NEW ENGLAND FRUIT MEETINGS 2001

PROCEEDINGS

ONE HUNDRED AND SEVENTH
ANNUAL MEETING
MASSACHUSETTS FRUIT GROWERS'
ASSOCIATION, INC.

January 10 and 11, 2001

Volume 107

Published by the
MASSACHUSETTS FRUIT GROWERS' ASSOCIATION, INC.
P.O. Box 9632, North Amherst, MA 01059-9632

New England Fruit Meetings

Massachusetts Fruit Growers' Association, Inc.
in cooperation with the
New England University Cooperative Extensions

Sturbridge Host Hotel & Conference Center

January 10-11, 2001

Cooperating Groups:

Connecticut Pomological Society
Maine State Pomological Society
Massachusetts Fruit Growers' Association
New Hampshire Fruit Growers Association
Rhode Island Fruit Growers' Association
Vermont Tree Fruit Growers' Association

Edited by William J. Bramlage

Massachusetts Fruit Growers' Association, Inc.
P.O. Box 9632
North Amherst, MA 01059-9632

Table of Contents

BY-LAWS

Massachusetts Fruit Growers' Association, Inc.

Article I - Name

The name of the organization shall be the Massachusetts Fruit Growers' Association, Incorporated.

Article II - Object

The object of the Association shall be to encourage the growing and marketing of fruits adapted to this climate and all pertaining thereto.

Article III - Membership

Section 1. Any person interested in fruit growing in Massachusetts may become an active member of the Association by paying the annual dues, due January 1st, for the ensuing calendar year.

Members of the professional staff of the University of Massachusetts and any other public servants of the fruit industry may become members of the Massachusetts Fruit Growers' Association in good standing without payment of dues by vote of the Board of Directors.

Section 2. Any association or society of fruit growers, in Massachusetts may affiliate not less than a majority of its members into active voting membership in the Massachusetts Fruit Growers' Association by paying such dues as the Board of Directors may designate. Such payment shall be due January 1st for the ensuing calendar year.

Section 3. Any member may be elected to honorary life-membership in the Association by vote of the Board of Directors. Honorary life-members shall be entitled to all privileges of membership and shall be exempt from payment of dues.

Section 4. Members in good standing shall receive a copy of the Association's annual report.

Section 5. Any individual interested in fruit growing in Massachusetts alternatively may become an associate member of the Association by paying annual dues, due January 1st, for the ensuing calendar year. The amount of these dues will be set by the Board of Directors at their Annual Fall Meeting, and shall be lower than the dues for active membership. Associate members shall receive a copy of the Association's annual report, but shall not have voting privileges at business meetings of the Association.

Article IV - Meetings

Section 1. The Association shall hold its annual 2-day meeting and trade show sometime in late January or early February at a time and place to be determined by the Board of Directors.

Section 2. The annual meeting for the election of officers and transaction of business shall be held on the first day of the annual convention at the time and place of said convention.

Section 3. The order of business to be observed at the annual meeting shall be as follows:

1. Determination of quorum.

2. Call to order and reading of minutes of previous meetings.
3. Reports of officers.
4. Reports of committees.
5. Unfinished business.
6. New business.
7. Election of officers.

Section 4. Other meetings may be held at the direction of the President or the Executive Committee.

Section 5. Notice of the time and place of each meeting of the Association shall be mailed to every member, postage prepaid, at his last known address at least ten days before the date of such meeting.

Section 6. Twenty-five members shall constitute a quorum for the transaction of business at any meeting of the Association, but a lesser number may meet, call to order and adjourn.

Article V - Officers

Section 1. The officers of the Association shall be a President, three Vice-Presidents, Secretary, Treasurer, Auditor and Board of Directors.

The President shall be chairman of the Board of Directors and of the Executive Committee.

The offices of Secretary and Treasurer may be held by one and the same person. With the approval of the Executive Committee, the Secretary may appoint or employ such assistants as are needed to conduct the affairs of the Secretary's Office.

The Secretary, Treasurer and all assistants appointed or employed by the Secretary shall receive such salary and reimbursement for expenses as may be determined by the Executive Committee.

The Treasurer shall be under bond in such sum as the Executive Committee may determine.

The President and Secretary shall be ex-officio members of all committees.

Section 2. Each year the President of the Association shall appoint a nominating committee, which shall submit to the Secretary on or before December 1st nominations for President, Vice-Presidents, Secretary, Treasurer, and Auditor, to serve for a term of one year.

Section 3. The Board of Directors shall consist of the President, Vice-Presidents, Secretary, Treasurer, Auditor, last ex-president of the Association, Chairman of the Horticultural Research Fund, and Presidents of affiliated organizations, ex-officio, and twelve Directors at large nominated in the following manner:

Each year the Nominating Committee shall submit to the Secretary on or before December 1st a list of six candidates for Directors at Large for a term of three years. The six candidates for Directors at Large so nominated shall be fruit growers. The Directors shall be nominated with due regard for the various kinds of fruit grown by the membership and the geographical distribution of fruit production within the state.

The President and Secretary, acting for the Board of Directors, may invite one member of the fruit growers' association from each of other five New England States, the Extension Fruit Specialists and the other members of the professional staff of the University of Massachusetts, the Massachusetts Department of Agriculture, and the County Extension Services to attend the meetings of the Board of Directors and take part in its deliberations.

Section 4. Before each annual meeting the Secretary of the Association shall prepare ballots containing the names of all persons nominated for office by the Nominating Committee, with additional space in each category for writing in the names of any members of the Association nominated from the floor preceding the voting. Said ballots shall be used by the members in electing the officers, and shall carry directions for voting in the different categories and instructing the members to vote for not more than four names for Directors at Large for a three-year term, the four candidates for Directors at Large receiving the greatest number of votes to be declared elected.

Article VI - Finance Committee

The President, immediate past-President, Treasurer and one Director or former Director appointed by the President shall constitute the Finance Committee. The President will serve as Chairman of the Finance Committee.

Article VII - Executive Committee

The President, Vice-Presidents, Secretary, Treasurer and Auditor shall constitute the Executive Committee.

Article VIII - Duties of Officers

Section 1. The Presidents shall:

(a) Preside over all meetings of the Association, Board of Directors and Executive Committee.
(b) Appoint committees for various purposes.
(c) Perform all other duties pertaining to the office.

Section 2. In the absence of the President one of the Vice-Presidents shall perform the duties of that office.

Section 3. The Secretary shall:

(a) Keep a record of all meetings of the Association, Board of Directors and Executive Committee.
(b) Serve all notices required by the by-laws of the Association.
(c) Conduct correspondence.
(d) Keep a list of members of the Association.
(e) Collect dues and turn them over to the Treasurer.

Section 4. The Treasurer shall:

(a) Have charge of all moneys of the Association.
(b) Pay out money on bills approved by the President and Secretary.
(c) Make a written report of the Association's finances at the meetings of the Board of Directors and at the annual meeting of the Association.
(d) At the close of this term of office turn over all funds and records in his

possession to his successor.

Section 5. The Auditor shall be entitled to examine all books, papers and vouchers at any time, and shall make a written report at the annual meeting of the Association.

Section 6. The Board of Directors shall:

(a) Outline the policies and direct the work of the Association.
(b) Endeavor to increase the membership of the association.
(c) Meet twice a year, in February and November, at the call of the President, for the purpose of planning the program of the Association's activities of the coming year, considering the program for the annual convention, preparing the annual report, and taking action on any other business or referring it to a meeting of the Association.
(d) Set the amount of the annual dues at its October meeting. Special meetings of the Board may be called by the President. Twelve members shall constitute a quorum at any meeting of the Board.

Article IX - Duties of Finance Committee

The Finance Committee shall formulate a financial policy for the Association and draw up a budget of expenditures for consideration by the Board of Directors.

Article X - Duties of Executive Committee

The Executive committee shall:

(a) Represent and act for the Board of Directors when it is not in session.
(b) Fill vacancies in office occurring between annual meetings.
(c) Perform all other duties revolving upon it under these by-laws.

Article XI - Reserve Fund

The association shall maintain a reserve fund, which shall consist of such of the Association's funds as the Board of Directors may designate. Principal and income from said fund may be expended by vote of the Board of Directors.

Article XII - Fiscal Year

The fiscal year of the Association shall commence December 1st and end on the 30th day of the following November.

Article XIII - Amendments

These by-laws may be amended at any meeting of the Association by two-thirds vote of the members present and voting, notice of the proposed amendment having been included in the call for such meeting.

Officers and Directors for 2001

Massachusetts Fruit Growers' Association, Inc.

PRESIDENT

William Broderick	Sterling

VICE PRESIDENTS

Timothy Smith	Shelburne
Ken Nicewicz	Bolton
Kim Wiezbicki	East Longmeadow

SECRETARY/TREASURER

Wesley Autio	Pelham

AUDITOR

Robert Davis	Bolton

PAST PRESIDENT

David Bishop	Shelburne

DIRECTORS REPRESENTING LOCAL ASSOCIATIONS

Essex County Fruit Growers Association

James O'Brien, Jr.	Peabody

DIRECTORS AT LARGE

Term expires in 2002

David Chandler	Sterling
Robert Tuttle	Warren
Richard Bartlett	Richmond
Mario Lanni	Lunenburg

Term expires in 2003

Franklyn Carlson	Harvard
Hamilton Lincoln, Jr.	North Brookfield
Maurice Tougas	Northborough
Steve Ware	Bolton

Term expires in 2004

William Fitzgerald	Methuen
Thomas Clark	Deerfield
Gordon Kimball	Lunenburg
Alex Dowse	Sherborn

Committees for 2001

Massachusetts Fruit Growers' Association, Inc.

Executive:	W. Broderick (chair), T. Smith, K. Nicewicz, K. Wiezbicki, R. Davis, W. Autio, and D. Bishop.
Program:	D. Greene (chair), executive committee
Legislative:	A. Dowse (chair), K. Nicewicz, and D. Bishop
Finance:	W. Broderick (chair), R. Davis, W. Autio, T. Smith, K. Nicewicz, K. Wiezbicki, and D. Bishop
Cider:	S. Ware (chair), T. Clark, D. Shearer, and F. Carlson
UMass Fruit Advisory:	F. Carlson (chair), R. Davis, J. Blanchard, D. Greene, and T. Smith
Nominations:	D. Chandler (chair) and R. Tuttle
Harvest Labor:	R. Davis (chair), F. Carlson, W. Broderick, and G. Kimball
Annual Meeting Facililties:	R. Smiley (chair)
Marketing, Publicity, & Promotion:	K Nicewicz (chair), H. Lincoln, Jr., K. Wiezbicki, R. Tuttle, and T. Clark

Minutes
Meeting of the Board of Directors
Massachusetts Fruit Growers' Association, Inc.
Old Mill Restaurant, Westminster, Massachusetts
March 1, 2000

The meeting was called to order by President Broderick at 2:00 PM. Individuals present were Wes Autio, Rick Bartlett, David Bishop, Bill Broderick, Frank Carlson, Tom Clark, Charlie Costa, Bob Davis, Kip Graham, Mary Jordan, Mario Lani, Ken Nicewicz, Bob Smiley, Tim Smith, Mo Tougas, and Steve Ware.

Secretary's Report

Autio presented the minutes of the previous Directors' Meeting. Minutes were moved, seconded, and passed.

Treasurer's Report

Autio presented the Treasurer's Report. Specific details appear below. The Treasurer's Report was moved, seconded and passed.

GENERAL FUND		
Balance -- Shawmut Bank, 12/31/00		$29,009.43
Receipts		
Active member dues -- 2000	$6,800.00	
Associate member dues -- 2000	1,000.00	
Exhibitor member dues – 2000	250.00	
Exhibitor member dues – 2001	25.00	
Annual meeting – 2000	4,010.00	
Annual meeting – 2001	335.00	
Annual meeting registration fee -- 2000	4,960.00	
Checking account interest	22.72	
Horticultural Research Fund Donations	690.00	
Apple Market Report	6.50	
Fruit Notes	540.00	
UMass Tree Fruit Newsletter	2,355.00	
Horticultural Research Center donations	969.00	
IPM donations	621.00	$22,584.22
Disbursements		
Administration	$358.75	
Secretary/Treasurer salary	531.01	
Annual meeting – 2000	19,235.99	
Proceedings – 1999	4,108.35	
Affiliations	300.00	($24,534.10)
Balance -- Fleet Bank, 2/29/00		**$27,059.55**

HORTICULTURAL RESEARCH FUND		
Balance -- Fleet Bank, 12/31/99	$8,027.29	
Receipts		
Interest	$27.60	$27.60
Balance -- Fleet Bank, 2/29/00		**$8,054.89**
Balance -- Merrill Lynch, 12/31/98	$163,202.83	
Cash – 2/29/00		$24,340.16
Investments (value as of 2/29/00)		
MediaOne Finance Trust	$17,762.50	
AMLI Residential Properties	4,087.40	
General Electric	13,237.50	
Liberty All-Star Equity Fund	54,330.50	
Liberty All-Star Growth Fund	11,710.31	
Royce Value Trust	17,997.03	
Zweig Fund	10,634.30	
Franklin Universal Trust	9,843.00	$139,602.54
Balance -- Merrill Lynch, 2/29/00		**$163,942.70**
Total Balance -- Horticultural Research Fund/Reserve Fund		**$171,997.59**
Overall increase in value in 2000 not related to grant expenditures and transfers from the General Fund		0.4%

Cider Committee

Carlson presented the report of the Cider Committee including information from USAA. FDA is stating that a 5-log reduction in pathogens will be required from the beginning of the cider-making process, not from the tree. Also, it appears that UV should be getting favorable review from FDA soon. Likely, a HACCP program will be required. Smiley reported that we received a grant to assist with an education program for cider producers. If pasteurization becomes mandatory, however, the number of producer may be too small to warrant the program.

Legislative Committee

Nicewicz announced Ag. Day at the Statehouse. A motion was made, seconded, and passed to donate $100 to the Mass. Ag. Promotion Board to support Ag. Day. Nicewicz also introduced Kip Graham and Charlie Costa from FSA to discuss the proposed relief for apple growers to assist with problems associated with the dry summer followed by the hurricane in September. Much discussion ensued and a letter of support for this legislation will be developed.

Marketing, Publicity, & Promotion Committee

Nicewicz introduced Mary Jordan from DFA. Ms. Jordan encouraged growers to contact Larry Street, the marketing specialist at DFA responsible for apples. Also, she encouraged participation in Ag. Day at the Statehouse. Ms. Jordan detailed several activities underway at DFA regarding promotion.

UMass Fruit Advisory Committee

Carlson reported that the Committee will meet with Dean Helgesen in the spring.

2000 New England Fruit Meetings & Trade Show

Smiley reported that there were 58 paid exhibitors in 78 booths. This was an decrease of

3 exhibitors and 6 booths over 1999. The number of exhibitors is down reflecting the continuing loss of potential exhibitors through consolidations in the agricultural chemical industry. Smiley also gave the dates of the next New England Fruit Meetings & Trade Show as January 9-11, 2001. Autio presented the balance sheet (details are presented below), showing an apparent surplus of $8,750.26. He also noted that publishing and mailing the *Proceedings* would cost approximately 4,780. If the cost of the *Proceedings* were considered part of the cost of the Meetings, the net would be approximately $3,970.26. Autio reported that attendance was just over 400 each day of the meeting. Pesticide recertification credits were accessed on Wednesday by 40, 7, 7, 5, 7, 1, and 2 individuals from MA, ME, NH, VT, CT, RI, and NY, respectively. On Thursday, 69, 4, 22, 9, 14, 5, and 4 individuals from MA, ME, NH, VT, CT, RI, and NY, respectively, accessed recertification credit.

2000 New England Fruit Meetings & Trade Show		
Receipts		
Exhibitors	$24,836.00	
Registration	4,960.00	$29,796.00
Disbursements		
Registration desk	$466.66	
Booth equipment	2,384.00	
Facilities (+electrical, social, AV, hospitality)	7,175.81	
Insurance	750.00	
Program Chairman	1,000.00	
Speakers	4,210.00	
Trade Show Manager expenses	1,560.18	
Trade Show Manager honorarium	2,500.00	
Exhibitor Buyers Guide	205.75	
Program	309.75	
Apples	144.00	
Badges	129.59	
Refund	210.00	($21,045.74)
Apparent surplus		**$8,750.26**

2000 Proceedings of the New England Fruit Meetings		
Receipts		
Ads (estimated)	$350.00	
Sales (estimated)	70.00	$420.00
Disbursements		
Printing (estimated)	$3,500.00	
Postage (estimated)	700.00	
Editor honorarium	1,000.00	($5,200.00)
Estimated net cost		**($4,780.00)**
New England Fruit Meetings & Trade Show Net		**$3,970.26**

Finance Committee

Autio presented a proposed budget for 2000. Discussion ensued, and the budget was moved, seconded, and passed as described below.

General Fund -- Budget, 2000			
	Budget, 1999	Actual, 1999	Budget, 2000
Beginning balance	**$3,732.05**	**$3,732.05**	**$9,243.18**
Receipts			
Checking account interest	$120.00	$100.23	$50.00
Membership	12,000.00	11,900.00	12,000.00
Ads	500.00	350.00	350.00
Fruit Meeting balance	12,320.00	12,242.39	8,750.00
Apple Market Report	450.00	494.00	450.00
Sale of *Proceedings*	35.00	140.00	70.00
Cider account	2,000.00	694.00	1,000.00
Summer Meeting	0.00	390.00	300.00
Miscellaneous	0.00	103.00	0.00
Total	**$27,425.00**	**$26,413.62**	**$22,970.00**
Disbursements			
Administration	$2,500.00	$2,361.79	$2,500.00
Proceedings	6,000.00	1,000.00	9,400.00
Secretary/Treasurer salary	2,300.00	2,124.04	2,300.00
Affiliations	400.00	180.00	400.00
Apple Market Report	450.00	0.00	450.00
Horticultural Research Fund	2,500.00	2,500.00	2,500.00
Cider account	3,000.00	2,064.66	1,000.00
U.S. Apple Association	5,867.00	5,867.00	5,295.00
NE Tree Fruit Res. Comm.	4,000.00	4,000.00	4,000.00
Summer Meeting	0.00	390.00	300.00
Miscellaneous	500.00	415.00	500.00
Total	**($27,517.00)**	**($20,902.49)**	**($28,645.00)**
Ending balance	**$3,640.05**	**$9,243.18**	**$3,568.18**

New Business

Broderick made committee assignments for 2000:

Executive:	W. Broderick (chair), T. Smith, K. Nicewicz, K. Wiezbicki, R. Davis, W. Autio, and D. Bishop.
Program:	D. Greene (chair), executive committee
Legislative:	A. Dowse (chair), K. Nicewicz, D. May, and D. Bishop
Finance:	W. Broderick (chair), R. Davis, W. Autio, T. Smith, K. Nicewicz, K. Wiezbicki, and D. Bishop
Cider:	K. Bohne (chair), T. Clark, S. Ware, D. Shearer, and F. Carlson
UMass Fruit Advisory:	F. Carlson (chair), R. Davis, J. Blanchard, D. Greene, and T. Smith
Nominations:	D. Chandler (chair) and R. Tuttle
Harvest Labor:	R. Davis (chair), F. Carlson, W. Broderick, and G. Kimball
Annual Meeting Facililties:	R. Smiley (chair)
Marketing, Publicity, & Promotion:	K Nicewicz (chair), H. Lincoln, Jr., K. Wiezbicki, R. Tuttle, and T. Clark

Broderick also announced an effort to promote the Massachusetts Fruit Growers' Association.

The meeting was adjourned at 4:10 PM.

Respectfully submitted by
Wesley R. Autio, *Secretary*

Minutes
Meeting of the Board of Directors
Massachusetts Fruit Growers' Association, Inc.
Old Mill Restaurant, Westminster, Massachusetts
December 6, 2000

The meeting was called to order by President Broderick at 2:00 PM. Individuals present were Wes Autio, John Blanchard, Bill Broderick, Frank Carlson, David Chandler, Tom Clark, Jon Clements, Charlie Costa, Bob Davis, Alex Dowse, Paul Fisher, Kip Graham, Mario Lani, Ken Nicewicz, Jamie O'Brien, Jesse Rice, Joe Sincuk, Bob Smiley, Tim Smith, Mo Tougas, Bob Tuttle, Steve Ware, and Kim Wiezbicki.

Secretary's Report

Autio presented the minutes of the previous Directors' Meeting. Minutes were moved, seconded, and passed. Autio also presented membership numbers changing from 203, 220, 200, 182, 185, to 181 in 1995, 1996, 1997, 1998, 1999, and 2000, respectively. It was moved, seconded, and passed to make Steve Demski and Cleve Willis courtesy members.

