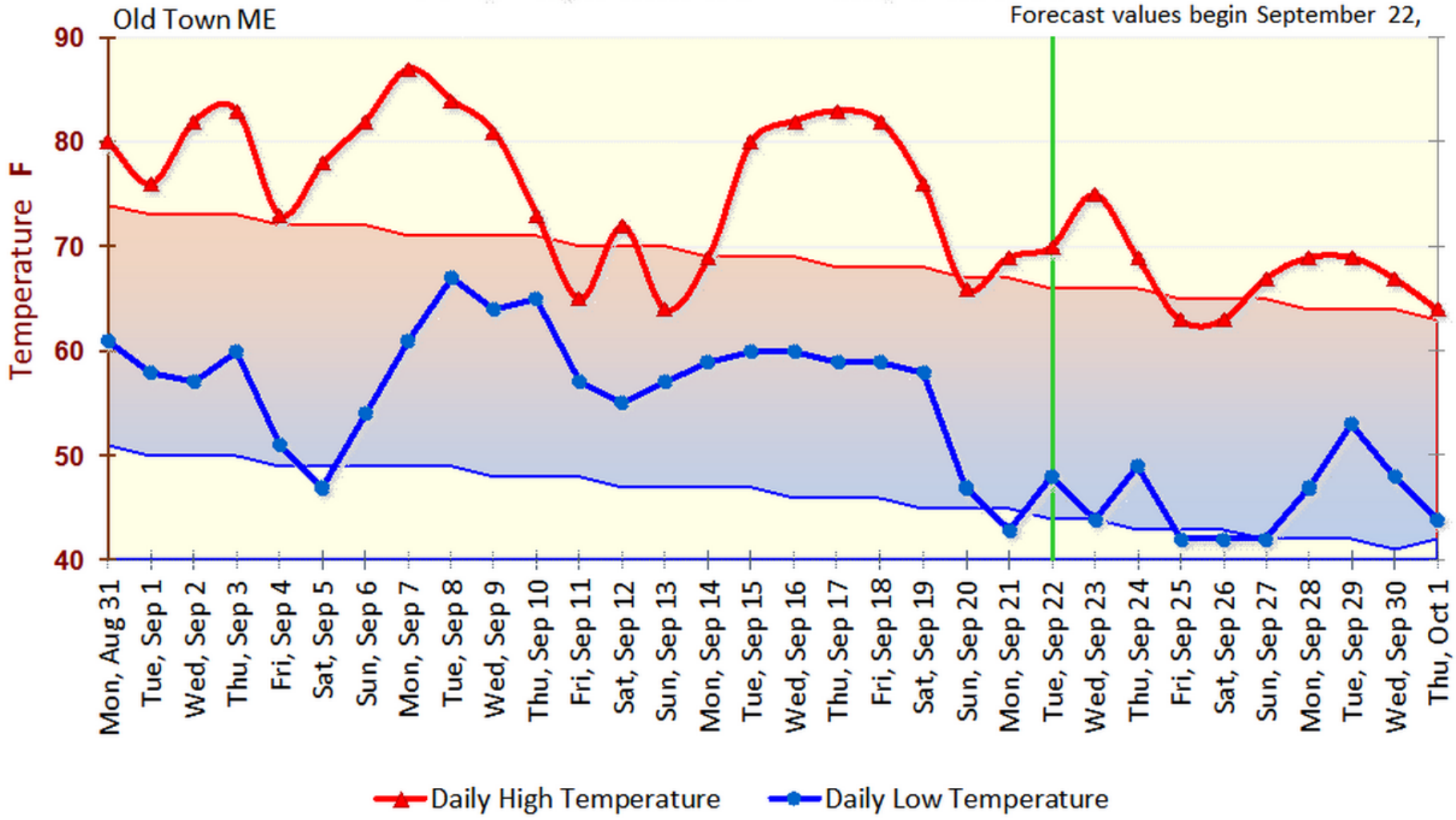
Black straight dashed line = Climatic average cumulative inches precipitation for same 10-day period.

* = Forecast 24-hour chance of precipitation.

Purple solid line = Observed cumulative precipitation from first date to last date on chart.