Treasurer's Report

Autio presented the Treasurer's Report. The General Fund began 2000 with a balance of $29,009.43. With $47,975.16 in receipts and $48,768.30 in disbursements so far in 2000, the balance on December 6 was $28,216.29. The Horticultural Research Fund began 2000 with a balance of $171,230. A total of $231,631.56 was recieved in donations and interest and $7,823.60 was disbursed on projects to leave a balance on December 6 of $423,925.75. The primary donation was $212,000 from Mr. Jack Blais. The Treasurer's Report was moved, seconded and passed. Further, it was moved, seconded, and passed to utilize the same investment approach as in the past, with Frank Southwick, Wes Autio, and Joe Sincuk making investment decisions.

2000 New England Fruit Meetings & Trade Show

Smiley reported that there were 74 booth spaces rented and that consolidation of support industries continues to reduce the number of exhibitors and potential exhibitors. It was moved, seconded, and passed to charge $20 per copy of the Proceedings of the New England Fruit Meetings to individuals who are not members of any New England state tree-fruit organization.

Old Business

Reports were received by the Directors from the Trustees of the Horticultural Research Fund, the Legislative Committee, the UMass Fruit Advisory Committee, the Harvest Labor Committee, and the Marketing Committee.

New Business

Charlie Costa, Kip Graham, and Paul Fisher provided some details of the upcoming Market Loss Program. They distributed draft outlines and took questions. It was moved, seconded, and passed to provide a courtesy booth at the 2001 New England Fruit Meetings for FSA to provide information on this program.

It was moved, seconded, and passed to expend up to $1,000 to develop a web site for the Massachusetts Fruit Growers' Association. Jon Clements will lead this effort. It also was moved, seconded, and passed to request the name of www.massfruitgrowers.org.

The meeting was adjourned at 4:00 PM.

Respectfully submitted by
Wesley R. Autio, *Secretary*

Minutes
Annual Business Meeting
Massachusetts Fruit Growers' Association, Inc.
Sturbridge Host Hotel, Sturbridge, Massachusetts
January 10, 2001

The Annual Business Meeting was called to order at 11:55 AM by President William Broderick. President Broderick offered words of welcome to the membership. Twenty-one individuals were present. President Broderick asked for a moment of silence in honor of two long-time members who passed during the year: Richard Gilmore and Donald May.

Secretary's Report

The Annual Business Meeting of the Massachusetts Fruit Growers' Association, Inc. was held on January 5, 2000. Twenty-five members attended. Directors met on March 1 and December 6, the Executive Committee met on June 16, and the Trustees of the Horticultural Research Fund met on March 27, July 12, and October 18. The Annual Summer Meeting was on July 19 at the UMass Horticultural Research Center in Belchertown. Approximately 100 individuals attended. One-hundred and eighty-one individuals were members of the Association in 1999, a slight decrease from 1999. Below are the membership figures for 1995-2000. Minutes of the 1999 meeting were presented and accepted.

Category	1995	1996	1997	1998	1999	2000
Active members	52	51	47	45	45	43
Associate members	58	73	62	59	56	60
Exhibitor members	67	72	69	56	62	57
Courtesy members	18	16	15	15	15	14
Life members	8	8	7	7	7	7
Total	203	220	200	182	185	181

Treasurer's Report

The General Fund began the year with a balance of $29,009.43. Receipts totaled $47,975.16, and disbursements totaled $49,827.90. The balance on December 31 was $27,156.69. Please note that the expenses of printing and mailing the *Proceedings* have not yet occurred. The Horticultural Research Fund began the year with a balance of $171,230.12. A total of $2,500 was moved into the Horticultural Research Fund from the General Fund, $213,340 were received as donations, $1,015 were received from UMass Extension Twilight Meetings, and $7,783.60 were expended on the renovation of Jon Clement's office. The balance as of December 31 was $426,015.72. Over the year, the Horticultural Research Fund grew by 149%; however, excluding moneys added from the General Fund and donations and excluding disbursements, the fund rose in value by 19%.

Detailed General Fund and Horticultural Research Fund information follow.

GENERAL FUND

Balance -- Fleet Bank, 12/31/99			$29,009.43
Receipts			
	Active member dues -- 2000	$8,600.00	
	Associate member dues -- 2000	$1,500.00	
	Exhibitor member dues – 2000	$250.00	
	Exhibitor member dues – 2001	$1,075.00	
	Annual meeting – 2000	$4,010.00	
	Annual meeting – 2001	$18,911.00	
	Annual meeting registration fee -- 2000	$4,960.00	
	Subscriptions	$70.00	
	Cider	$710.00	
	Summer Meeting	$493.00	
	Checking account interest	$29.73	
	Horticultural Research Fund donations	$840.00	
	Adjustment for an uncashed check	$40.00	
	Apple Market Report	$461.43	
	Fruit Notes	$710.00	
	Healthy Fruit	$3,095.00	
	Horticultural Research Center donations	$1,534.00	
	IPM donations	$686.00	$47,975.16
Disbursements			
	Administration	$1,801.04	
	Secretary/Treasurer salary	$2,124.04	
	Annual meeting – 2000	$20,083.63	
	Annual meeting – 2001	$1,325.99	
	Proceedings – 1999	$4,108.35	
	Promotion	$100.00	
	Summer Meeting	$447.85	
	US Apple Association	$5,295.00	
	NE Tree Fruit Growers Research Committee	$4,000.00	
	Affiliations	$730.00	
	Cider	$447.00	
	Horticultural Research Fund	$2,500.00	
	Horticultural Research Fund donations	$840.00	
	Fruit Notes	$710.00	
	Healthy Fruit	$3,095.00	
	Horticultural Research Center donations	$1,534.00	
	IPM donations	$686.00	$(49,827.90)
Balance -- Fleet Bank, 12/31/00			$27,156.69

HORTICULTURAL RESEARCH FUND

Balance -- Fleet Bank, 12/31/99		$8,027.29
Receipts		
Sincuk sales	$13,825.00	
Donation -- A. Clark	$500.00	
Donation -- J. Blais	$212,000.00	
Donations -- members	$840.00	
Twilight Meeting receipts	$1,015.00	
Transfer from General Fund	$2,500.00	
Interest	$983.84	$231,663.84
Disbursements		
Clements office	$7,783.60	
Transfer to Merrill Lynch account	$220,000.00	
Service fees to wire money to Merrill Lynch	$40.00	$(227,823.60)
Balance -- Fleet Bank, 12/31/00		$11,867.53
Balance -- Merrill Lynch, 12/31/99		$163,202.83
Transfer from Fleet Bank account	$220,000.00	
Cash -- 12/31/00		$269,673.00
Investments (value as of 12/31/00)		
AMLI Residential Properties	$4,937.50	
General Electric	$14,381.25	
Philip Morris	$8,800.00	
Franklin Universal Trust	$11,156.25	
Liberty All-Star Equity Fund	$62,543.25	
Liberty All-Star Growth Fund	$10,588.88	
Royce Value Trust	$20,862.19	
Zweig Fund	$11,205.88	$144,475.19
Balance -- Merrill Lynch, 12/31/00		$414,148.19
Total Balance -- Horticultural Research Fund/Reserve Fund		$426,015.72
Overall increase in value in 2000		149%
Overall increase not related to grant expenditures and deposits		19%
Approved expenditures for operation of the Horticultural Research Center		$19,732.35

Robert Davis, Auditor, reported that the Treasurer's report was accurate as presented. It was moved, seconded, and passed to accept the Treasurer's report as presented.

New Business

Motion: It was moved, seconded, and passed to allocate $100 in support of Ag. Day at the Statehouse.

The Nominations Committee presented nominees for officers and directors and asked for additional nominations from the floor. None were received. Bill Boderick was elected president for one year, Tim Smith, Ken Nicewicz, and Kim Wiezbicki were elected vice presidents for one year, Wes Autio was elected secretary and treasurer for one year, and Bob Davis was elected auditor for one year. Tom Clark, Alex Dowse, Bill Fitzgerald, and Gordon Kimball were elected directors at large for three years.

Meeting was adjourned at 12:20 PM.

Respectfully submitted,
Wesley R. Autio, *Secretary*

A MODEL FOR EARLY ASSESSMENT OF CHEMICAL THINNER RESPONSE ON APPLES

Duane W. Greene and James Krupa
Department of Plant and Soil Sciences
University of Massachusetts, Amherst, MA 01003

Chemical thinning time is one of the most stressful periods during the year because of the importance of decisions involved in the process, and the uncertainties involved in the outcome. In recent years researchers and extension personnel have complicated the problem even more, because they have been recommending multiple thinner applications. This is a very good approach since it improves the probability of achieving a good thinner response. The question remains, however, how does a grower assess whether or not a thinner worked, and if it did work, how well did it work? Two years ago we presented preliminary data on assessment of initial set and thinner response. This communication provides an update of the chemical thinning information, and presents a model we have developed to predict thinner response early enough to make a follow up thinner application.

Once fruit reach the 6 to 7 mm stage of development they are entering the most vulnerable stage in their young lives, where they are competing with other fruit, rapidly growing shoots, and other sinks for metabolites and photosynthate. Weak fruit and fruit that are unable to compete with other stronger carbohydrate sinks will most likely abscise. This is one of the most common times to apply a chemical thinner. During this period of time growers face a dilemma. They must answer one or more questions. Did my chemical thinner work? Should I have applied a chemical thinner? Should I now apply a thinner (or another thinner)?

Assessing Thinner Response

The response to chemical thinner application can be assessed in two ways: either by counting persisting fruit, or by following individual fruit growth rates. Thinning experiments were done in 1998 and 1999 that illustrated the relative effectiveness of these two methods. Ten spurs on each of twelve McIntosh trees were selected and tagged. When fruit reached an average of 8 to 9 mm in size, all fruit on each spur were counted and individually identified by numbering them with a Magic Marker. NAA at 8 ppm was applied as a dilute handgun spray to six of the trees while the remaining trees were left unsprayed and served as the controls. At 2 to 3-day intervals from the time of application to the end of June drop, fruit were measured, using a digital caliper, and the number of persisting fruit on each spur was counted.

In 1998 fruit set on spurs treated with NAA was similar to that on unsprayed control trees until 14 days after application (Fig. 1). It was not until over 3 weeks after NAA application that it was possible to make a true assessment of final fruit set and thinner response. Likewise, differences in fruit set between NAA and control trees in 1999 did not manifest themselves until two weeks after application, and it required an additional week to get a clear picture of final set. If a grower was to wait 2 to 3 weeks to apply a followup thinner, fruit development would have proceeded too far so that they would not respond reliably to a thinner application.

Growth rates of fruit that persisted to harvest and those that abscised 2 to 3 weeks after NAA application are shown in Fig. 2. In 1998 growth rate of fruit treated with NAA and later abscised during June drop slowed noticeably 4 days after application, and the reduction in growth was statistically significant 7 days after application. In 1999, 5 days after application growth rate of abscising fruit treated with NAA was significantly less than fruit that would persist to harvest. These results are significant in that they confirm that measurable reductions in fruit growth precede abscission by nearly 2 weeks, and declining fruit growth rates provides a very good indicator of which fruit will abscise well in advance of when they actually do abscise. Fruit growth rate appears to be useful to assess thinner response while fruit are still vulnerable to chemical thinners.

A Model to Predict Fruit Set and Thinner Response

Growth of fruit that drop during the June drop period slows well in advance of abscission. Based upon observations of fruit growth in previous studies, we advanced the hypothesis that all fruit will drop if their growth rates slow to 50% or less of the growth rate of fruit that persist. We feel that there are two key elements in being able to predict thinning response. First, you must be able to identify fruit that will persist to harvest so that you can use these as a standard to determine a reduction in growth rate. Second, you must measure fruit individually, just as fruit are starting to respond to the thinner, which usually occurs between 3 and 7 days after application.

In 1999 we set up an experiment to test our hypothesis and to see if we could predict the thinning response to NAA within 7 days of application, thus allowing us time to make subsequent thinner applications, if necessary. Two limbs 4 to 6 inches in diameter were selected on six mature McIntosh/M.7 trees growing at the University of Massachusetts Horticultural Research Center in Belchertown. At the pink stage of flower development all blossom clusters were counted on the tagged limbs and the blossom cluster density was calculated by dividing the number of blossom clusters by the limb cross sectional area. Five well exposed spurs were selected and tagged on each of the identified limbs. When developing fruit averaged 8 to 9 mm in diameter, all fruit on each spur were individually identified using a Magic Marker and then measured using a digital caliper. NAA at 8 ppm was then applied on one of the two limbs on each tree. The remaining tagged limb was left unsprayed and served as a control which represents normal June drop. We have measured fruit at 2 to 3 day intervals starting on the day of application, but measurement at 2 or 3 days after application and again at 7 days may be all that is necessary. In order to identify fruit that will persist to harvest we selected the largest fruit on each spur on the untreated check limb, and from these we only used growth rates of the 15 fastest growing fruit. After June drop, the numbers of fruit persisting on tagged limbs were counted.

Seven days after NAA application, 84% of fruit on spurs treated with NAA had growth rates that were 50% or less of those for the 15 fastest growing fruit on spurs of control limbs (Table 1). Since 84% of the fruit are predicted to abscise, we can predict that final fruit set will be 16%. Similarly, 42% of the fruit on control spurs had growth rates 50% or less that of the fastest growing fruit, so we can predict that fruit set following June drop on these limbs will be 58%.

We determined actual fruit set on limbs where fruit were measured and predictions were made. Actual fruit set on limbs treated with NAA was 16% and 1.9 fruit per cm limb cross-sectional area (Table 2). Fruit per cm limb cross-sectional area was predicted to be 1.6 (16% of 10.1 blossom clusters per cm lim cross-section area) while the actual measure was extremely close at 1.9 . Fruit set on control limbs was predicted to be 58% and 4.8 fruit per cm limb cross-section area, while it actually turned out to be 61% set and 5.4 fruit per cm limb cross-sectional area.

We are extremely encouraged by the accuracy of this predictive system and the flexibility that it may allow us to predict thinning problems early enough to make additional thinning treatment(s). We hope to test this system more widely this coming season. This system can be used now, but the calculations will take considerable time, and some help may be needed in the setup. We hope to have a system in place in the Spring of 2001 on the UMass Agroecology Fruit Team web page (www.umass.edu/fruitadvisor/) to help with the prediction. Growers will be able to enter the fruit growth data, the spread sheet will do the calculations, and growers will come up with a fruit set prediction almost immediately.

Table 1. Predicted fruit set 4 to 7 days after thinner application based upon the percent of fruit with growth rates 50% or less that of the rate of fruit proposed to persist.

Treatment ($Mg.L^{-1}$)	Predicted fruit abscission (%)	Predicted fruit set (%)
Control	42	58
NAA 8	84	16

Table 2. Effects of NAA on fruit set and the prediction of final fruit set based on fruit growth rates taken from 4 to 7 days after NAA application.

Treatment	Bloom	Actual fruit set		Predicted fruit set	
($mg.L^{-1}$)	BC/cm limb x-sect area	Fruit/cm limb x-sect area	Fruit set (%)	Fruit/cm limb x-sect area	Fruit set (%)
Control	8.3a*	5.4a	61a	4.8	58
NAA 8	10.1a	1.9b	16b	1.6	16

*Significant at P=0.05, Duncan's multiple range test if numbers in a column are followed by different letters.

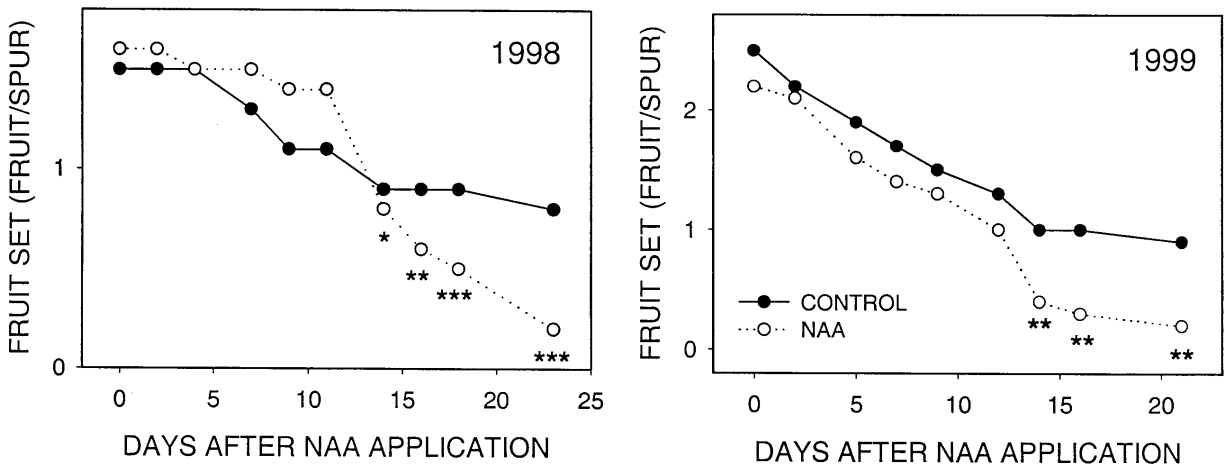


Figure 1. Kinetics of fruit set of McIntosh apples on untreated spurs and those that were treated with 8 ppm NAA when fruit size averaged 8 to 9 mm.

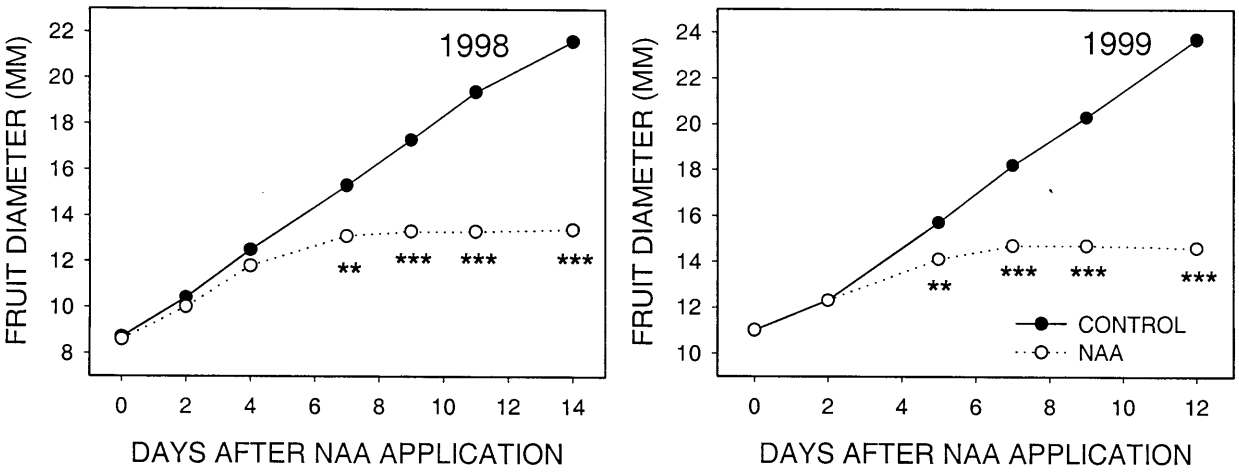


Figure 2. Fruit growth rates of McIntosh apples treated with 8 ppm NAA that abscised during June drop, and of control fruit that persisted to harvests.

TOP TEN THINGS A FRUIT GROWER NEEDS TO DO TO SURVIVE IN THE 21ST CENTURY

Win Cowgill
Professor and Agriculture Agent
Rutgers Cooperative Extension
4 Gauntt Place
Flemington, NJ 08822

Jon Clements
Extension Tree Fruit Specialist
Plant & Soil Science Department
University of Massachusetts
Amherst, MA 01002

We would like to give you our opinion on what we consider to be the 'Top 10 Things a Tree Fruit Grower Must Do to Survive in the 21st Century.' Our 'Top 10' list is based on an article published in American Fruit Grower, November 2000. Of course not every item will apply to your orchard, but we hope you will consider some of them crucial to surviving in the challenging future of orcharding. Here they are:

1. Take advantage of free money! Contact your local Farm Services Agency Office. Never have there been so many assistance programs available to apple growers at once, including: Special Apple Loan Program; Apple Market Loss Assistance Program; Apple Quality Loss Program for the 1999/2000 crops; 2000 Crop Disaster Program; and Adjusted Gross Revenue (AGR) Insurance. You deserve the assistance—take advantage of it!

2. Have a well thought out business plan. Consider including: a primary aim; strategic objective; organizational strategy; management strategy; people strategy; marketing strategy (more on this later); and systems strategy. 'The E Myth Revisited' by Michael Gerber (ISBN 0-88730-728-0) is a recommended reading reference when first thinking about the business plan process. Hire a consultant if necessary to devise and prepare a business plan that makes sense for your operation. Consider the saying, "If you don't know where you're going, you'll certainly never get there!"

3. Have a marketing strategy. It should start, end, live, and die with the customer! Know who your customer is, i.e. demographics. Know why he buys, i.e. psychographics. Your orchard system will be in part determined by the need for quantity, quality, and marketability of fruit. Like a business plan, a marketing plan will help you stay focused on how to get your fruit sold. Then, your orchard system will follow naturally.

Now, we know you are probably wondering what makes us the experts on these topics? Well, if you don't necessarily believe *everything* we say, we thought you might like to hear from some fellow orchardists in their own words:

New Jersey fruit grower George Melick talks about his retail marketing strategy both on- and off-farm...

> *"Take advantage of suburbia that has moved to you. Try to raise what you can sell to the neighbors or an immediate market where you can control the end, because that is where you are going to get the best dollar for your efforts. I don't see the future in wholesaling out of here. There is no question entertainment farming is a big thing. I recognized there was a future there, say 15 – 20 years ago, and we didn't have the help until one of our sons got out of college because it took his friends and friends of the family to help us. We*

started to advertise for pick-your-own. Luckily we had an apple orchard that was right close to the barn and we have also a cider mill and we are in proximity to North Jersey and to New York City. It is very accessible. So it was easy to over time advertise, work it up with the media, and now on Fall weekends we are bombarded with people that come out. That is a real plus as far as the ability to earn money from the farm."

Gary Mount, owner of Terhune Orchard in Princeton, NJ, talks about the evolution of his retail marketing plan...

"For me the fruit business, especially the apple business, is very bright. We find that people are more and more interested in buying apples from us. True, they might not buy as much each time they come, but they are very interested in types of apples and they're interested in knowing us as the people who grow their apples. They're interested in seeing the different varieties of apples that we have. Here we sell all of our apples retail. We don't wholesale anything so we have to balance our production with our sales. You always hope that you can increase your retail sales, but you can't double the amount. If you have a bumper crop you just can't get another truck and ship another truckload. We started with 55 acres here at the farm. We just had three crops, apples, peaches and pears and we made apple cider, the four things that sell. Now we are open all year and grow about 30 different crops. Apples and peaches are still the mainstays of what we grow. Now we are farming about 200 acres of those 30 different crops. Again, our whole focus is selling things retail directly to the consumers. New Jersey, is an expensive place to farm: our taxes are high, we are very densely populated, and it is hard to get labor and labor costs a lot more than maybe other areas. But there is a plus side too because we have lots of customers. For a future for us, I would see that we still focus on the retail marketing. We try to bring more people but also think of ways that when they come here they will buy more."

4. Re-plant five to ten percent of your acreage annually to take advantage of new cultivars and improved strains. Remove older blocks first. Use high-density, labor-efficient production systems to get into production within three years, tops.

5. Adopt new computer technology to become a more efficient, informed manager. Good uses of the computer include: business and pesticide record-keeping; decision support such as New Jersey's innovative 'IPMD' (IPM Database); weather data collection and analysis; communication, including subscribing to electronic newsletters and e-mail discussion groups. Keep an eye on the evolving role of web-based/internet information dissemination and decision-support applications. Also, watch closely the role of precision agriculture and GIS in future orcharding.

New Jersey grower Gary Mount talks about how he uses technology in his day-to-day orchard operation, including e-mail and digital pictures to Extension specialists...

"As far as computers and the internet and e-mail, it's been pretty helpful. There have been several occasions where I've had problems with crops and I've taken a picture with my digital camera. I e-mail that to one of the Rutgers Specialists. I also grow vegetables, and I'm particularly new at vegetables and don't know a lot of what can happen, and most of our vegetable specialists are in the southern part of the state which is a two hour drive to anybody either there or back. So for me to be able to take a picture of some cantaloupe that had some physiological problem I had no idea what it was, and to e-mail that to a specialist at Rutgers who could look at it that day and give me a call or e-mail me back—that was a terrific thing!"

6. Develop and religiously maintain block-by-block and/or crop enterprise production records. Growers must know which blocks or crops are profitable, and which are not—get rid of

blocks as soon as you determine they are not making you any money. The computer application 'Finpak' (University of Minnesota) is particularly useful for cash flow, balance sheets, budgeting, and profit-and-loss analysis.

Massachusetts wholesale apple and peach grower Bill Broderick talks about his use of computer software to keep track of block-by-block production and financial records...

> *"One part or one piece of new technology that I've used for the last 4 years is this particular software that I can do a much better job of recording and comparing the inputs for each individual block instead of just having averages for the whole farm. We do a pretty good job of comparing block-to-block data so that we know when blocks have become very unprofitable and it's just time to start up the chainsaw and cut it down. There is one block, this one here in particular, that was removed this year because of that. We use this technology to do our very best to keep track of every detail of every hour of every individual who worked in the block and we can express the dollars that were spent there and have a pretty good handle on exactly how profitable or unprofitable we are being in each different block—that helps me to make decisions."*

7. Controlling costs and maximizing efficiency are critical—there is no room for waste in today's competitive fruit production environment. Therefore you must identify and establish orchard systems that maximize efficiency and minimize cost of establishment. Examples include: inexpensive support systems with low maintenance; minimal input tree training and pruning; long rows or big blocks to maximize crop protection and labor operation efficiency. Labor is often one of your biggest expenses—every effort must be made to reduce labor costs and adopt labor-efficient management practices in the field and right on down through the storage and marketing operations.

8. Orchard system design must maximize sunlight interception to optimize yields. Tree and row spacing and the training system used need to make sure seventy percent (70%) of available sunlight is captured. To achieve this, row width should be no more then one and one-half times planned tree height. In-row tree spacing should be carefully considered using knowledge of scion, rootstock, and soil vigor.

9. Fruit quality must be optimized in the design and implementation of all orchard systems. This includes early tree training, skillful pruning, and careful handling of harvested fruit. Attentive pest management is also integral to producing top-quality fruit.

Andrew Martin, Honey Pot Hill Orchards in Stow, MA talks about the importance of producing only the highest quality fruit in today's competitive marketing environment...

> *"Pruning on an annual basis and doing a good job pruning. Being right on top of our chemical applications so that we don't use too much but so we can keep our cost down there. But being timely and effective and not missing using anything so we have good fruit when it comes harvest time. Summer pruning so we have good fruit. Chemical thinning effectively, and following up with hand thinning if necessary. Making sure once we get our fruit to harvest that it is harvested correctly, timely and appropriately. I went to a seminar once that said to 'inspect what we expect' and I think most of us, as growers don't inspect our fruit enough when it is being harvested. We just can't afford to have bruising. We can't afford to have stem punctures. It has gotta be almost perfect if we are gonna be really successful and profitable in the future."*

10. Plant moderate to high-density orchard systems, utilizing the most production-efficient dwarfing rootstocks available (trees the size of M.9 and clones, B9, Ottawa 3 up to M.26, and CG.30). They will all be supported and grown on virgin or replant disease-free ground (fumigated or rotated with cover crops).

Again, New Jersey fruit grower Gary Mount talks about his high-density apple orchard systems, which have been particularly effective for him in reducing labor costs and increasing profitability…

> *"Ahh, the system. We started almost 20 years ago with a trellis, a four wire trellis, a very standard trellis that now's sort of old hat but then was quite new. This has worked very well in supporting the trees, spreading the branches out, getting I think fairly good production from that. Like many growers, I always get this thing about not being able to walk through the rows, not being able to walk around the tree, having to walk all the way to the end of the row to get anywhere. We pretty much have gone now in our plantings to an individually staked tree. I'm not too good on the terminology of this tree but I like a tree on M. 9. It is a compact tree where almost all the apples can be picked from the ground. I talked about our labor being very expensive and in addition to that, we are the only orchard in this area, so when we get people to work for us, they're like particular orchard people. They are people that have really decided that they really like working on a farm and they really specialize in it. So they are very, very productive workers and I think that even though we may sacrifice some production by keeping a tree that you can pick everything from the ground—and I'm sure we do sacrifice some production; we could get more if it was a 10' or a 12' tree, maybe like a vertical ax or something like that—but we really can maximize the production of these precious workers."*

11. We know, we added an extra thing for you to do! Plant new and improved fruit varieties to capitalize on profitable, early developing markets for high-quality, in-demand fruit. Also, give the customers what they want. If they come into the store looking for a hot new variety such as Honeycrisp, you don't want to have to send them out the door empty-handed!

Gary Mount of Terhune Orchard talks about his adoption of new apple varieties as his customer's tastes have changed with time...

> *"As far as varieties, well we're so excited about the new varieties, and the reason for that—particularly I imagine they might be a pain in the neck for somebody who's trying to wholesale them and figure out what to ship where—but for us, our customers are really interested in variety. They want to see what's new. They want to have a different taste and so when you can have your old standard, like Stayman Winesap here, and then you bring in, for instance, one of our new plantings, a Cameo right next to it—well people are really interested in comparing the flavors and seeing which one they like best. They take some of both, they take them home, they come back and ask for them by name. So things we planted recently might be Fuji, Cameo, Honeycrisp, Pink Lady."*

We want to extend special thanks to the growers who gladly offered their wisdom and experience in front of the video camera:

George Melick
Melick Town Farm
Oldwick, NJ

Gary Mount
Terhune Orchard
Princeton, NJ

Andrew Martin
Honey Pot Hill Orchard
Stowe, MA

Bill Broderick
Sunnycrest Orchard
Sterling, MA

And for more information, visit these web sites:

- http://www.virtualorchard.net for general production and marketing information and on-

line communication resources such as the apple-crop e-mail list

- http://www.ne183.org for new apple variety information
- http://www.nc140.org for rootstock and orchard systems information
- http://www.idfta.org for dwarf fruit tree production information
- and http://www.umass.edu/fruitadvisor/ for UMass fruit Extension and research information

Some last thoughts from New Jersey fruit grower George Melick on how rapid change is now, and how it will continue to affect the fruit industry...

> *"Well, in the fruit industry it is no different than any other industry involving technology. Whatever has happened in the past, we think it has happened very fast, but in the future it is going to be even faster and it's gong to be unbelievably fast."*

MARKETING APPLES IN A GLOBAL ECONOMY

A. Desmond O'Rourke
Belrose, Inc., Pullman, Washington 99163

Introduction

The issue before us today is not simply about marketing apples in a global economy, rather it is about whether or not it can be done profitably. Some parts of the apple industry will adapt to these global forces, just as they have adapted to changes in the past. The question each of you faces is whether you can afford to make the needed changes, or, if you make the needed changes, whether you can continue to operate at a profit.

Major Global Trends

In the brief time available, I can only focus on four major global trends that are affecting everyone in the fruit industry. These are:

1) The Shrinking of Space and Time
2) The Changing Consumer
3) Increasing Competition, and
4) Power Accumulation by Retailers

None of these trends is new or, on its own, particularly startling. However, it is the combination of changes, and the speed and intensity of change that is making adaptation so difficult for traditional fruit growers.

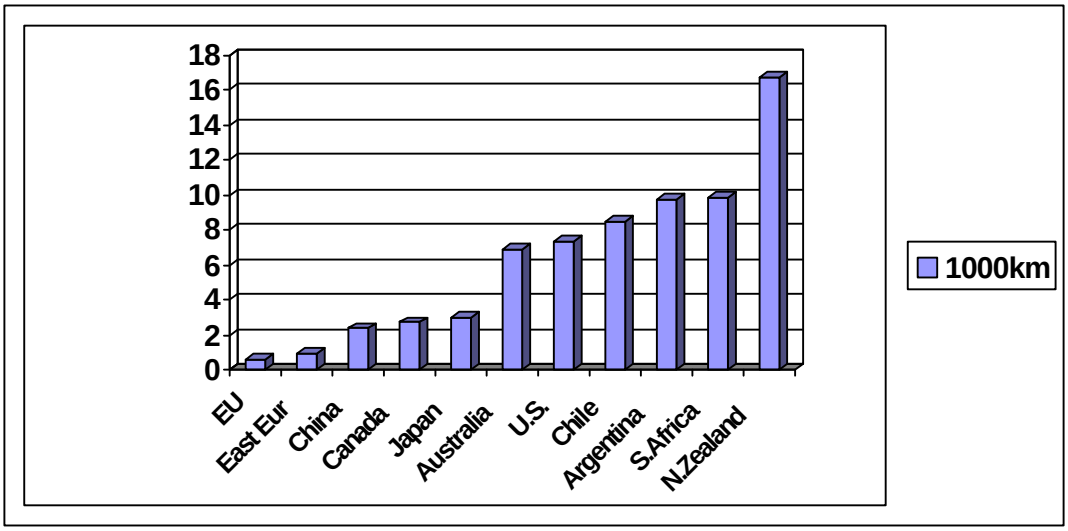
Shrinking Space and Time

The shrinking of space and time has been brought about by technological changes in communication, electronics and transportation. Some of the consequences for the fruit industry are that the traditional advantages of local suppliers over distant suppliers have been eroded. A retailer in Boston can see a load of apples being inspected before loading at Valparaiso, Chile. He can get an immediate print-out of quality parameters. Through global positioning system technology, he can track that load's movement up the Pacific Ocean, through the Panama Canal, along the Atlantic seaboard, being unloaded at Philadelphia and on its way by truck to Boston. The results of any inspections at his dock can be instantaneously transmitted to the shipper in Chile. With proper scheduling and seamless handoffs, Chilean fruit can be at the retail warehouse just in time to replenish retail store shelves in Boston. Information can also flow back to the Chilean exporter about what is happening in Bangkok, Birmingham or Boston so that he can change marketing plans accordingly.

Large investment flows can and do move around the world at the speed of light. In the fruit business, investments can flow into those producing regions that appear to have a temporary advantage in cost or quality. Once committed, those investments contribute to a long-term increase in production and marketing capacity but not, unfortunately, in demand.

Distance has not been totally conquered. For example, New England suppliers are probably on average 200-300 kilometers from most of their customers. In contrast, in the 1999-2000 season, major exporters such as Argentina, Chile and New Zealand were, on average, many thousands of kilometers from their export customers (figure 1). The biggest U.S. exporter, Washington State, is over 2,000 kilometers away from most U.S. markets and, on average, 7,300 kilometers away from its major export markets. New Zealand was, on average, almost 17,000 kilometers away from its major export markets.

Figure 1: Average Distances to Major Export Markets, 1999-2000
(1,000 kilometers)



This does give local suppliers a considerable cushion in competition with imports. For the last 20 years, declining real energy prices have weakened that cushion. However, the recent turnaround in energy prices should help local suppliers.

Changing Consumers

In the developed world, including North America, Western Europe, Japan and Oceania, the population is growing slowly and aging rapidly. The key apple buying households, couples with children, are shrinking as a share of the market. The younger generations have less interest in buying or consuming fresh apples. Income increases no longer lead to higher consumption.

In contrast, in much of the developing world, the population of young people and young households will continue to grow rapidly for several decades. When their incomes rise, they do tend to sharply increase their consumption of apples. In most cases, these apples have to be imported. When times are good, as they were in Asia for much of the 1980s and 1990s, apple imports zoom. However, the Asian economic crisis of 1997 and the related slumps in Russia, Eastern Europe and Latin America, seriously slowed apple imports. Between 1996 and 1999, world import demand for fresh apples fell over 20 percent. The volume of imports fell by only 4.5 percent, but the average price declined by 17.2 percent. For the last three years, we have had the ironic situation that the people in prosperous countries had little interest in buying more apples, while the people in developing countries that would have gladly bought more apples were suffering through recession.

The developing country recessions appear to be easing, and apple imports are starting to recover. However, the apple industry everywhere is recognizing that sluggish demand in the developed world is among its major ongoing challenges.

Increasing Competition

Competition for apples is becoming more intense. Within the apple industry, the World Apple Report (January 2001) forecasts that world apple production will grow a further 38.3 percent in this decade. Meantime, world population will grow by only 12.2 percent (UN, 1998). While the biggest increase in apple production will be in China, the increase in the rest of the world could exceed 7 million metric tons, or about 370 million 42-lb boxes, much bigger than current total U.S. apple production.

Production of major competing fruits and berries also expanded rapidly in the 1990s. While the rate of growth tailed off after 1997 because of adverse weather and declining prices, there is potential in the ground for further increases in supplies of competing fruits. In the developed world, there is rapidly growing demand for the more exotic fruits at the expense of traditional items like apples and pears.

However, the biggest competitive pressure for fresh apples is likely to come from the endless stream of snack items that tempt consumers. These range from candies to cookies to chips to fast food outlets at every corner. Many of these items are backed by huge promotional budgets and powerful marketing organizations. They are innovative and aggressive in ingredients, packaging, consumer appeal, incentive schemes, and niche development. Their motto is "Food is Fun," but they have also invaded the market for healthy snacks.

Power Accumulation by Retailers

Big food wholesalers and retailers have always been a challenge to apple marketers. However, in the second half of the 1990s, a spate of mergers led to fewer and fewer dominant players. The merger mania was one response to the invasion of the food retailing business by the world's largest discount chain, Wal-Mart (Larson, 1997). Wal-Mart saw the value of using food to generate store traffic for the more profitable non-food items that had been its staple. Wal-Mart was able to use its superior logistical systems and huge purchasing power to sell food at prices substantially lower than those of the traditional supermarket chains. To survive, the traditional chains tried to introduce various cost cutting and efficiency measures. When these were not enough, they were willing to give up their independence in hopes that the merged units could imitate Wal-Mart's purchasing power.

The jury is still out as to whether even this will be enough to save the surviving traditional supermarket chains. However, in the meantime, they have been squeezing suppliers to provide the same (or better) goods at a lower price, and to contribute additional slotting fees, promotional allowances, marketing services, etc. that can enhance the retailers' net margins. Many of these larger retailers believe that they can increase profitability by reducing the number of suppliers. This has set off a mad scramble among suppliers to get big enough through internal growth, merger or acquisition to qualify as a preferred supplier. It has created near panic among the smaller suppliers about whether there will be a role for them in the produce distribution system a decade hence. Many growers, in turn, have had to find new homes for their fruit as their marketers or packers have been absorbed or disappeared.

Consolidation at the retail level is not just an American trend. Companies like Wal-Mart, Ahold, Carrefour and Tesco are now expanding in many countries around the world. They are beginning to talk seriously about global sourcing of their needs. This is likely to come first in nonfoods, but could come relatively soon in major, standardized produce items like Fuji apples or D'Anjou pears.

Apple Industry Responses Around the World

In response to the changing global environment, the apple industry in many countries and regions is changing its perspectives. When I first began studying the apple industry in the 1970s, most regions and countries were self-centered in their policies and in their marketing strategies. Each producing area wanted to be known for its flagship variety, Washington Red Delicious, French Golden Delicious, New England McIntosh, South African Granny Smith. As most regions have introduced new varieties and the role of the flagship varieties has diminished, each region has tried to stretch its promotional dollars over more varieties. Many regions now want to be known for producing a portfolio of apples. It has become increasingly difficult for most regions to differentiate themselves.

New Zealand broke ranks first in trying to become known for a series of new varieties. By the time competitors were imitating its successful introductions, it aimed to have moved on to newer, better varieties. It sought to skim the cream off the world market for each new variety

before moving on. It became international-market driven. Few other regions were willing to jettison their established varieties as was New Zealand. Progressive nurseries, growers and marketers began to band together to set up multinational alliances or "clubs" to limit the supplies reaching the market and to coordinate promotion and marketing of specific varieties such as Delblush, Pink Lady or Cameo. These clubs would coexist with and be an additional cost to the established generic promotion programs.

While the New Zealand approach or the "marketing club" approach may secure premium prices for a small proportion of the industry, there is general acceptance that something must be done to revitalize demand for apples in the developed world and to tackle the overall problem of excess supplies. The Washington apple industry in 1998 approved a special three-year assessment of 15 cents per box for apple promotion in the U.S. The EU Commission has provided matching funds to member countries for apple promotion. The U.S. Apple Association has sponsored an initiative (so far unsuccessful) for a national generic promotional program for apples. The Southern Hemisphere Association of Fresh Fruit Exporters has been exploring what joint action member countries could take to better match supply with demand (Dall, 1999). In Fall 2000, some Southern Hemisphere countries teamed with a few Northern European countries to form the World Apple and Pear Association. They are trying to bring in the U.S. and China as members.