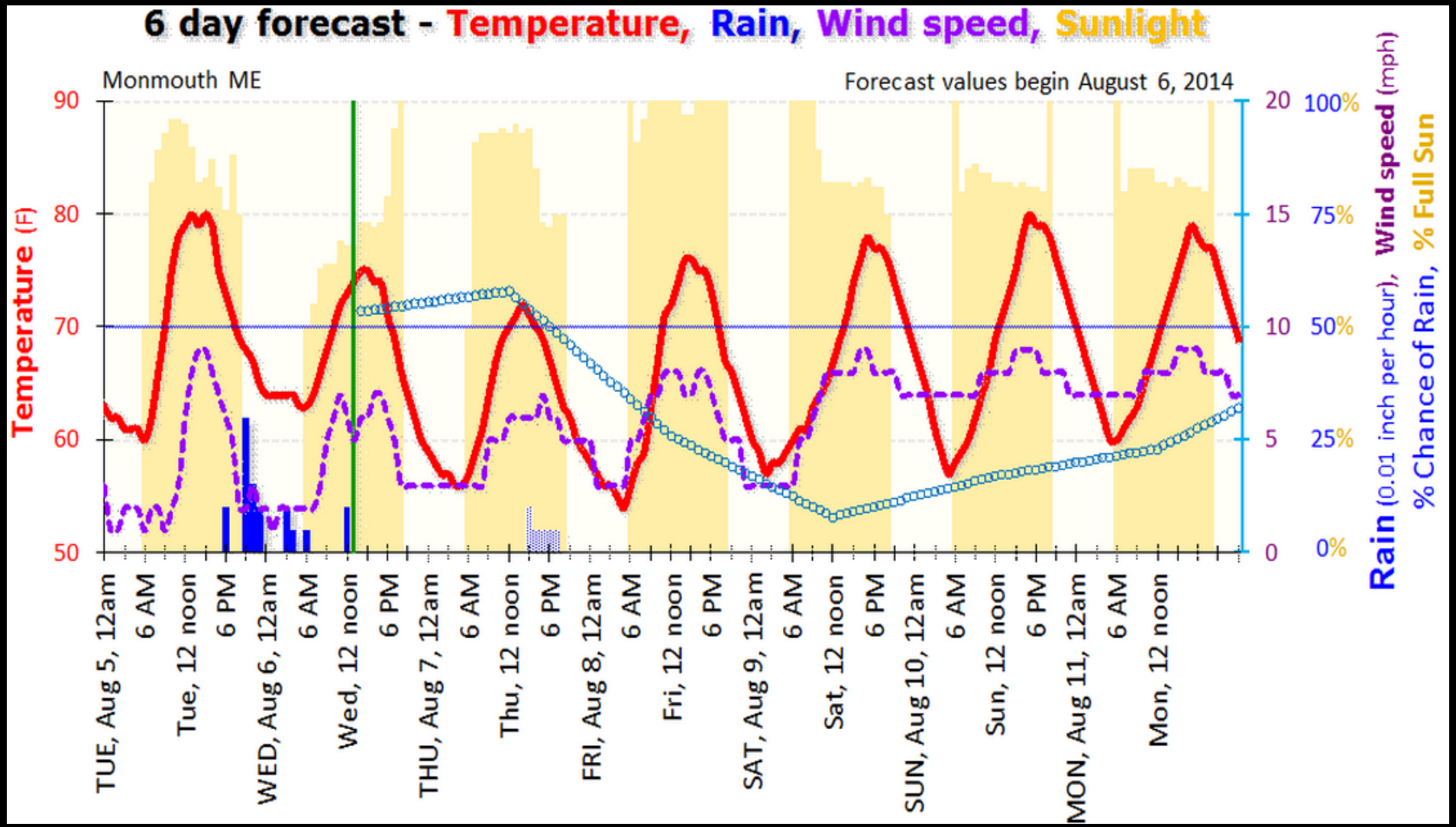
Purple straight dotted line = Climatic average cumulative precipitation from first date to last date on chart.

Daily High and Low Temperatures



Horizontal colored band = Climatic average high and low temperature range for these dates.
Vertical green line = Today's date and beginning of forecast values.
Temperature values are for 2 meters (~ 6 feet) above the ground at a site with good air drainage.
Low temperature values on this chart are not designed for use as frost indicator.