Crucial First Steps

In any step program to deal with a vice or addiction, the first, and often the hardest step, is to recognize the extent of the problem. For much of the apple industry, getting to that first step has been a prolonged affair. However, it does seem that the global apple industry has at last come to a consensus about what its problems are.

The next step is to agree on what can be done to improve the situation and how remedies can be financed in the present weakened state of the industry. For many firms and districts, time is not on their side. The pressures of continuing technological change, weak demand, strong competition and powerful distributors is not likely to diminish in the near future. Firms and districts that want to remain important players in the global market will have to get on the fast track for change or they will be washed away by outside forces.

References

Dall, Peter. "Deciduous Fruit Problems Global." Deciduous Fruit Grower, 49:11, 6-12, December 1999.

Larson, Ronald B. "Key Developments in the Food Distribution System." Univ. of Minnesota, Retail Food Industry Center, Working Paper 97-08.

___ World Population Prospects. The 1998 Revision. UN, Dept of Economic and Social Affairs, Geneva 1998.

___ "World Apples to 2010." World Apple Report, 8:1, 5-9, January 2001

HEALTH MARKETING: "AN APPLE A DAY" TAKES ON NEW MEANING

Julia Stewart Daly, Public Relations Director
U.S. Apple Association
6707 Old Dominion Drive, Suite 320, *McLean, VA* 22101

New research is reinforcing the adage " An apple a day keeps the doctor away." Meanwhile, consumers report they are increasingly health conscious, purchasing foods and products to prevent health problems. By coupling these two trends, our association hopes to boost consumers' nutritional image of apples and apple products.

The U.S. Apple Association (USApple) recent~vamped our public relations program to focus on promoting the health benefits of apples and apple products.

Making the Case for Apple Health Promotion

Why health promotion? Consumers are increasingly health conscious, they shop to prevent health problems, and they already understand the importance of fruits and vegetables to better health. In addition, health promotion sells products, as evidenced by the recent experiences of Cheerios, Heinz Ketchup and Calcium Tropicana, to name a few examples. However, consumers are confused about *what* to do to improve their health - creating a tremendous opportunity for the apple industry to fill that knowledge gap.

The apple industry has a great story to tell! Apples pack a number of important nutrients. For example, apples are one of the best available sources of dietary fiber, providing 5 grams per standard serving size (defined by the Food and Drug Administration as one medium apple weighing 154 grams, halfway between a 113- and 125-count apple). That's more fiber per serving than most grains and cereals. Further, apples contain both soluble and insoluble types of fiber, providing health benefits ranging from reducing cholesterol and promoting heart health, to maintaining digestive regularity and a healthy body weight.

Apples are also a rich source of phytonutrients ("plant-based nutrients"). Cornell University researchers recently reported that antioxidants found in apples and apple juice pack more cancer-fighting capability than a 1,500-milligram megadose of vitamin C. Flavonoids, a powerful antioxidant found in greatest volume in apples and onions, have been linked by Finnish researchers to reduced risk of heart disease and lung cancer . Apples and apple juice also contain potassium, which has been found to reduce the risk of stroke. Apples and apple juice are two of the best dietary sources of boron, a trace mineral that may reduce calcium loss and promote bone health.

Apples are also notable for what they *don't* contain -no fat, no cholesterol, and no sodium. These nutrients, when overeaten, can cause serious health problems, including obesity and heart disease.

USApple's Nutrition Research and Promotion Program

To encourage consumers to eat more apples for their better health, USApple is sponsoring new apple nutrition research and promoting apple health benefits messages. The health benefits messages are coupled with "how to" information that will help consumers actually change their dietary behavior -that is, to eat more apples and apple products. Examples of apple "how to" information include variety descriptions, storage and preparation tips, and recipes and other easy usage ideas.

Last year, USApple and its partner, the Processed Apples Institute, funded four new apple nutrition research projects. Two studies involve cardiovascular health, one involves cancer prevention, and the fourth relates to neurological health. These studies seek either to identify new apple health benefits, or to uncover the specific mechanism by which apple nutrients can protect against a certain disease. In addition, a cardiovascular research project recently

completed at the University of California-Davis is expected to be published sometime this year. By sponsoring new research projects, we hope to ensure that the apple industry has *new* health benefits news to report in the months and years to come.

Our promotion effort focuses on consumer "influencer" audiences including the media, and health educators such as dietitians and nutritionists. Media coverage of nutrition and health is increasing, and consumers report that newspapers and magazines are their *most frequent source* of health information. Meanwhile, consumers report that health professionals are the *source they most trust* for health information.

In 2000, USApple successfully raised the nutritional profile of apples through a range of activities, including conducting a media symposium attended by major media representatives, publicizing breaking research news such as the Cornell study and launching a healthy new holiday tradition with apples at its core: wishing Santa a healthy Christmas, with apples. As a result, USApple generated more than 200 million media "impressions" since Apri11999.

Promoting Apple Health Benefits Locally

Jump on the health bandwagon! Incorporate health promotion into your apple marketing program. Here are some tips for crafting health messages:

- **Keep it simple.** Convey research findings and health benefits in short, simple language, and include concrete health benefits. For example: "British researchers report that apples may reduce the risk of lung cancer among men who eat an apple a day."
- **Keep it positive.** Scaring consumers about potential health risks usually does not motivate them to purchase more healthy items.
- **Provide easy advice on what to do to achieve better health.** For example: "Want to lose weight? Snack on apples to satisfy your sweet tooth without adding to your waistline."
- **Differentiate apples from other "health foods."** Stress apples' particular nutrition power points, as well as their year-round availability and ease of storability. Apples are a better regular source of nutrients than foods with limited availability, or that spoil before they can be eaten.
- **Don't forget taste.** Above all, consumers want a tasty eating experience -and apples, in their multitude of varieties and flavors, provide just that.

To maximize your health promotion program, communicate consistently, repeatedly and through a range of activities and venues. Here are some suggestions:

- **At retail**: Promote apple nutrient content and health benefits on stickers and packaging, on point-of-sale signage, and in take-home brochures; tie into existing promotions, such as the "5 A Day -For Better Health" campaign; provide product samples; cross-merchandise apples with healthy tie-in products; and offer free recipes.
- **In the media**: Include apple health benefits messages and how-to information in your paid advertisements; provide breaking apple health news to your local news reporters; develop custom recipes for your newspaper's food editor.
- **In the community**: Team with your state's 5 A Day Coordinator or health organization to sponsor a local health event; partner with local employers to stuff coupons in paychecks; conduct school tours; provide local health educators with apple nutrition education materials.

"An Apple a Day" Takes on New Meaning

Now perhaps more than ever is the time to market the health benefits of apples. We have a great story to tell to a receptive consumer audience, with myriad avenues to tell our story -at retail, in the media, and in our local communities. To boost apples' nutritional profile, the apple industry must differentiate apples from other "health" foods and stress the flavor experience of

eating an apple. And above all, have fun doing it!

USApple: Reach for the Summit

The U.S. Apple Association (USApple) is the apple industry's only national trade association. USApple's mission is to provide the means for all segments of the U.S. apple industry to join in appropriate collective efforts to profitably produce and market apples and apple products.

The U.S. apple industry is facing a number of serious challenges, including stagnant domestic consumption, increasing competition from other produce items, retail consolidation and expanding global apple production. As a result, U.S. grower prices have been steadily declining since 1995.

These factors present our industry with a Mount Everest-sized challenge. Yet, even Mount Everest can be scaled with the right tools. USApple is seeking to maintain and enhance our current level of services in t areas, to ensure we remain an effective advocate for the U.S. apple industry. Our recent successes demonstrate the value we return to the industry, and make the case for increasing our funding.

Recent USApple government affairs priorities included resolving our antidumping case against unfairly-priced imports of Chinese apple juice concentrate, seeking federal programs to provide economic relief and enhanced risk management tools to growers, monitoring implementation of the Food Quality Protection Act (FQP A), and seeking H- 2A farm labor reform.

Imports of cheap Chinese apple juice concentrate flooded the United States between 1995 and 1998, increasing 1,200 percent. During that same time, juice apple prices fell from a national average of $153 per ton in 1995 to $57 a ton in 1998, costing U.S. apple growers an estimated $135 million in lost revenue. USApple filed the industry's trade case against China in mid-1999, which slowed these imports to a trickle. As a result, U.S. juice apple prices rose to a national average of $98 per ton, and growers received $49 million more for their 1999 juice apple crop than their 1998 crop. In May 2000, the U.S. government levied duties of 52 percent on most of these imports.

In 2000, USApple secured $100 million in market-loss assistance and $38 million in crop-loss assistance for U.S. apple growers. USApple also gained $200 million for federal surplus commodity purchases of fruits and vegetables including apples, to remove excess supplies from the market. USApple also achieved approval ora new $99 million federal low-interest loan program for apple producers, and gained a record $81 million in apple purchases for federal feeding programs including school lunches. USApple worked with the U .S. Department of Agriculture to overhaul that agency's apple crop insurance program, creating a new pilot program offering expanded quality coverage at lower premiums to most apple growers.

USApple estimates that our government affairs activities generated at least $332 million in grower funds, returning $1,045 for every dollar invested in USApple's government affairs program. We were successful because we aggressively promoted the industry's agenda in the halls of Congress, we recognized our allies by awarding them with the association's newly-created "Golden Apple Award," and we utilized our newly- formed Political Action Committee to support their re-election.

As previously noted, our recent public relations activities targeting media generated an estimated 200 million media impressions, generating $6 worth of positive media coverage (ad space equivalent) for every $1 invested in USApple's public relations program.

The U.S. apple industry faces a host of considerable challenges. The Chinese government recently petitioned the U.S. government to permit imports of fresh-market Fuji apples. In addition, ongoing FQP A implementation threatens to reduce our industry's access to effective and affordable crop protection tools. Finally, we are still striving to reform the current H-2A farm labor program to meet our industry's labor needs.

Yet even Mount Everest be scaled with the right team and the right tools. Last fall, USApple introduced a strategic plan to maintain an enhance our government affairs, nutrition

research and promotion, and crisis communications efforts on behalf of the entire industry. USApple dues were last increased in 1989, following the Alar crisis, to create USApple's government affairs program. Our industry is clearly facing another period of financial crisis. With additional funding, USApple will be able to maintain and enhance our efforts to correct the problems confronting our industry. Without additional funds, USApple's efforts in these critical areas will have to be cut back.

I encourage the industry to provide USApple with the tools we need to maintain our financial footing and to reach the much-needed next level of service to our industry. Please voice and vote your support for increased USApple funding when your group considers our association's proposal in the near future.

APPLE VARIETY SELECTION IN A GLOBAL ECONOMY

A. Desmond O'Rourke
Belrose, Inc., Pullman WA 99163

Introduction

Few decisions are more important for apple growers and for the packers and marketers they work with than when to plant a new variety, when to retain an established variety or when to throw an old favorite out of the ground and out of your program. The relatively rapid success in the last two decades of varieties like Jonagold and Elstar in Europe and Fuji and Gala in the U.S. has sent nurseries, growers and marketers into an almost frantic search for the next new "winning" variety. However, I would argue that such big "winners" are most unlikely to come along in the next two decades, and that the winning formulas in the future will be much more complicated than simply planting the right variety at the right time.

The Welcoming Markets of the 1980s

A number of unique circumstances existed in the 1980s that allowed new varieties to flourish. In the retail food sector, supermarkets saw profits in building ever-larger stores and in expanding high-margin sections such as produce. Many stores at that time carried only three or four varieties of apples, usually Red Delicious, Golden Delicious, McIntosh or Granny Smith. They were eager to add both new lines of apples and new and exotic fruits. Consumers were also growing in affluence and willing to try more types of fruit and more varieties and strains of each fruit. At the same time, there was a stable of well-tested apple varieties whose production could be expanded rapidly in favorable growing areas.

Granny Smith had been discovered in Australia in 1868 and had been a Southern Hemisphere staple for decades before it was popularized in Europe and North America in the 1980s (Norton and King, 1987). Elstar was first introduced in 1955. Fuji had been introduced in Japan in 1962 and become well established throughout Asia when the West discovered it. Jonagold had been introduced by the New York Agricultural Experiment Station in 1968 and undergone early testing in Europe two decades before it became widely accepted there. Gala had gone through many improvements since its release in New Zealand in 1960. These thoroughly-tested "new" varieties were a perfect fit for the new food retailing environment. Growers, retailers and consumers all benefited from their market entry.

Success of New Varieties

An annual survey of retailers conducted by the World Apple Report documents the wide acceptance that has been attained by many of the new varieties. Retailers are asked to rate each variety from 1=poor to 5=excellent. The nearer to 5 the average score, the better the variety's rating. In 1995, Red Delicious was still the top variety with a rating of 4.25 compared to a rating of 4.13 for McIntosh, 3.38 for Golden Delicious and 3.07 for Rome Beauty. Of the newer varieties, Gala did best with a rating of 4.20. However, other new varieties lagged far behind Gala. Retailers gave Fuji a rating of 3.53, Braeburn 3.36, Jonagold 3.57 and Empire 2.80. By the year 2000, the ratings of the traditional varieties had changed little, but the rating of Gala had risen to 4.56, while Fuji, Braeburn and Empire all had ratings above 4.00.

Each year, the survey also questioned retailers about their future stocking plans for each variety. Consistently, retailers planned to stock more Fuji, Gala, Braeburn and Jonagold apples. In the year 2000, they turned more positive on Empire. However, by the year 2000, over half planned to stock less Romes and about 10 percent planned to stock less Red Delicious, Golden Delicious and McIntosh. As the newer varieties have become more widely distributed and accepted they have begun to displace some of the more established varieties.

The era of ever-expanding shelf space for apple varieties is coming to an end. Retailers

are less and less willing to add another apple variety, even on a trial basis. The environment that facilitated the expansion of Gala and Fuji in the 1980s and 1990s no longer exists. From now on, a new variety will have to have a very special appeal to be adopted by retailers.

Too Much of a Good Thing

The long testing period for the Galas and the Fujis also made it easier for growers around the world to increase their plantings and production rapidly, and they have indeed done so. By my estimates, Gala was the fourth most widely produced variety in the world (excluding China) in the year 2000, behind Red Delicious, Golden Delicious and Granny Smith. If China was included, Fuji would be the third largest variety after Red Delicious and Golden Delicious. In the next decade, Gala and Fuji will push Granny Smith out of third place in the rest of the world. If China is included, Fuji will become the world's leading variety.

As supplies have increased, the premiums once enjoyed by these new varieties have disappeared. The outlook for the next decade is for greater supplies from many Southern and Northern Hemisphere producers on a twelve-month basis, so price pressures are not likely to weaken. The avalanche of Chinese Fujis will also be felt in more and more markets.

Rabbit out of a Hat

Many promoters still believe that with enough market insight, hard work and luck they can come up with the next Gala or Fuji. There is no shortage of contenders, varieties like Pink Lady® from Australia, Cameo from Washington State, Rubens from Italy, Pacific Rose from New Zealand, Honeycrisp from Minnesota. I have no doubt that each of these is an excellent apple. However, the welcoming market conditions which made Gala and Fuji such rapid successes no longer exist. Now newcomers must compete with not just three or four major varieties but with nine or ten. To get shelf space for a new variety, sellers may have to displace an existing variety, and to get consumer acceptance they may have to cannibalize their existing varieties. Recognizing this situation, many promoters are now looking at niche marketing rather than mass marketing of newer varieties.

Controlled Niche Marketing

In the future, a grower who wishes to plant new varieties will also have to accept many limitations and controls on his or her operation. These niche marketing attempts differ in many ways from the traditional mass marketing that has characterized the produce industry.

Mass Marketing versus Niche Marketing

ISSUE	MASS MARKETING	NICHE MARKETING
Plant ownership	Public	Private
Product appeal	Generic	Targeted Consumers
Price	Set by market	Premium Sought
Promotion	Regional (low fees)	Controlled (high fees)
Packaging	Anything Goes	Controlled
Supply/ Marketing	No limits	Strict Limits
Quality Standards	Public minimums	Agreed Targets

The promoters begin with the conviction that their variety offers special value to a given subset of consumers. However, they believe that to capture that value in a price premium, they must control the volume produced and marketed, they must maintain high quality standards appropriate to the variety, they must maintain uniform standards of product identification, packaging and promotion, and they must have their own credible promotional program. To do all this they must have plant protection and international partners to meet year-round market needs. They must be able to charge participants substantial fees for production and marketing. The grower commits to a program that is much more costly than traditional programs in the hope that the higher returns will more than offset the higher costs.

Clearly, this approach carries much higher risks than the traditional approach. If , for any reason, the premiums are not forthcoming, it may be difficult for these international alliances to hold together. Pink Lady® has successfully developed a premium niche in the British market. However, many analysts suspect that may be due to unusual factors in the British retail trade and unusual tastes and preferences among British consumers which will not be duplicated elsewhere. This will increase the need for promotional efforts to expand the market elsewhere. However, the more tightly supply is controlled, the higher the marketing fees per box must be to generate a given promotional budget. No one knows what the optimal balance of supply control and promotional fees might be for a new variety. Promoters will have to proceed by trial and error. And errors will be costly.

Managing Old Varieties Better

Retailer and consumer studies confirm that the existing apple varieties are generally acceptable. However, too often consumers are disappointed in the taste of their favorite apple. It may be immature, overripe, lack crunch or fail to provide the blend of sweet and tart taste that characterizes most good apples. A disappointed consumer is slower to make a repeat purchase and more likely to be attracted to another fruit. A variety's reputation is not writ in stone but is a work in progress. The apple industry needs to pay as much attention to maintaining or improving the reputation of the apples it traditionally has sold as the niche marketers intend to devote to creating the reputation of their new varieties.

Focus on Product, not Variety

We can all also learn from the niche marketers' approach to their markets. They are not trying to sell a variety as it comes out of the orchard and hope that it satisfies consumers. They are trying to develop a product that uniquely satisfies a certain segment of consumers. In their control of quality standards, their logo, packaging, sales agencies, their promotional messages, etc, they are trying to maintain their product's uniqueness.

Exactly the same marketing imperatives apply to keeping an existing variety profitable. The industry needs to re-examine what sort of product package it has developed for Red Delicious, McIntosh, Cortland, Empire, etc. It needs to know where it is succeeding with consumers and where it is failing, and then it needs to involve researchers, extension agents, growers, packers and marketers in helping to deliver a product nearer to the consumers' desire.

A Balanced Portfolio

Two years ago, Dr. Jim Schupp, then with the University of Maine, argued that because the introduction of a new apple variety involves a tremendous investment in time and money and added risk, growers in the north central and northeastern regions of the U.S. might be better to continue to concentrate on varieties that can not be grown elsewhere. When they do invest in a new variety, it should be just one part of their product portfolio.

I agree with Dr. Schupp. Producers should continue to seek out the new variety that has unique consumer appeal and that can be grown well in their own orchards. But, they should not bet the farm on any one new variety. The world apple market does not need another new variety.

However, the world apple market desperately needs to deliver all the products it offers in a way that makes consumers want to buy more apples. This may not be as glamorous or exciting a way to do business as trying to find the next “hot new variety”, but it is a more surefooted way of ensuring survival and profits.

References

Schupp, Jim. “Are established apple varieties becoming obsolete?” The Fruit Growers News, March 1999, 50-51.

Norton, Robert A. and Jacqueline King. Apple Cultivars for Puget Sound. Washington State University, Cooperative Extension, EB1436, September 1987.

___ “World Apples to 2010.” World Apple Report, 8:1, 5-9, January 2001

WEB-BASED INTERACTIVE ORCHARDING TOOLS

Jon Clements
Extension Tree Fruit Specialist
University of Massachusetts Horticultural Research Center
393 Sabin St., Belchertown, MA 01007
clements@umext.umass.edu

It's estimated that half the commercial and hobby fruit growers in New England today use a computer to access fruit production information on the Internet. Thus, in the past few years, numerous Internet resources of interest to fruit growers have been developed. Mostly, these web sites mirror existing publications, i.e. orchard production and crop protection guides, fact sheets, newsletters, etc. Good examples include the PennState Tree Fruit Production Guide <http://tfpg.cas.psu.edu/>, and Scaffolds Fruit Newsletter <http://www.nysaes.cornell.edu/ent/scaffolds/>.

Some web sites also include up-to-the date production and pest management information including diagnostic keys and pictures that significantly enhance print publications; a particularly good example is West Virginia University's Tree Fruit Research and Extension Center <http://www.caf.wvu.edu/kearneysville/>. A few web sites go even a step further by including web-based interactive orcharding tools that ought to be very useful to orchardists as we move into a new century of fruit growing.

First, why develop and deploy web-based orcharding tools? As mentioned, the trend is clear—more and more savvy fruit growers are equipping themselves with computers and using the Internet for information to help them be more productive and profitable orchardists. Soon, tapping the Internet for timely, comprehensive, and value-added fruit production information will be the norm. Clearly then, those who buck the trend will fall by the wayside as information providers (i.e., extension, industry, and the grower community itself) exploit the universal availability, easy development, and timely information delivery offered by the standards-based Internet. Bottom line: the Internet has become the communication and information delivery vehicle of choice for business conducted in this country today, and fruit growing should be no exception!

So, assuming that the Internet will be an integral part of every orchardist's day-to-day business, what's needed to join your peers on the Internet if you are not already there? It's really quite simple. First, you need a personal computer running either Windows or Macintosh Operating Systems (<http://www.microsoft.com/windows/> or <http://www.apple.com/software/> respectively). Second, you'll need an account and Internet connection provided by an Internet Service Provider (ISP). ISP's include America On-Line <http://www.aol.com> and Earthlink <http://www.earthlink.net>; or, for a list of local ISP's, check out 'The List' <http://www.thelist.com/ >. Finally, you need a web browser application. Popular web browsers include Microsoft's Internet Explorer <http://www.microsoft.com/windows/ie/default.htm> and Netscape's Communicator <http://home.netscape.com/computing/download/index.html>. That's it, that's all you need to take advantage of the Internet in your orchard business.

OK, you know that web-based interactive orcharding tools are worth checking into, and you now have an Internet-connected personal computer, so where can you find some real-world applications? Well, here are a few good examples of web-based interactive orcharding tools worth looking into:

Previously mentioned was the PennState Tree Fruit Production Guide <http://tfpg.cas.psu.edu/>. The Guide is an exemplary example of porting a print publication to the web. However, they have gone further to include several useful 'Javascript' Programs ('Javascript' is simply a programming language that works with your browser to actually 'do' something such as a calculation.) For example there is a 'JavaScript' Program for **Determining the Amount of Elemental Calcium in a Commercially Formulated Product**. Based on your input, you can

easily compare costs of different products based on calcium content, or determine the amount of product per acre needed. Another program is a utility for apple growers to help them **Calculate the Costs of Various Tree Support Systems**. Of course, these examples are tailored to Pennsylvania fruit growing conditions; however, they can easily be used for Northeast orchards with little (if any) modification or interpretation.

Apple Scion/Rootstock Selection and Planning for Michigan

<http://www.hrt.msu.edu/department/Perry/Apple_Articles/mispacingfinal1.htm> is a very helpful program for determining in- and across-row apple tree spacing based on user input. The grower enters several factors, including scion variety, rootstock, soil vigor class, irrigation presence or absence, and management intensity and planting system. The program quickly computes suggested tree-row width and between-tree distance within rows. Again, the calculations are tweaked for regional (Michigan) conditions; however, they ought to be applicable to most northeast orchards, too.

A Block-Specific Sprayer Calibration Worksheet

<http://www.umass.edu/fruitadvisor/clements/trvcalculator.html> on the UMass Fruit Advisor <http://www.umass.edu/fruitadvisor/> makes on-the-fly calculations of Dilute Gallons Per Acre based on Tree Row Volume. Furthermore, it makes quick work of determining sprayer output in Gallons Per Minute based on the Dilute GPA calculation, desired spray concentration, and tractor travel speed. Now you have no excuse for not making block-specific sprayer calibration calculations! Also on the UMass Fruit Advisor are a couple of calculators for **Predicting Scald Incidence in Delicious Apples** <http://www.umass.edu/fruitadvisor/clements/scaldpredictor.html>. All you need to input is harvest date, number of days below 50^0 F., and starch index at harvest. Using the calculator you can easily fine-tune your need (or lack of need!) for pre-storage DPA treatment of Northeast grown Delicious.

Glen Koehler's O**rchard Radar** site <http://pmo.umext.maine.edu/apple/applpage.htm>, hosted by the University of Maine Apple IPM Program, has been in the forefront of web-based orcharding tools for a number of years. Based on a commercial, site-specific weather product (E-Weather®, <http://www.skybit.com>) delivered by Internet e-mail, Orchard Radar "uses the data as input for apple pest management and horticulture models, and then uses the Internet again to distribute the model estimates to growers." During the growing season—and currently only for the University of Maine's Highmoor Farm—new web pages are generated daily that include: apple scab disease models (infection periods, fungicide timing, ascospore maturity); fireblight daily risk and symptom dates; flyspeck prevention and spray dates based on fungicide class; insect models (codling moth, leaf rollers and miners, leafhopper, san jose scale, etc.) that include emergence and activity based on degree day accumulations; insecticide residue depletion for plum curculio; European red mite key (emergence) and resampling dates; and storage scald–September chilling hour accumulation, among others. Orchard Radar's clear intention is to be a "supplementary" tool for decision making, and at this point is only applicable to orchards near Highmoor Farm in Maine. However, it's destined to be a preview of both the 'cutting edge' present and the future of enhanced IPM information delivery and interpretation.

So, get on-line (be there or be square!) and check out these web sites with interactive orcharding tools. Be sure to contact the author/developer if you have any feedback, usability problems, or perhaps a suggestion for another useful tool that could be deployed on the web. Remember, change in the fruit industry is happening at an unprecedented rate, and you can bet the web will play a far greater and more useful role in the future of orcharding.

FACTORS AFFECTING FRUIT SET IN PEAR

Renae E. Moran
University of Maine
rmoran@umext.maine.edu

As with apple, fruit set of pear can be low and unpredictable. Many factors are involved in determining how many fruit will set and these include the weather, bloom date, pollinator activity, flower attractiveness, pollinizer choice, tree health and nutrition, and light penetration into the tree canopy. Poor set results when any of these factors is less than favorable. Understanding how each of these factors contributes to fruit set can remove some of the unpredictability.

How much fruit is needed for a good sized crop load? A good level of fruit set is 30 fruit for every 100 flower clusters when bloom is heavy. More than this is needed when bloom is light. Another way to measure set is on a limb cross-sectional area basis. When there is one fruit for every cm^2 limb cross-sectional area, crop load is light. A moderate crop load has 2-3 fruit per cm^2 limb cross-sectional area and a heavy one has 4-5 fruit per cm^2 limb cross-sectional area. To measure fruit set, tag a limb at bloom and count the number of flower clusters. After June drop, count the number of fruit on the same limb. Also count the number of seeds per fruit in several fruit. A seed count of 4-5 per fruit indicates good set. Less than two per fruit indicates poor pollination. When fruit set and seed count are greater next to pollinizers, poor set is most likely due to pollination problems. When set is uniformly low throughout the orchard, non-pollination factors such as deficient N or Zn, or winter injury, may be the cause.

Early Bloom and Temperature

Because pears bloom earlier than apples, weather during bloom is typically more unfavorable for pollination. Temperatures are generally cooler during pear bloom. As a consequence, bee activity may not be enough for adequate set. Honey bees are not active when temperature is below 50°F, so hives should be protected from wind, but in the sun so that they warm up quickly. Small orchards near uncultivated land may have plenty of feral bees, but populations vary from year to year making them unpredictable. Large orchards or orchards with no feral bees should have at least one strong hive per acre in the orchard during bloom. High populations of bees increase the size of the bee's working area which improves the chance of cross pollination.

Fertilization is also favored by warmer temperature. Once pollen is transferred to the flower, it must germinate and grow through the style of the flower to reach the ovule where fertilization takes place. This happens very slowly when the temperature is cold. At 40°F, it takes 12 days, but at 60°F, it happens in two days. This is important because the ovule will live an average of 11 days after the flower opens. So, at cold temperatures, the ovule will die before the pollen tube reaches it, so there is no fertilization.

Flower Attractiveness

Pear flowers are not very attractive to nectar-collecting bees. This is because their nectar is lower in sugar than that of flowers of many other plants. Consequently, pollination depends on pollen-collecting bees.

Pollinizer Trees

Pears are self-sterile, like apples, so they require cross pollination with another variety. In some instances, parthenocarpic (seedless) fruit set occurs without pollination. This occurs when the average temperature during bloom is 70-85°F. These temperatures do not normally occur in New England during pear bloom, so parthenocarpic fruit set does not normally occur. Pollinizer trees are required for good-sized crops.

When selecting a pollinizer variety, it is important to be aware of two problems: varieties that have sterile pollen, and incompatibility. Two varieties that are known to be sterile are Magness and Waite. They are useless as pollinizer trees. In addition, Bartlett and Seckel are incompatible and will not be pollinated by each other. They will pollinate other varieties, however. In addition, varieties that bloom at the same time should be used so that pollen is available when flowers are open.

In regions where bad weather occurs frequently during bloom, close spacings of pollinizer trees can increase set. A recommended spacing is making every third tree in every third row a pollinizer tree.

Nutrition

All essential nutrients are important to fruit set when they limit tree health, but N, B, Zn and Cu deficiencies appear to be the most important when it comes to fruit set. Boron deficiency lowers fruit set since it is essential for pollen growth. Zinc deficiency interferes with normal bud development and leads to poor flowering. The role of copper in fruit set is not clear, but is essential for all energy-requiring processes. Both flower and fruit growth are energy-requiring processes and this may be why Cu is involved in fruit set. Deficient levels of nitrogen reduce the life span of ovules so there is a greater chance that they will die before being fertilized, particularly when it is cold during bloom.

Pears require nitrogen every year, but the amount to be added depends somewhat on how much N is already in the soil. Infertile soils can supply 30 lbs. actual N/acre to pear trees, so 30 lbs/acre actual N should be applied to pear trees growing on them. Soils that supply 50 lbs/acre should have 20 more lbs/acre added. Soils that supply 65 lbs/acre should have 10 lbs/acre added. Soils that supply 80 lbs/acre should have 3 lbs/acre added. The amount of N in soil is somewhat related to the amount of organic matter. In general, for each percent of organic matter present in soil, there is a supply of 20 lbs N/acre. Soils with more than 4% organic matter need little or no added N. Deficiencies or excesses of N, as measured by foliar analysis, will alter the amount of N that should be added.

Foliar levels that should be maintained are similar to levels recommended for apple. A N level below 2.6% is recommended due to pear's susceptibility to fireblight. The ratio of N/K should be near 1.2, but not above 1.4 in orchards with shoot blight problems.

Optimum Foliar Levels of Nutrients for Pear (From Shear and Faust, 1980).	
Nutrient	Sufficiency Range
N	1.8 - 2.6%
P	0.12 - 0.25%
K	1.0 - 2.0%
Ca	1.0 - 3.7%
Mg	0.25 - 0.90%
B	20 - 60 ppm
Mn	20 - 170 ppm
Zn	20 - 60 ppm
Fe	100 - 800 ppm
Cu	6 - 25 ppm

Crop Load

This year's crop load can influence next year's in two ways. Heavy crops lead to a hormone imbalance that causes biennial bearing. Pear is biennial for the same reason as apple. Seeds release a hormone, gibberellin, that moves into buds and prevents them from forming flowers, so they remain vegetative. With a heavy crop there is more of this hormone moving into buds, so fewer of them develop flowers. The other way a heavy crop reduces fruit set is by depletion of stored carbohydrates and nutrients. This weakens the tree and leaves less resources available for early fruit growth. Since there is only a very small leaf canopy present at bloom, early flower and fruit growth depend on stored nutrients until the leaf canopy develops.

Light Penetration into the Tree Canopy

Sufficient fruit set depends on an adequate supply of light. About 60% of full sun is needed for maximum fruit set. Areas of the tree canopy that are shaded by other limbs generally have poor set. Light penetration is maintained by annual pruning of unproductive shoots and limbs, and by avoiding pruning cuts that overstimulate regrowth. Dwarfing rootstocks improve light, but the ones that are available are not well tested in New England growing conditions.

Mite Damage

A heavy mite infestation can lower next year's fruit set for the same reason that heavy crops and excessive shading do. They weaken the tree and reduce stored reserves. Mites damage leaves, which decreases photosynthesis. When heavy mite damage occurs early in the season, it does more damage to the tree than when it occurs later.

Summary

Some of the factors that influence fruit set, such as the weather, are beyond our control. However, several factors are within our control and can be managed to promote fruit set. Bringing in enough bee hives and good selection of pollinizer trees can favor pollination. Managing tree nutrition, pruning to maintain light and controlling the level of insect damage to foliage are practices improve tree health and favor fruit retention.

LEAF SPOTTING: CAUSES AND SOLUTIONS

David A. Rosenberger
Cornell University's Hudson Valley Lab
PO Box 727, Highland, NY 12661

Introduction

Leaf spots on apples can be caused by fungal pathogens, air pollution, viruses, or injury from pesticides or foliar nutrients. Determining the causes of leaf spots is often difficult because the spotting caused by different pathogens or injuries looks very much alike. In some cases, leaf spots develop as a result of interactions among multiple factors, any one of which would not cause leaf spotting on its own. Following is a brief description of the most common causes of leaf spotting in apples in the Northeast, along with comments on how to minimize damage from leaf spotting.

Leaf Spots Caused by Fungi

Many fungi can cause spots on apple leaves. Apple scab, cedar apple rust, hawthorn rust, and powdery mildew cause spots on leaves although they are not usually classified as "leaf-spotting fungi." Frog-eye leaf spot caused by Botryosphaeria obtusa exemplifies the more stereotypical leaf spot disease in that its nondescript brown leaf spots are very similar to those caused by many other fungi and by non-pathogenic agents that damage leaf tissue.

Frog-eye leaf spots are usually round dark brown spots, 2-5 mm in diameter, with an almost black border and a tan center. The leaf spots become irregular in shape as they age because of irregular growth at the lesion margins and secondary invasion by other pathogens. Individual leaves may have a single spot or as many as 30 to 50 spots.

In sprayed orchards, frog-eye leaf spots are usually concentrated in the vicinity of mummified fruitlets that were retained after fruit thinning the previous year or beneath twigs and branches that were killed by fire blight during the previous season. Fruitlet mummies and blight-killed wood are rapidly colonized by B. obtusa and then provide inoculum for infecting the leaves the following season. Spores are dispersed by splashing rain during extended wetting periods from about tight cluster through second cover. Frog-eye leaf spot can usually be differentiated from other kinds of leaf spots by its non-random distribution and its association with nearby inoculum sources.

Frog-eye leaf spot is most common on apple cultivars that retain fruitlets after chemical thinning. These include Cortland, Northern Spy, and Honeycrisp, among others. However, all cultivars may retain thinned fruit in years when weather conditions following fruit thinning fail to promote rapid abscission of thinned fruitlets.

Severe frog-eye leaf spot may cause some premature leaf drop, but most infections cause little more than cosmetic damage to the foliage. The same fungus that causes frog-eye leaf spot also causes black rot fruit decay, but there is no evidence that leaf spots contribute to fruit infection. Instead, the inoculum for fruit infection comes from the same fruit mummies and blighted wood that contributes the inoculum for leaf infection. Thus, frog-eye on leaves can be viewed as an indicator for conditions that may have favored infection of fruit, but the leaves themselves do not contribute directly to the development of black rot on fruit. Black rot infections in fruit may remain quiescent until fruit ripen because green fruit contain inhibitors that prevent fungal growth.

Frog-eye leaf spot is easily controlled by including captan, Flint, Sovran, Benlate, or Topsin M in scab control programs, although Benlate and Topsin M are no longer recommended for scab control because many orchards contain scab strains that are resistant to these fungicides. The SI fungicides do not provide good control of frog-eye leaf spot. Polyram, thiram, and the mancozeb fungicides provide adequate control of frog-eye when applied at rates of 6-8 lb/A, but they are only marginally effective at 3 lb/A.

Apple scab, rust diseases, and powdery mildew may cause obscure leaf spots when their normal symptom development is arrested by fungicides. Syllit, Benlate, and Topsin M were used for many years to arrest apple scab epidemics because these fungicides could stop fungal growth and/or spore production in developing lesions. Scab spots arrested by these fungicides were often a rusty, red-brown color instead of the typical olive-brown of normal scab lesions, but these spots were still recognizable as apple scab because they were still the usual size and shape of normal scab spots.

The SI fungicides (Rubigan, Nova, and Procure) and the strobilurin fungicides (Sovran and Flint) can arrest development of apple scab earlier in the infection process. When these fungicides are applied more than 96 hours after the start of a wetting period, only "ghost lesions" or other aberrant scab spots may develop on leaves. Ghost lesions are indistinct pale spots 2-3 mm in diameter that develop where the scab fungus disrupted normal cell functions before the fungus was arrested by the fungicide.

Post-infection application of the SIs and strobilurins can also cause "burned out" mildew and rust spots on leaves. Mildew lesions arrested by fungicides may appear as large but indistinct chlorotic lesions on the upper leaf surface or as more sharply-defined red blotches on the lower surface of leaves. Portions of the leaf compromised by mildew may be more susceptible to subsequent invasion by other leaf spotting pathogens.

Rust infections arrested by the SI fungicides often produce small 1-2 mm diameter tan or brown leaf spots, sometimes with a tiny orange fleck in the center of the leaf spot. Similar lesions can appear on McIntosh, Liberty, and other rust-resistant cultivars if trees are subjected to high levels of rust inoculum in the absence of fungicide protection. On the rust-resistant cultivars, fungal development is arrested by the genetic resistance of the host, but leaf cells damaged by the initial infection still die and produce leaf spots similar to those that occur when rust infections on susceptible cultivars are arrested by fungicides.

Rust-induced leaf spots develop when fungi such as Botryosphaeria, Alternaria, or Phomopsis invade cells killed or damaged by failed rust infections. These fungi move from the dead or dying cells to adjacent healthy tissue, thereby enlarging the leaf spots until they are indistinguishable from frog-eye leaf spots. Thus, trees of rust-resistant cultivars such as McIntosh may suddenly develop what appears to be a severe outbreak of frog-eye leaf spot when the infection was actually initiated by cedar apple rust spores attacking a non-susceptible host. However, rust-induced leaf spots are usually uniformly distributed throughout tree canopies, whereas frog-eye leaf spots are clustered near inoculum sources. Sometime the original orange-yellow rust lesion remains visible in the center of rust induced leaf spots whereas frog-eye leaf spots never have orange centers.

Rust-induced leaf spotting is most common on terminal leaves that develop during the spring growth flush between petal fall and second cover, but it can also occur on cluster leaves. Rust-induced leaf spotting can be prevented by protecting trees from rust infections during the interval between tight cluster and second cover. Captan, Syllit, Benlate, and Topsin M do not control rust diseases. Flint and Sovran have only marginal rust activity. The SIs and carbamate fungicides (mancozeb, Polyram, Ferbam, and Thiram) are very effective against rust diseases.

Alternaria leaf spot looks very similar to frog-eye leaf spot. Alternaria can be isolated from leaf spots in many orchards, especially in late summer, but Alternaria leaf spot is not known to cause economic damages in the northeast. In North Carolina and Virginia, a severe form of Alternaria leaf spot known as Alternaria blotch spreads rapidly during summer and causes premature defoliation of affected trees. Delicious is particularly susceptible. The strain of Alternaria mali that causes defoliation in the southeast may be different from the common Alternaria mali present in northeastern orchards.

During the past 20 years, I have encountered three cases where an unknown leaf spot caused extensive late-summer defoliation to apple trees in "hot spots" within managed orchards. In all three situations, the leaf spotting affected multiple cultivars including cultivars that have been reported as relatively resistant to Alternaria blotch. In all three cases, an Alternaria species was isolated from the leaf spots, but we never proved that Alternaria actually caused the defoliation. Alternaria is common on leaf surfaces and rapidly invades damaged tissue on leaves, so proving the cause-and-effect relationship is especially important when attempting to

separate cases where Alternaria causes leaf spots from those where Alternaria only acted as a secondary invader. Lacking evidence to the contrary, we believe that Alternaria leaf spot remains an insignificant problem in the northeastern United States. None of our fungicides is very effective for preventing Alternaria leaf spot or Alternaria blotch.

Other fungi that can cause apple leaf spots in the Northeast include Phoma pomorum, the cause of Phoma leaf and fruit spot, Phyllosticta solitaria, the cause of apple blotch, Colletotrichum gloeosporioides, cause of apple bitter rot, and Phomopsis mali, the cause of Phomopsis canker and Phomopsis fruit decay. None of these fungi is an important cause of leaf spotting in commercial orchards in the northeast.