Active charts and tables for this location were last updated: Tuesday, September 22, 2015 at 5:36 AM


6 day forecast - Temperature, Rain, Wind speed, Sunlight
Monmouth ME
Forecast values begin August 6, 2014
Temperature (F)
90
80
70
60
50
20
15
10
5
0
100%
75%
50%
25%
0%
Rain (0.01 inch per hour), Wind speed (mph)
% Chance of Rain, % Full Sun
TUE, Aug 5, 12am
6 AM
Tue, 12 noon
6 PM
WED, Aug 6, 12am
6 AM
Wed, 12 noon
6 PM
THU, Aug 7, 12am
6 AM
Thu, 12 noon
6 PM
FRI, Aug 8, 12am
6 AM
Fri, 12 noon
6 PM
SAT, Aug 9, 12am
6 AM
Sat, 12 noon
6 PM
SUN, Aug 10, 12am
6 AM
Sun, 12 noon
6 PM
MON, Aug 11, 12am
6 AM
Mon, 12 noon

Text profiles of Primary apple scab Infection periods

****** Primary Infection Period 1 Details ******

Begin: Tuesday, April 15 at 5 AM ---> Last rain hour: Wednesday, April 16 at 4 AM.
Growth stage at start of period: Between Green Tip and Quarter Inch Green
This infection period accounts for less than 1% of the year's total primary scab risk.
Approximately 1.56 inch rain and 27 leaf wet hours, with 48 F degrees average temperature during wet hours.
Cumulative scab ascospore release by end of this wetting period is roughly < 1%.

Reliable pre-infection protection during this period expected if full dose + good coverage captan or EBDC fungicide applied since Monday, April 14, 12 AM, or if strobilurin fungicide applied since Monday, April 14, 12 AM.

Wetting period long enough only for ascospores released at night.

Opportunity for surface fungicide kickback ends Wednesday, April 16, at 3 PM.

Opportunity for sterol inhibitor or strobilurin fungicide kickback ends Friday, April 18, at 5 AM.

First generation lesions arising from this infection period would start appearing by Tuesday, May 6.
If conidia from 1st generation lesions spread infection, 2nd generation lesions could show as early as Wednesday, May 21.

****** Primary Infection Period 2 Details ******

Begin: Tuesday, April 22 at 8 PM ---> Last rain hour: Wednesday, April 23 at 2 PM.
Growth stage at start of period: Between Green Tip and Quarter Inch Green
This infection period accounts for less than 1% of the year's total primary scab risk.
Approximately 0.25 inch rain and 20 leaf wet hours, with 50 F degrees average temperature during wet hours.
Cumulative scab ascospore release by end of this wetting period is roughly 3%.

Reliable pre-infection protection during this period expected if full dose + good coverage captan or EBDC fungicide applied since Monday, April 14, 12 AM, or if strobilurin fungicide applied since Saturday, April 19, 6 AM.

Wetting period long enough only for ascospores released at night.

Opportunity for surface fungicide kickback ends Thursday, April 24, at 6 AM.

Opportunity for sterol inhibitor or strobilurin fungicide kickback ends Friday, April 25, at 8 PM.

First generation lesions arising from this infection period would start appearing by Saturday, May 10.
If conidia from 1st generation lesions spread infection, 2nd generation lesions could show as early as Monday, May 26.

SCAB FUNGICIDE RESPRAY DATES

Primary scab

*** For orchards protected by a PROTECTANT fungicide** (captan, mancozeb, Topsin, Syllit)

These estimates also a best guess for SDHI fungicides (Luna, Merivon, Fontelis).

* For orchards protected by a STROBILURIN fungicide (Flint, Pristine, Sovran, Cabrio).

* For orchards protected by a SULFUR fungicide

These next two tables are only for use in orchards where low scab index was measured the previous fall.

* For Protectant fungicides used in LOW-SCAB orchards

* For Strobilurin fungicides used in LOW-SCAB blocks

Secondary scab

1st and 2nd generation scab lesion appearance dates

Secondary Scab Fungicide Respray Dates

Respray guidelines for transition period between end of primary scab ascospore releases and confirmation of successful scab control.

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* FIRE BLIGHT *

Models estimate relative risk. Absolute risk depends on infection pressure, cultivar, rootstock etc.

CougarBlight – blossom infection risk

CougarBlight - blossom infection risk chart

Eastern Fire Blight Model - blossom infection risk

Fire blight – susceptible blossom respray dates