Leaf Spots Caused by Spray Injury

Many pesticides can injure leaves if the pesticides are applied at inappropriate rates, under unusual environmental conditions, or in untested mixtures with other pesticides. It is impossible to list all of the potential materials or mixtures that might cause phytotoxicity because no one can evaluate all of the combinations that fruit growers might mix in a spray tank or duplicate all of the host and environmental conditions that occur in orchards. However, some of the more common culprits or phytotoxicity should be mentioned.

Captan is a potent fungicide on leaf surfaces, but captan is phytotoxic when it moves inside leaves or fruit. Most growers know that captan, if applied within 7 to 10 days of an oil spray, can cause severe leaf spotting, especially on Delicious. This captan-induced leaf spotting occurs because oil deposits on leaves carry captan into the leaf cells. Captan penetrates leaves more easily when leaves have developed under extended periods of cloudy weather because sunlight and dry conditions are required to stimulate development of thick cuticle layers that prevent captan from reaching leaf cells.

Captan-injury can also occur when captan is tank mixed with other products that are formulated with special wetting agents or penetrants. The captan label specifically states “The use of spreaders that cause excessive wetting is not advised.” In 1998, liquid calcium chloride products that were tank-mixed with captan caused extensive injury on Empire fruit in the Hudson Valley. The calcium chloride was formulated to optimize absorption, but the adjuvants in calcium formulation also allowed captan to pass through the fruit cuticle.

Over the past 20 years, I have seen cases of leaf spotting that have been traced to applications of various other pesticides including Sevin XLR, Lorsban, and Asana. In some cases, these products had been applied in mixtures with captan whereas other cases involved other pesticides. None of these incidents resulted in serious leaf damage, and they are cited here only to illustrate that many different pesticides may cause phytotoxic leaf spotting under certain conditions.

Among the new fungicides, note that the Flint label contains the following warning: “Do not apply Flint in combination with organo-silicate surfactants to apples or pears or crop injury may occur.” I have not yet seen any injury from Flint, but label warnings should be heeded.

Another strobilurin fungicide, azoxystrobin, is extremely phytotoxic to McIntosh, Gala, and a few other apple cultivars. Concentrations of azoxystrobin as low as 5 parts per billion have been reported to cause a leaf spotting on McIntosh that is indistinguishable from frog-eye leaf spot. Higher concentrations will cause damage similar to that observed with paraquat. Azoxystrobin is labeled as “Abound” for use on grapes and stone fruits and as “Quadris” for use on corn, soybeans, small grains, vegetables, and Christmas trees. The large number of labeled uses for azoxystrobin raises the probability that apple growers in the northeast will experience occasional problems due to off-site drift of azoxystrobin. Azoxystrobin injury due to off-site drift should be easy to diagnose because the leaf spotting will appear suddenly, will be evenly distributed throughout the canopy, and will occur only on McIntosh, Gala, and a few other Mac-related cultivars whereas adjacent cultivars will be completely unaffected. The latter is the most distinguishing characteristic because no other pesticide or fungal pathogen that might cause leaf spotting on apples is so distinctly delimited by cultivar.

Leaf Spots Caused by Air Pollution

Air pollutants can cause or contribute to leaf spotting diseases in several ways. In one incident that I witnessed in the Hudson Valley, oily particulates ejected from an electrical power plant smoke stack caused severe leaf spotting on leaves and fruit in orchards within several miles of the plant. The cause of the leaf spotting was never fully proven, although we later learned that it could have been proven had we collected fresh samples for chemical analyses by regulatory agencies. Rather, the cause of this leaf-spotting incident was deduced from the limited locale in which it occurred and from the observation that similar spotting also occurred in leaves in adjacent wood lots and shade trees.

A more common air pollutant that contributes to leaf spotting is ozone. Ozone injury appears as irregular purple mottling on the lower surface of apple leaves. It may sometimes be confused with symptoms typically associated with aging mildew lesions. Ozone injury occurs most commonly during late summer and is usually found on the bottom sides of cupped leaves that are positioned in such a way that a portion of the lower leaf surface faces upwards. The economic importance of ozone injury on apples is not known, but leaves compromised by ozone injury may be more prone to infection by weak fungal pathogens that cause late-season leaf spotting.

Leaf Spots Caused by Virus Diseases

Apple mosaic virus can cause a yellow mottling or spotting on leaves of apple trees that carry this “latent virus.” Apple mosaic spreads only via infected propagation material. It is present in many trees planted before the mid 1970’s and in some later plantings that were derived from non-certified stock. Infected trees often show symptoms only in years with a cool, prolonged spring. Thus, trees may remain symptomless for many years, then one year they may suddenly develop distinct yellow mottling on leaves during early June. There is no cure for affected trees and no danger that the virus will spread to adjacent trees. Apart from the occasional flush of leaf symptoms, the virus has no visible effect on tree health.

Leaf Spots from Unknown Causes

Necrotic leaf blotch is a disease that occurs primarily on Golden Delicious trees. Leaves develop irregular brown spots that may encompass 10-20% of the individual leaf surface. The first symptoms usually appear in early August. Affected leaves soon turn yellow and drop from the tree. Affected trees may lose more than 50% of their leaves during August and early September, and the yellowing of the affected leaves makes this a very noticeable disease. Although necrotic leaf blotch does not cause fruit drop or fruit blemishes, it may have adverse effects on fruit size and quality.

Dr. Turner Sutton in North Carolina studied necrotic leaf blotch in the early 1970’s, but he was unable to identify the cause of the disease. Sutton showed that the disorder is not caused by a fungus, bacterium, or air pollution and that it is not related to foliar nutrient levels. Symptoms and subsequent leaf drop frequently occur in distinct "waves" in mid to late summer. In controlled environment tests, Sutton showed that the disorder failed to develop on leaves of trees held at 86/79/F. day/night temperatures, whereas 33% of leaves on trees held at 79/72 or 72/64 day/night temperatures developed leaf blotch. He also showed that potted trees watered every day had roughly three times more leaves affected than did similar trees watered only every second or third day. The results suggest that necrotic leaf blotch is favored by relatively cool, wet weather in late summer.

Sutton found that mancozeb fungicides applied during summer suppressed necrotic leaf blotch whereas Captan, Benlate, and Topsin M were ineffective. Mancozeb fungicides can no longer be applied during summer, so there is currently no fungicide program available for reducing the severity of this disorder.

Late-season leaf spotting is a term used to describe nondescript small (1-3 mm diameter) leaf spots that become apparent in unsprayed or poorly sprayed orchards during late summer. In one study at the Hudson Valley Lab, late-season leaf spotting developed during September on Liberty trees that were left unsprayed throughout summer whereas trees that received summer fungicides did not develop leaf spots. Unsprayed trees defoliated 15 days earlier in October and had weaker flower buds the following spring. Isolations made from the leaf spots on unsprayed Liberty trees yielded a variety of obscure fungi, and the cause of the late-season leaf spotting remains unknown.

Since this study, similar late-season leaf spotting has been noted in various commercial orchards, especially where summer fungicide programs were terminated early. Late-season leaf spotting can degrade foliage quality in autumn, but further study is required to determine both the cause(s) of this disease and its economic importance.

Conclusions

With the exception of well-known leaf diseases like apple scab, powdery mildew and rust, most leaf spotting diseases of apple that occur in northeastern United States cause little if any direct economic damage. Causes of leaf spots can sometimes be deduced from disease patterns within the orchard, the time of symptom appearance, and characteristics of the individual leaf spots. However, causes for many leaf spot outbreaks cannot be easily determined. Where phytotoxicity from pesticide sprays or foliar nutrients is a probable cause, growers should carefully note the mixtures, spray conditions, and stage of host growth so that similar injury can be avoided in the future.

SUGGESTIONS FOR THE USE OF APOGEE™ FOR VEGETATIVE GROWTH CONTROL AND FOR SHOOT FIRE BLIGHT SUPPRESSION

George M. Greene II
Department of Horticulture
The Pennsylvania State University
Fruit Research and Extension Center
Biglerville, PA 17307

Introduction

There are many factors that affect the vegetative vigor of fruit trees. Many of these are fixed at planting time while others are under the control of the grower to a greater or lesser extent. Some of these factors are soil type, variety, strain, rootstock, nutrition, training system, dormant and summer pruning, crop load and availability of water. Some of these may or may not be under grower control. However, the degree of control varies and may fluctuate not only from season to season but also during the season. Excessive vigor is deleterious in several ways including reduction in fruit quality, reduction in fruit quantity and an increase in pruning expenses. In addition, excessive vigor can directly and indirectly result in both an increased level of diseases and pests or an increased use of pesticides to control these pests. On the other hand, orchards that have a good balance between vegetative growth and fruit production can have minimal production costs per unit of fruit. However, prior to the arrival of Apogee®, growers have not had a rapid, easily used technique to reduce excessive vigor in trees.

Apogee® Research

The growth regulator Apogee™ became available for commercial use in 2000. This material has the ability to inhibit the production of active forms of gibberillic acid. Some other growth regulators can also interfere with this process but none have been labeled for food crops. Extensive research has been done on Apogee™ by several eastern pomologists including: Duane Greene, Univ. of Mass., Terrence Robinson, Cornell University, NY, Steve Miller, USDA Lab in WV, Ross Byers at VPI & SU in VA, Dick Unrath at North Carolina State University, and the author. These researchers have met annually to assess results and plan further research. It soon became obvious that several factors influenced the ability of Apogee® to control vegetative growth. One of these appeared to be the latitude of the orchard or the length of growing season of the orchard. Early in the research it appeared that more northern areas with a shorter season may need one or two sprays while more southern areas, with a longer growing season, may need lower rates but may need up to 8 or 10 applications. One overriding fact became obvious from the Apogee® research. That is, where sufficient material was applied in an appropriate manner for a long enough period, growth control was nearly assured. This is in contrast to the use of many other PGRs that can be quite variable in their response.

Benefits of Apogee® Use

The benefits that may be accrued from the use of Apogee™ include the following:

1) increased fruit color due to better light penetration of the more open canopy
2) increased productivity due to higher vigor buds inside the tree canopy
3) reduced pruning costs due to reduced shoot growth
4) reduced disease and insect control costs due to a reduced tree row volume
5) reduced fire blight in shoots due to shorter period of terminal growth
6) reduced disease control costs due to due to shorter period of terminal growth

7) reduced insect control due to shorter period of terminal growth

Some of these benefits have been documented through research and others may be only the opinion of experienced pomologists.

Pennsylvania Apogee® Recommendations

Recommendations for the use of Apogee™ vary depending on all the variables mentioned earlier, especially the latitude, inherent vigor in the block, variety, crop load and amount of rainfall. Under south central PA conditions it appears that the rates and timing shown in Table 1 should be adequate to result in good vigor control. In situations where there is abundant rainfall during the summer, especially where the crop is light, applications in July may be needed to give season long control. Fresh market growers that may accrue both reduced pruning costs and increased income from enhanced fruit quality may be the most likely to use Apogee®. Fresh market orchard blocks that have high yields per acre and that have a fruit quality problem that Apogee® may impact will likely be the orchards where Apogee® will be used first. On the other hand, processing apple growers that will not see an increase in income based on enhanced fruit quality may be more hesitant to use Apogee®. Of course, both fresh market and processing orchards may gain the disease and insect control benefits alluded to earlier.

Table 1. Suggested rate and timing scenarios to control excessive shoot growth in apples with Apogee®.

	Application timing and rate (rate in oz. per 100 gallons)[z]				
Tree vigor level	1-3 inches of terminal growth	+10-14 days	+10-14 days	+10-14 days	+10-14 days
Medium 1	5	3	3		
Medium 2	5	4	4		
High 1	6	5	4		
High 2	6	5	4	3	
Very high 1	7	4	5	4	
Very high 2	7	6	5	4	3
Crop loss 1	8	6	5	4	3
Crop loss 2	8	7	6	5	4

[z] To calculate the amount to apply per acre multiply these rates by the tree row volume of that orchard.

The per acre rate for an orchard with a 300 gallon tree row volume would vary from about 1/2 to 1 1/2 pounds per acre based on these dilute rates in oz. per 100 gallons.

Suppression of Shoot Fire Blight

Several researchers (Hickey in PA, Yoder in VA and Jones in MI) have successfully demonstrated a reduction in the incidence and/or severity of shoot fire blight. Although there has been some difference of opinion on the rate necessary to give good control it appears that two sprays at 6.0 oz/100 gallons, dilute equivalent, applied at the per acre rate based on the tree volume should give a significant reduction in the incidence and severity of fire blight in shoots. It appears that Apogee® needs to be applied 7-10 days ahead of the fire blight infection to be effective. Details to be worked out include the length of time that Apogee® reduces fire blight infections. Apogee™ does not appear to be effective on blossom blight control since this type of blight normally occurs prior to the application of Apogee®.

AN UPDATE ON PLUM POX

George M. Greene II
Department of Horticulture
The Pennsylvania State University
Fruit Research and Extension Center
Biglerville, PA 17307

Introduction

Plum pox (PPV) is a virus disease that is causing much interest in North America since it was discovered in PA in 1999. It is a disease that was first discovered in the Balkans around 1915. By 1984 it had spread to many places in Europe and to India. By 1922 it had been eradicated in a few places but had also spread to Chile. In the fall of 1999 it was identified in one localized area of Adams County, Pennsylvania. Unfortunately, fruit symptoms had been seen for two years prior to that but local experts were unable to identify this disorder.

PPV Strains, Symptoms and Spread

PPV has several strains including M, D, E, A and C. These strains can be quite variable in the species that they attack and in the symptoms that are produced in the susceptible plants. In addition, symptoms can vary from cultivar to cultivar, some having distinct flower coloration, some having distinct fruit symptoms, but others having no symptoms at all. Strain D of PPV was originally found in southern France in apricots. It is the only strain that is found in the U. S., Canada, and Chile and it is not seed transmitted. It can infect peaches, plums, apricots, and nectarines, but not cherries. Fortunately, this strain is not very aggressive. In contrast, the M (Marcus) strain is the most aggressive strain in peaches and was originally found in northern Greece. It is the strain that is most easily vectored and it is believed to be seed transmitted although that information is controversial. Plum pox can be spread by mechanical means through propagation materials or by natural spread since several aphids vector this virus. Some strains are seed borne. Aphid transmission is possible when an aphid acquires the virus during feeding probes. The aphid can then transmit the virus for up to one hour but since the virus is not systemic in the aphid the virus dies after about one hour. It is thought that aphids can travel from 100 to 120 meters before the virus dies. Most aphids that transmit viruses do not have peach or *Prunus* as a preferred host so these aphids often skip many trees before landing and making another feeding probe. This tends to limit the spread of the virus and makes control easier.

Control Strategies

Plum pox control strategies can be prevention, eradication or management as noted below:

Prevention
- Rigorous inspection at all ports of entry
- Public education for those in industry
- Some surveillance
- Nursery certification programs

Eradication
- Index and destroy infected material
- Establish quarantine zone
- Establish moratorium for planting *Prunus*
- Certify quality propagative materials
- Perform regular surveys of orchards and nurseries

Management

Certify quality propagative materials
Develop cultivars resistant to the virus
Survey regularly to detect plants in earliest stages of infection
Immediately destroy infected plants
Control vector populations

In eradication it is hoped that, once found, the virus can be eradicated so that the area will then be PPV free. In the management mode, PPV is common in many plants in a locale and it is thought to be impossible to eradicate. In those situations growers must remove all plant identified as having the viruses and only PPV free material may be planted.

1999 Pennsylvania Survey

A survey for PPV was begun in PA in the fall of 1999 once it was identified here. Since the virus was not identified until late August and since leaves are the primary plant material used for detection, not much time was available to locate this disease. A quick survey system was set up which involved an X pattern across all orchards near the site of initial detection. Blocks were identified in the locale where PPV had been found and ELISA procedures were used once suitable standards could be identified. In addition to the X pattern of sampling more intensive samples of 20 X 20 tree segments in positive orchards were taken in order to aid in the epidemiological studies. These studies were conducted to develop a more refined sampling method that would be the most efficient means for detecting the virus based on the number of samples collected, the amount of dollars expended and the available manpower. All participating federal, state and local agencies cooperated in an admirable manner to make detection likely. Early on, eradication was the only option talked about. In addition, affected growers cooperated fully even though they knew that their orchards would need to be destroyed if found to be positive for PPV. Several positive orchards were identified in the fall of 1999 and a quarantine area was established. The quarantine area established included Latimore and Huntington Townships in the northeast corner of Adams County. After leaf fall a conference was held in Gettysburg, PA with invited foreign speakers who were experts in the detection and management of PPV. In addition, USDA, Agricultural Research Service (ARS), and Animal and Plant Health Inspection Service (APHIS) personnel were actively involved.

2000 Pennsylvania Survey

In 2000 the revised survey methods were utilized that had been developed based on the intensive epidemiological studies that were conducted in 1999. Extensive sampling was conducted in all areas of Pennsylvania. A listing of the 2000 results is given below:

	Total	PPV Negative	PPV Positive
No. of Samples	65,022	64,623	399
No. of Blocks	1654	1614	40

Although the area of quarantine was enlarged it should be remembered that it is one small geographical area. The quarantine area now includes Latimore, Huntington and part of Menallen Townships in Adams County and a very small part of Middleton and Dickinson Townships in Cumberland County. The Pennsylvania Department of Agriculture (PDA) and USDA APHIS worked together in detecting and surveying orchards and in establishing quarantine parameters. After the 2000 PPV survey, 875 acres of orchards were destroyed. This was about 1/8 of the Pennsylvania susceptible stone fruit acreage. In addition, a 3-year moratorium was placed on planting in the quarantine area and serious consideration is now being given to the removal of all

susceptible *Prunus* species within 200 meters of any positive orchard. The results of the 2000 survey showed that PPV has been found in one small pocket of Pennsylvania orchards and that Pennsylvania fruit tree nurseries are PPV free. The spread of PPV in Pennsylvania may be explained by one introduction with subsequent spread by aphids. The path of entry into Pennsylvania is not known. The USDA and PDA developed a plan to reimburse growers for peach orchards that needed to be destroyed. The value of these orchards was calculated based on average yield per acre and on the average value per bushel. The gross margin for each year was calculated and the net present value of an orchard of ages 1 to 25 was calculated. The maximum reimbursement rate was approximately $14,000 per acre for an orchard of 7 years of age. Reimbursement for younger and older orchards was less than this.

Weed and Aphid Surveys

Additional work was done in Pennsylvania to determine if there was either *Prunus* or non-*Prunus* plant materials (weeds and trees) in areas surrounding PPV infected orchards. This research was essential to conduct if eradication was to be successful. Fortunately, no positive samples were detected. In this survey, 7,000 samples were run involving 245 total species. In addition, there were many surveys done for aphids trying to determine which species of aphids were present and which aphids might play a role in dispersal of this disease.

2000 Canadian Survey

In the fall of 1999, Canada placed an embargo on the importation of all *Prunus* material from the US. In the spring of 2000, Canadian authorities began a trace back of peach trees that were purchased in Canada from nurseries located in south central Pennsylvania. Plum pox was confirmed in some peach trees that had originally been purchased in Pennsylvania but this did not confirm that the infection originated in Pennsylvania. In other words, there was no proof that the trees were infected when they entered Canada. Subsequent surveys of fruit tree nurseries in Pennsylvania indicated that all nurseries were negative and clean of PPV and that the positive trees found in Canada in all likelihood had been infected in Canada after arrival. In addition, the USDA, APHIS conducted intensive trace backs of peach trees grown by nurseries located in south central Pennsylvania. The trees that were suspected of carrying the virus to Canada were actually grown in Tennessee and were propagated from virus-free budwood collected in California. Subsequent surveys in Canada indicate that PPV was widespread in Ontario. The results of the Ontario survey up to Nov. 14, 2000 are:

	Total	PPV Positive	Growers Positive
No. of Samples	100,913	947	81
No. of Blocks	5,099	240	240

These results could be compared to the Pennsylvania survey where only 40 blocks were positive compared to the 240 positive in Ontario. In Ontario, one propagator was positive for PPV. The main area where PPV was found in Ontario was near St. Catherine although positive samples were also detected near Simcoe and Harrow. The percentage of total positive samples detected in Ontario by varieties varies from 21% for Veecling, 19% for Baby Gold 7, to an intermediate level of about 3% for Redhaven, and 2.5% for Garnet Beauty. Low percentages of samples were detected in plums and in Cresthaven and Vivid peaches. The wide distribution of PPV in Canada can be explained by a possible propagation link. It is thought that the wide distribution of PPV came about by the distribution of inspected budwood of a highly desirable clingstone peach variety. The selection of a new clingstone peach was made in 1981 and the selections were planted in the experiment station in 1983. Budwood was sent to a nursery in 1988 and finished trees were planted at Site 13 in 1990. Since this peach variety was highly desirable and many growers wanted trees, budwood was distributed from Site 13 in 1992. Finished trees from this propagation were sold in 1994. No budwood was collected from Site 13

after 1996. Site 13 and surrounding orchards were determined to be highly infected with PPV in 2000.

Summary

The status of Pennsylvania PPV is that it was detected in 40 blocks of trees and all 875 acres of infected orchards have been removed. In addition, a 3-year moratorium was placed on planting in the quarantine area and serious consideration is now being given to the removal of all susceptible *Prunus* species within 200 meters of any positive orchard. There are two medium size nurseries in Adams County, Pennsylvania, and both are PPV free. In addition, trace backs have been intensively carried out on most *Prunus* trees sold by the nursery that is located closest to the PPV infected area. Thus, PA nurseries have been more intensively investigated than nurseries from other states so you should feel confident in buying peach, nectarine and plum trees from PA nurseries. Pennsylvania has had a Fruit Tree Improvement Program since the 1960's that involves personnel from PDA, Penn State University, and participating nurserymen. This program has helped the nurserymen maintain the high quality of trees produced in Pennsylvania and has developed plans to deal with PPV. It is anticipated that there may be a national plan for nursery certification in order to deal with PPV on a national basis.

Credit is given to the following personnel for contributing to this presentation: Pennsylvania Department of Agriculture - Nancy Richwine and Ruth Welliver; USDA, APHIS - Gary Clements and Bill Swartz; Canadian Food Inspection Service - Neil Miles; and Penn State University - Jason Harper, John Halbrendt, Jim Travis and Greg Krawczyk.

THE FQPA AND NEW CHEMICALS

Arthur M. Agnello
Department of Entomology
New York State Agricultural Experiment Station
Geneva, NY 14456

The Food Quality Protection Act (FQPA) of 1996 put into motion one of the broadest and most comprehensive reviews of modern pesticide use enacted since FIFRA (the Federal Insecticide, Fungicide and Rodenticide Act) was passed in 1947. By rescinding the Delaney Clause of the 1958 Federal Food, Drug and Cosmetic Act, which barred processed food from containing even trace amounts of cancer-causing chemicals, this measure created a unified health standard for both raw and processed foods, with specific guidelines to protect children from pesticide hazards, by grouping together and evaluating all pesticides having common modes of action. Although this legislation sidestepped the prospect of outright cancellation of several key pesticides currently labeled for agricultural and non-agricultural use, its mandate to ultimately assess total cumulative risk in the population posed by similar active ingredients has instituted a review and reregistration process that has already made considerable progress towards an endpoint that will radically change the profile of pesticide programs currently used by fruit growers in the U.S. and worldwide.

The intended impacts of the FQPA are laudable and relatively straightforward - to restrict or cancel the use of harmful pesticides, and to increase reliance on the use of more reduced-risk materials. However, any sweeping reform brings with it also a number of unintended impacts. Some of the unintended impacts to be addressed here include: regulatory bottlenecks, a potential increase in pesticide resistance, a lack of effective alternative pest controls, greater economic hardship in the agricultural sector, difficulty in meeting market demands, and possible regional shifts in fruit production. These changes are realized not only by the people and businesses involved in the commercial end of the fruit industry, but also express themselves in the form of a greater burden on the elements of the public sector that are involved with the industry. One immediate outcome is an increased demand for research on and extension of new materials and techniques that would ostensibly serve as replacement technologies for the active ingredients expected to be lost in this process. Shifts are seen on both sides of the regulatory window, with a higher incidence of requests for Specific Emergency Exemptions -- state-initiated FIFRA Section 18's -- on the one hand, and more stringent pesticide use enforcement measures on the other. This generates a mostly desirable, if somewhat defensive, response in the form of heightened commodity group advocacy, and the establishment of more practical and realistic communication with the U.S. Environmental Protection Agency (EPA). Greater effort has been expended to provide regulators with better use and usage data, residue data, USDA-requested crop profiles and pest management strategic plans.

Predictably, this has led to a greater regulatory bottleneck at the EPA, which has always been inadequately staffed to meet its legislated mandates. For example, of the roughly 600 emergency exemptions submitted in 1998, 68% were issued, but 16% were pending at the end of the year, and another 11% were withdrawn by the states in view of failure of timely action on their request. Of the minor crop registration data packages submitted in 2000, 36% were delayed or rescheduled until at least the next year.

One intended impact of the FQPA is the progression of lost product uses in apples, a commodity that is a major risk driver because it constitutes a large part of the diets of infants and children. The first of these decisions came in 1999, when the use of methyl parathion was cancelled, and that of azinphosmethyl was restricted. Its tolerance was lowered, the maximum yearly use reduced, its pre-harvest interval (PHI) increased, and chemigation or application by air prohibited. In 2000, the use of chlorpyrifos in apples was restricted to the prebloom period, and a lowering of its tolerance is now likely. Also, the insecticide-acaricide Carzol was prohibited beyond the petal fall stage. An increase in the PHI of phosmet is anticipated, and

diazinon has already begun a phase-out of its interior residential uses, presaging an eventual withdrawl from minor crops like apples in the near future. One unintended consequence of this strategy may well be an increase in the development of pesticide resistance in the short term, as agriculturists rely to a greater extent on a narrower group of chemistries. For instance, products containing spinosad saw 164 new labeled uses in 2000. Some of the eliminated pesticides had been important resistance management tools in fruit programs; methyl parathion and chlorpyrifos were used commonly to control populations of codling moth resistant to azinphosmethyl in the western states.

The agrichemical industry has been responding in an effort to fill the void being created by the anticipated loss of most organophospate and carbamate uses in commodities like apples, but the process is slow and expensive, so a number of discontinuities are showing up between the product cancellations and their potential replacements. There is still a noticeable shortage of effective alternative controls for some pests; one assessment of current registrations shows only 8% of new pest control products to have activity against those insects falling outside of the traditional major categories of caterpillars and soft-bodied insects ' the beetles, bugs, and flies, which threaten to lead the next wave of "problem pests" in some fruit systems. A greater reliance on more reduced-risk materials can be seen as favorable by one measure. For example, spinosad, with an LD50 of greater than 5000 mg/kg, is typical of such products, and pheromone mating disruption is being evaluated on a wider scale than ever as a means of control. Over 125,000 acres in the U.S. were treated with pheromone for codling moth control last year, and new dispenser technologies are being developed, such as sprayable formulations, automated microsprayer systems, and paraffin-based liquids. However, control of internally feeding worms potentially still could be compromised, as mating disruption is not a stand-alone tactic, and efficacy of the new chemistries is not always equivalent to the OP standards.

As a result, fruit growers may increasingly find themselves having difficulty meeting market demands in the face of stringent market, phytosanitation and cosmetic standards that were formerly manageable with the availability of organophosphates. Internationally, a zero tolerance for apple maggot in some markets (e.g., Brazil) dictates a prophylactic spray program that has traditionally relied upon OP's. Even within the U.S., detection of a single plum curculio larva in loads from each of 12 farms resulted in the dumping of over a half million pounds of sweet cherries last year. Trends such as these could have the unintended consequence of regional shifts in the production of certain crops. For instance, OP's traditionally have been targeted against a suite of key pests in the eastern apple-producing states: plum curculio, codling moth, oriental fruit moth, lesser appleworm, European apple sawfly and apple maggot. Of these, only codling moth poses a significant threat in the western states, so it is not hard to imagine a production shift to this region in the event that effective and affordable alternatives to the traditional strategies do not become available.

Still, fruit growers have been fortunate in that a number of new products already have been developed and labeled for use, and others promise to be available soon. With the phasing out of products based on the older chemical classes such as the organochlorines, organophosphates, and carbamates, there has been a surge in the development of other classes of active ingredients since the mid-1990's. Among those actively being pursued are:

- Synthetic Pyrethroids (Asana, Ambush/Pounce, Danitol, Karate/Matador): Developed in the late 1970's, these generally have a longer residual than carbamates and OP's; they exhibit good contact activity and quick knockdown, but can be quite toxic to beneficials.
- Bacterially Produced Acaricides and Insecticides (B.t., Agri-Mek, SpinTor, Proclaim): Derived from bacteria in soil; diverse modes of action. Safe to humans, beneficials, and the environment; narrow spectrum of activity.
- Insect Growth Regulators (IGR's): This group is characterized by diverse chemistries and modes of action; they often have a narrow activity spectrum, and are generally safe to predators. Timing is critical to their effectiveness. Some of the different types of IGR's follow:

- Chitin Synthesis Inhibitors (CHI's; Dimilin, Cascade, Rimon): Members of this oldest group of IGR's disrupt the enzymes producing chitin in the insect cuticle. They have long residual activity, but unfortunately there is cross-resistance between the CHI's and OP's. They are regarded as safe to the environment, but are toxic to aquatic arthropods.
- Juvenile Hormone Analogs (JHA's; Comply, Esteem): Mimic natural insect juvenile hormones; often most effective upon lepidopterous pests. Application timing is very critical, and they may be slow acting.
- Molt Accelerating Compounds (MAC's; Confirm, Intrepid): First discovered in the 1980's; active mostly on lepidopterous larvae, and act by inducing a premature lethal molt in the insect, which leaves it unable to feed. Safe to the environment and beneficials; effective at low rates, and with long residual activity (20-28 days).

Some of these products have been available for several seasons so far, and we therefore have a reasonable idea of their strengths and weaknesses under representative growing conditions. However, others are so new that it will be some time before growers and the people who advise them are able to use them to their fullest advantage, both horticulturally and economically. Following are use profiles for some selected new chemicals, based on what has been observed in experimental and commercial settings where they have been applied (refer also to Table 1).

ACTARA (thiamethoxam)
Company: Syngenta (Novartis)
Classification: A thianicotinyl (neonicotinoid). Related to Provado.
Mode of Action: Systemic insecticide with both contact and ingestion activity. Toxic to bees, slight toxicity to most beneficials, nontoxic to predatory mites.
Targeted Pests: Aphids, plum curculio, European apple sawfly, leafhoppers, mealybugs
Observations: Rapid uptake of residue from leaf surface into plant tissues. Some activity on mirids (tarnished plant bug, mullein plant bug), little on leps.

AGRI-MEK (avermectin)
Company: Syngenta (Novartis)
Source: Produced by a soil bacterium, Streptomyces avermitilis.
Mode of Action: Stops muscle movement and paralyzes pests. Both movement and feeding are inhibited and pest dies.
Pest Activity: Pear psylla, mites, leafminers, leafhoppers.
Observations: Penetrates the plant cuticle (translaminar). Long residual activity and control effectiveness. Most effective when applied in the early season before leaves harden off.

AVAUNT (indoxacarb)
Company: DuPont
Classification: Oxadiazine, a new chemical class.
Mode of Action: Stomach and contact poison. Slight toxicity to beneficials and bees.
Targeted Pests: Plum curculio, apple maggot, leafhoppers, codling moth, oriental fruit moth.
Observations: Cross-resistance with OP's suspected in leafrollers; not active on scales or aphids; possible negative effect on Stethorus punctum.

CALYPSO (thiacloprid)
Company: Bayer
Classification: chloronicotinyl (neonicotinoid), same class as Provado.
Mode of Action: Contact and stomach activity. Minimal effect on beneficials and bees.

Targeted Pests: Plum curculio, codling moth, oriental fruit moth, leafminers, leafhoppers, apple maggot, sucking insects.
Observations: Some systemic activity in plant tissue. Not active on woolly apple aphid; registration not expected before 2002.

COMPLY (fenoxycarb)
Company: Syngenta (Novartis)
Classification: IGR, juvenile hormone analog.
Mode of Action: Intereferes with the molt of larvae to pupal stage. Also, sterilizes eggs, and may prevent adults from entering diapause.
Pest Activity: Pear psylla, leafrollers, leafminers.
Observations: Acts slowly against lepidopterous larvae. Material may be translaminar in leaves. Most effective in the early part of the season. Registration in U.S. questionable.

CONFIRM (tebufenozide)
Company: Rohm and Haas
Classification: Molt accelerating compound
Mode of Action: Initiates premature molting of lepidopterous larvae. Initially, causes larvae to stop feeding then die from starvation. Primarily active through ingestion.
Targeted Pests: Leafrollers, codling moth.
Observations: Most effective timing coincides with egg hatch. Long residual activity (14 ' 21 days). Safe to beneficials.

DANITOL (fenpropathrin)
Company: Valent Biosciences
Classification: Synthetic pyrethroid
Mode of Action: Contact activity. Toxic to many beneficial species.
Targeted Pests: Leafminers, leafhoppers, leafrollers, tarnished plant bug, aphids, plum curculio, internal leps, apple maggot, European red mite.

ESTEEEM (pyriproxyfen)
Company: Valent Biosciences
Classification: IGR, juvenile hormone analog.
Mode of Action: Taken up by insect cuticle, interferes with molting and egg hatch and development. Safe to most beneficials and bees.
Targeted Pests: San Jose scale, pear psylla.

INTREPID (methoxyfenozide)
Company: Rohm & Haas
Classification: A molt accelerating compound. Related to Confirm.
Mode of Action: Initiates premature molting of lepidopterous larvae. Initially, causes larvae to stop feeding then die from starvation. Primarily active through ingestion.
Targeted Pests: Leafrollers, codling moth, oriental fruit moth.

PROCLAIM (emamectin benzoate)
Company: Syngenta (Novartis)
Classification: An avermectin, related to Agri-Mek.
Mode of Action: Mostly ingestion activity, some contact efficacy. Safe to most beneficials; toxic to bees on contact, virtually safe when dried.
Targeted Pests: Lepidoptera, such as leafrollers and leafminers.
Observations: Needs adjuvant (e.g., horticultural mineral oil, Dyne-Amic).

PROVADO (imidacloprid)
Company: Bayer Corp.
Classification: A chloronicotinyl. A neonicotinoid, related to nicotine.
Mode of Action: Exhibits both systemic and contact activity against sucking insects. Safe to beneficials.
Targeted Pests: Aphids, leafminers, leafhoppers.
Observations: Some systemic activity in plant tissue.

SPINTOR (spinosad)
Company: Dow AgroSciences
Source: Naturally derived from a soil bacterium, Saccharopolyspora spinosa.
Mode of Action: Contact and stomach poison, acts on insect nervous system. Treated insects stop feeding and quickly become paralyzed.
Pest Activity: Lepidopterous larvae (leafrollers, leafminers), apple maggot
Observations: Activity often enhanced by addition of an adjuvant.

SURROUND (kaolin clay)
Company: Engelhard
Classification: Naturally occurring clay mineral.
Mode of Action: Particle film forms a physical barrier/deterrent to pest feeding, ovipositing, landing.
Targeted Pests: Plum curculio, leafhoppers, apple maggot, internal leps.
Observations: Not active on aphids, scales. May negatively impact hymenopterous parasitoids and generalist predators such as spiders.

Despite the considerable efficacy against most fruit pests represented in these materials, the ultimate determinants of each of their roles in the industry will be the diversity of growing conditions (climate, site, variety), pest pressures (together with pesticide use history, resistance, etc.), market demands, economics, and user sophistication to be found throughout the fruit industry. An admittedly nearsighted assessment of one potential scenario could easily lead to predictions of increased economic hardship associated with these new tools. A likely increase in pest control expenses is suggested by the 16-40% increased cost of new products, the greater number of applications often needed, their more information-intensive use patterns, and a consequently more complex production system; all this is set against a backdrop of negative economic growth in the agricultural sector over the past few decades. The business of growing fruit, never an easy job, will continue to require its members to diligently plan, experiment, prioritize, and constantly re-evaluate their methods in order to stay on the practical and profitable side of this challenging occupation.

Table 1. Activity profiles of new pesticide products being registered and currently available.			
Product Name (common name)	**Targeted Pests**	**Some activity**	**Little activity; Negative effects**
Actara (thiamethoxam)	Aphids, plum curculio, leafhoppers, European apple sawfly, mealybugs	Leafminers, plant bugs, apple maggot	Leps (codling moth, oriental fruit moth, leafrollers) San Jose scale
Avaunt (indoxacarb)	Plum curculio, apple maggot, European apple sawfly, leafhoppers	Leps (codling moth, oriental fruit moth, leafminers)	OBLR (cross-resistance with OP's?) Spirea aphid, San Jose scale; Harmful to *Stethorus*
Calypso (thiacloprid)	Plum curculio, codling moth, oriental fruit moth, leafminers, leafhoppers, apple maggot, aphids		San Jose scale
Confirm (tebufenozide)	Tufted apple budmoth, redbanded leafroller	Obliquebanded leafroller	Codling moth, oriental fruit moth
Danitol (fenpropathrin)	Leafminers, leafhoppers, leafrollers plant bugs, aphids, plum curculio, leps, apple maggot, mites		Harmful to most beneficial insects and mites
Esteem (pyriproxyfen)	San Jose scale, leafminers	Pear psylla	
Intrepid (methoxyfenozide)	Leafrollers, codling moth, oriental fruit moth	Leafminers	
Proclaim (emamectin benzoate)	Obliquebanded leafroller, leafminers	Leps (codling moth, oriental fruit moth)	
Surround (kaolin clay)	Plum curculio, apple maggot, leafhoppers, pear psylla	Leps (codling moth, oriental fruit moth, leafminers)	Aphids, scales; may suppress hymenop, parasitoids, spiders.

SCAB CONTROL STRATEGIES FOR 2001

Dave Rosenberger
Cornell University's Hudson Valley Lab
PO Box 727, Highland, NY 12661

Introduction

Two powerful new fungicides recently became available to New York apple growers. "Flint" and "Sovran" are broad-spectrum fungicides from the new chemistry class commonly known as strobilurins. The strobilurins are active against many plant pathogens at rates of only one to three ounces of active ingredient per acre. They have very low toxicity to birds, earthworms, beneficial insects, predaceous mites, and mammals (including humans). They break down quickly in soil but have good residual activity on foliage and fruit. Because of their broad spectra of activity and favorable environmental profiles, they are the most significant new group of fungicides to be developed since the sterol inhibitors (SIs).

The labels for Flint and Sovran restrict applications to no more than three back-to-back sprays and no more than four or five sprays per season. These restrictions are designed to limit selection pressure for development of fungicide-resistant pathogens. Resistance management with the SI fungicides (Nova, Procure, Rubigan) was based on using SIs in combinations with a contact fungicide such as captan or mancozeb. Flint and Sovran have been marketed as stand-alone products that do not need to be used in combinations. Instead, resistance management is based on applying one or two Flint or Sovran sprays, then switching to a fungicide with a different mode of action.

When different fungicides are used in alternating schedules, it is difficult to discern how much each individual product contributes to disease control. This paper reports results of two field trials that were conducted in the Hudson Valley during the 2000 growing season to evaluate the activity of Flint and Sovran for controlling apple scab, powdery mildew, rust diseases, and summer diseases. Results from a single year must always be interpreted with caution because weather-related variables have a significant impact on fungicide performance. Nevertheless, the data collected during the summer of 2000 provide insights concerning the best uses for Flint and Sovran in apple spray programs.

How do Flint and Sovran compare to SI fungicides?

Activity of Flint and Sovran was evaluated in an orchard of Jerseymac and Ginger Gold trees that was left unsprayed for an extended period before treatments were initiated. Trees were at petal fall on 10 May, and test treatments were initiated on 22 May, just a day or two before visible scab symptoms erupted on terminal leaves. This spray was timed to allow evaluation of post-infection or "pre-symptom" activity of the fungicides. For each fungicide treatment, four replicates were sprayed with test fungicides on 22 May and again on 31 May. Four additional replicates were sprayed with test fungicides on 22 May but received only mancozeb (Dithane 75DF, 1 lb/100 gal) on 31 May. No fungicides were applied to any plots after 31 May.

In previous years, Flint and Sovran provided the same levels of scab control when the rate of Sovran was two times the rate of Flint. Therefore, all of our tests in 2000 were designed to compare Flint and Sovran with rates adjusted to this 2:1 ratio.

The first major infection period of the year occurred 9-11 May with 36 hours of wetting and a mean temperature of 57/ F (Fig.1). Additional scab infection periods occurred 12-14 May (45 hr, 57/ F), and 18-22 May (89 hr, 51/ F). Another 50 hrs of intermittent wetting with a

mean temperature of 58/ F occurred 22-25 May. Fifteen secondary scab infection periods occurred between 1 June and 15 August.

Twenty-four hours after the first application, the ends of fifteen terminal shoots per tree were marked by placing a red tag on the node above the last leaf that had expanded to at least 50% of full size (Fig. 2). The tagged shoots were harvested from Jerseymac trees on 15 June and from Ginger Gold trees on 5 July. The 10 longest of the tagged shoots were evaluated for disease on a leaf-by-leaf basis. Leaves were counted as infected even if the scab lesions showed some evidence of being inactivated. However, leaves with chlorotic spots only (i.e., completely inactivated) were not counted as infected. Incidence of scab was evaluated again on 3 July and 16 August by observing terminal leaves on untagged shoots of Jerseymac trees. These later assessments, along with fruit evaluations completed in late July, measured the effectiveness of treatments for limiting secondary spread by reducing inoculum levels within the test trees.

Results of the 2000 Field Trial with Flint and Sovran

Field evaluations of scab on terminal leaves and fruit showed that Flint and Sovran controlled scab as well as or better than the standard Nova+Dithane treatment (Table 1). By 16 August, the incidence of scab on leaves was significantly higher in plots sprayed with Nova+Dithane than in plots receiving either rate of Flint or the high rate of Sovran.

Flint and Sovran were ineffective against rust diseases. Nova+Dithane provided nearly complete control of cedar apple rust and suppressed quince rust on both apple cultivars (Table 2). Nova+Dithane used in a full-season program usually provides complete control of quince rust, but in this experiment control was incomplete because many quince rust infections occurred April 21-23, almost 30 days before treatments were applied. Quince rust was much more severe on Jerseymac than on Ginger Gold, probably because of differences in bud stages on the two cultivars at the time of the infection period.

To further elucidate differences in treatments, the incidence of disease was compared for each leaf position above and below the tags that had been placed on shoots. Leaf positions were numbered from –1 to –5 counting down the shoot from the tag and +1 to +5 counting outward from the tag. Leaves in the –5 position were therefore the oldest and would have emerged at or shortly after petal fall on May 9. Leaves in the +5 position were the youngest and emerged after the first spray had been applied.

The fungi that cause apple scab, powdery mildew and cedar apple rust attack newly emerged leaves to a greater degree than older leaves on a shoot. Therefore, the incidence of disease at the various leaf positions in this experiment provided some indication of post-infection activity of the fungicides, although many leaves may have been susceptible to infection during more than one infection period. Leaves in positions –1 and–2 probably incurred infections both before and after the first fungicide application on 22 May, so scab control for those leaf positions may reflect a combination of protectant activity and post-infection activity. Disease control for leaf positions –3 through –5 represents post-infection activity against infections that occurred 9-14 May, or 8-13 days before the first treatment was applied.

Analysis of scab control on Jerseymac shoots harvested June 15 showed that the Flint and Sovran treatments were superior to the Nova+Dithane treatment when compared across leaf positions –5 to –1. Thus, Flint and Sovran provided better post-infection activity than Nova (Table 3). The level of post-infection activity was the same for plots receiving one spray as for those with two sprays of the test products (P=0.85), but disease control varied significantly by leaf position. The best control occurred on the oldest leaves where scab erupted through the leaf surface shortly after the first spray and on the youngest leaves where infections presumably occurred not more than 96 hours prior to the first application (Fig. 3)

In a similar leaf-by-leaf analysis of post-infection activity on Ginger Gold, differences among treatments were very similar to those observed for Jerseymac. The high rate of Flint and both rates of Sovran again provided significantly better control of scab on leaf positions –5 to –1 than did Nova+Dithane (data not shown). Differences in scab control among leaf positions –5 to –1 were smaller than on Jerseymac, but here two applications of the test products provided better control than did a single application. The benefit of two back-to-back applications was particularly evident for the Nova+Dithane treatment and verified the validity of the long-standing recommendation that back-to-back applications of SI sprays are essential for effective post-infection control of apple scab (Fig. 3).

Fungicide treatments were also compared for "protectant" activity by analyzing scab control on leaf positions +1 to +5. Leaves in positions +1 and +2 were partially formed when the first spray was applied (Fig. 1), but leaves in positions +3 to +5 developed after the first spray was applied. Scab control on leaves +3 to +5 represents the combined effects of fungicide redistribution from the older sprayed leaves, post-infection activity from the second spray application, and reduced inoculum within the tree due to anti-sporulant effects of the fungicides.

All of the fungicides provided similar levels of scab control for leaves in positions +1 to +5. There were no significant differences among treatments for either cultivar. However, two applications of the test products were more effective than a single application followed by Dithane (Fig. 4). The benefit of two applications was still evident when Jerseymac terminal leaves were evaluated in August (Table 1).

Activity of fungicides for controlling powdery mildew on Jerseymac was evaluated by leaf position as described above for apple scab. Unsprayed Ginger Gold trees adjacent to each plot provided abundant mildew inoculum. Leaves were counted as infected with mildew if they had visible white colonies, "burned out" or reddish-yellow lesions, or large yellowed areas where leaf tissue had been compromised by the early stages of mildew infection.

None of the treatments provided adequate post-infection control of mildew on leaf positions –5 to –1 (data not shown). For leaf positions +1 to +5, Nova was the most effective mildewcide. Differences among treatments were most obvious for leaf positions +1 and +2 where Nova was clearly superior to Flint or Sovran (Fig. 5). The poor control of mildew by Flint and Sovran for leaf positions +1 and +2 suggests that these fungicides did not provide quick protectant activity. Instead, these products may have provided control of mildew by arresting spore production, a process that evolved more slowly and contributed to the improved mildew control observed with Sovran and Flint for leaves in positions +3 through +5. Mildew control from a single spray of Nova dropped off sharply for leaf positions +4 and+5. Thus, Nova provided a more rapid suppression of mildew following the first spray than did Flint or Sovran, but suppressive effects of a single spray persisted longer with Sovran and Flint (Fig. 5). Two applications of Nova provided almost perfect protection against mildew on tagged leaves in all positions.

Other Considerations for Scab Control

Understanding the advantages and limitations of new fungicides is essential, but many other factors are also important in scab control. Following is a check list of items to consider:

1. Calibrate sprayers carefully to ensure that fungicides are being applied at the intended rates and with appropriate distribution throughout the tree canopy. Strobilurin fungicides applied alone may not redistribute as well as the old contact fungicides.

2. Consider both pesticide costs and disease risk factors in deciding which fungicides to apply at various times of year. Mancozeb at 3 lb of formulated product per acre can provide excellent scab control from green tip until at least the pink bud stage if applications are timed to precede predicted infection periods. However, mancozeb programs are "unforgiving" because they offer no post-infection activity to arrest development of missed infections. It makes sense

to begin every season with mancozeb as the primary prebloom fungicide and to continue using mancozeb alone until the point in the season where some infections may have been missed. Infections can be missed either due to poor fungicide timing or because a fungicide was applied under windy conditions that precluded good coverage. Sovran, Flint, or a SI+contact mixture should be applied within 10 days after one suspects that infections may have been missed in a mancozeb program. Delaying longer than 10 days may allow missed infections to sporulate, and that will complicate scab control for the rest of the season. In dry years, it may be possible to use mancozeb alone for disease control until petal fall whereas in other years stronger fungicides may be needed as early as tight cluster.

3. Be cautious about depending too heavily on mancozeb alone: if primary scab lesions are visible in trees before the first application of Sovran, Flint, or an SI fungicide, then scab control for the remainder of the season may become very difficult and expensive, especially if it is a cool wet season. Furthermore, applying Sovran, Flint, or SI fungicides to running epidemics will result in rapid selection for fungicide-resistant strains of apple scab.

4. Use at least two "power sprays" of Sovran, Flint, or SI fungicides every year to minimize risks of secondary scab and mildew infections. In dry years, the best timing for these two "power sprays" might be petal fall and first cover whereas in other years stronger protection may be needed at tight cluster and pink or at pink and bloom stages. In wet years, four or five applications of these "power" fungicides may be the only way to achieve complete disease control. Petal fall and first cover sprays are probably the most critical spray timings for controlling powdery mildew in the northeast. If three or four "power sprays" are used in a season, the longer one can wait to initiate these sprays, the better the mildew control is likely to be. Thus, using power sprays at tight cluster, pink, bloom, and petal fall will provide much less mildew control than if power sprays are applied at bloom, petal fall, and first and second cover, but the reverse is usually true for scab control.

5. Growers who have used just two or three SI fungicides for many years should consider using Sovran or Flint at petal fall and first cover one year followed by an SI fungicide at those timings the next year so as to reduce selection pressure for fungicide-resistant strains of powdery mildew. Growers who use four or five "power sprays" per year should be using SI fungicides for two or three of those sprays and either Sovran or Flint for the other two or three sprays each season as part of a resistance management strategy.

6. In a seasonal program involving four or five power sprays, there is no definitive reason for preferring Sovran or Flint followed by SI sprays as compared to SI sprays followed by Sovran or Flint. Both scenarios have advantages and disadvantages.

7. Sovran and Flint will not provide acceptable control of rust diseases under high disease pressure. Rust infections on fruit are usually initiated between tight cluster and petal fall whereas cedar apple rust usually causes the most leaf damage between petal fall and second cover. Where rust is a problem, a low rate of mancozeb, perhaps 1.5 lb/A, could be added to Sovran or Flint sprays to suppress rust.

Conclusions

In work reported here, Flint and Sovran were slightly more effective than Nova+Dithane for post-infection control of apple scab, and they were just as good as Nova+Dithane for protecting leaves and fruit. Against apple scab, Flint used at 1 oz/100 gal provided the same level of control as Sovran used at 2 oz/100 gal. Nova provided better control of mildew than either Flint or Sovran. Flint and Sovran were ineffective against rust diseases. Where apple growers previously used three or four applications of an SI fungicide to control scab and mildew, they should now change one or two of those applications to Flint or Sovran so as to reduce selection pressure for SI-resistant pathogens. Where rust diseases are severe, strobilurin

fungicides applied between tight cluster and second cover may need to be supplemented with a low rate of mancozeb to prevent damage from rust diseases.

Flint and Sovran should not be used alone against running epidemics of apple scab where lesions are already visible on leaves because doing so could quickly select for fungicide-resistant strains of the pathogen. When Flint and Sovran are used to "shut down" a running epidemic, they should be used in combinations with captan or mancozeb. Intelligent use of Flint and Sovran in apple disease control programs should extend the useful life of the SI fungicides for scab and mildew by delaying SI resistance.

Acknowledgments

Funding for some of the work reported here was provided by Novartis, BASF, and Rohm & Haas. The author thanks Wayne Wilcox for reviewing the manuscript and Fritz Meyer, Catherine Ahlers, Albert Woelfersheim, and Keri Van Camp for technical assistance.

Table 1. Incidence of apple scab on Jerseymac leaves and fruit from trees that were sprayed with fungicides on 22 and 31 May, then left unsprayed through the remainder of the season.

Material and rate of formulated product per 100 gal	% terminal leaves with scab 15 June	3 July	16 Aug	% fruit with scab 18 July
Control[1]	39	64	95	71
Effects of fungicide treatments[2]				
Nova 40W 1.5 oz + Dithane 75DF 1 lb	2 a	16 c	74 c	8 a
Flint 50WG 0.67 oz	1 a	9 ab	64 ab	10 a
Sovran 50W 1.33 oz	1 a	11 bc	70 bc	3 a
Flint 50WG 1 oz	1 a	6 a	59 a	4 a
Sovran 50W 2 oz	1 a	7 a	63 ab	8 a
Effects of number of sprays				
One spray (22 May) followed by Dithane	2 A	11 B	72 B	9 B
Two sprays (22 & 31 May)	1 A	8 A	60 A	4 A

[1] Controls were not included in the statistical analyses of treatments.
[2] A 2 X 5 factorial analysis was used to determine effects of fungicide treatments and effects of one spray versus two sprays of the test fungicides. Means for fungicide treatments followed by the same letter are not significantly different (P#0.05).

Table 2. Incidence of cedar apple rust and quince rust on trees that were sprayed on 22 and 31 May, then left unsprayed through the remainder of the season.

Material and rate of formulated product per 100 gal	% Ginger Gold leaves with cedar apple rust	% fruit with quince rust Jerseymac 18 Jul	Ginger Gold 8 Aug
Control[1]	29	30	1.6
Effects of fungicide treatments			
Nova 40W 1.5 oz + Dithane 75DF 1 lb	1 a[2]	14 a	0.3 a
Flint 50WG 0.67 oz	29 b	30 bc	1.7 b
Sovran 50W 1.33 oz	34 b	26 abc	1.9 b
Flint 50WG 1 oz	41 b	34 c	2.6 b
Sovran 50W 2 oz	40 b	17 ab	0.2 a
Effects of number of sprays			
One spray (22 May) followed by Dithane	27 A	27 A	1.0 A
Two sprays (22 & 31 May)	24 A	23 A	0.9 A

[1] Controls were not included in the statistical analyses of treatments.
[2] Means for fungicide treatments followed by the same letter are not significantly different (P#0.05).

Table 3. Post-infection control of apple scab on Jerseymac terminal leaves that were unfolded prior to the first fungicide application as determined from tagged shoots harvested 15 June.

Material and rate of formulated product per 100 gal	% control of apple scab by leaf position[1] -5	-4	-3	-2	-1	Grand mean for all leaf positions
Nova 40W 1.5 oz + Dithane 75DF 1 lb	63 a[2]	50 a	10 a	41 a	80 a	49 a
Flint 50WG 0.67 oz	79 ab	65 abc	45 b	59 abc	93 a	68 b
Sovran 50W 1.33 oz	84 ab	88 c	58 b	48 ab	86 a	73 b
Flint 50WG 1 oz	67 ab	59 ab	44 b	85 c	89 a	69 b
Sovran 50W 2 oz	92 b	84 bc	56 b	74 bc	92 a	80 b
Grand mean: all treatments	77 C[3]	69 BC	43 A	61 B	88 D	

[1] Leaf position indicated as "-5" was the fifth leaf down from the tag placed above the last expanded leaf at the time of the application. Therefore, leaf position –5 represents the oldest leaf and position –1 represents the youngest full leaf exposed at the time of application. Disease incidence in the unsprayed control trees for leaf positions –5 to –1 was 38, 55, 63, 65 and 72% of leaves infected, respectively.
[2] High numbers indicate better disease control since the means show percent disease control. Numbers within columns followed by the same letter are not significantly different (Fisher's Protected LSD, P#0.05).
[3] Grand means across the row followed by the same capital letter are not significantly different (Fisher's Protected LSD, P#0.05).

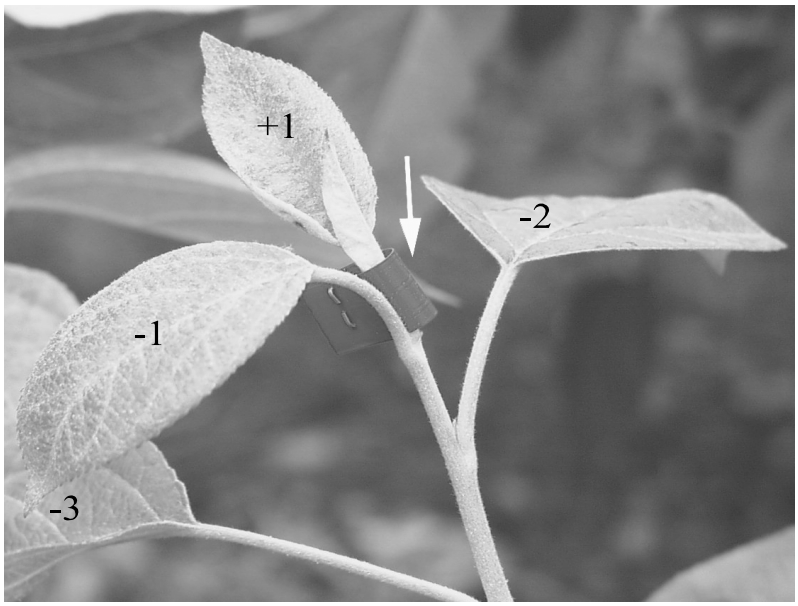


Fig. 1. Jerseymac shoot one day after fungicides were applied, showing tag (white arrow) on the internode above the last leaf that was expanded at the time of the fungicide applications. Leaves below this mark are designated as leaf positions –1 (closest to the tag) through –5, whereas leaves developing above the tag are designated +1 through +5.

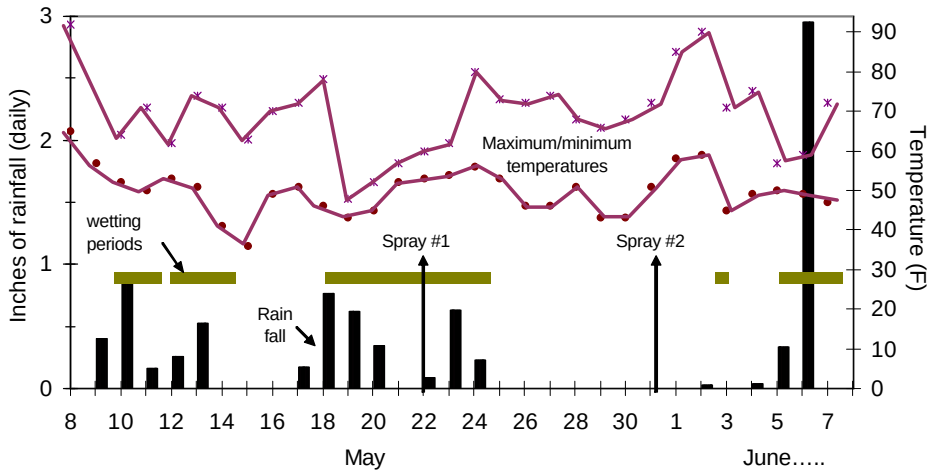


Fig. 2. Daily temperatures, wetting periods, and rainfall during the time that post-infection and protectant activities of Nova+Dithane, Sovran, and Flint were being evaluated in 2000.

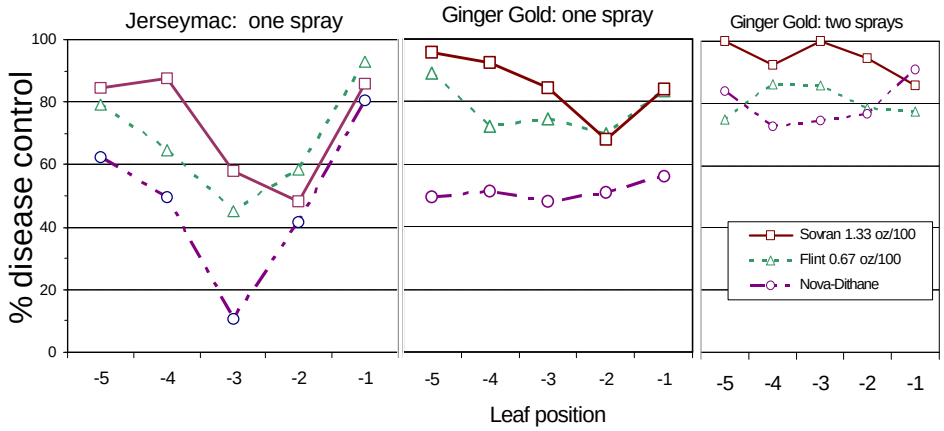


Fig. 3. Post-infection control of apple scab on Jerseymac and Ginger Gold, with results presented as percent disease control by leaf position for the five youngest leaves that developed prior to the first fungicide application. Disease incidence for the same leaf positions on unsprayed controls ranged from 38 to 75% of leaves infected for Jerseymacs and 63 to 96% for Ginger Gold.

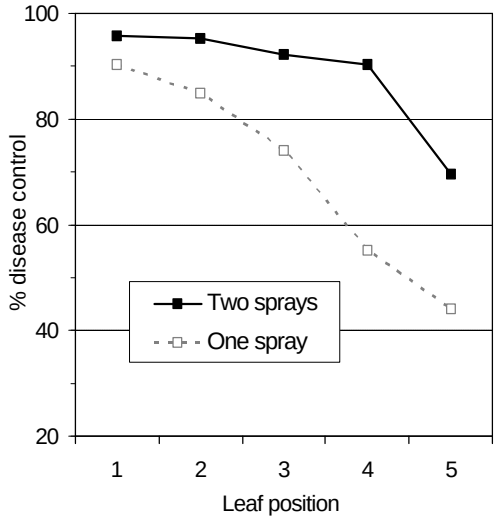


Fig. 4. Apple scab control following either one or two applications of fungicides, with results presented as percent disease control by leaf position. Disease incidence in unsprayed controls ranged from 90 to 95% of leaves infected.

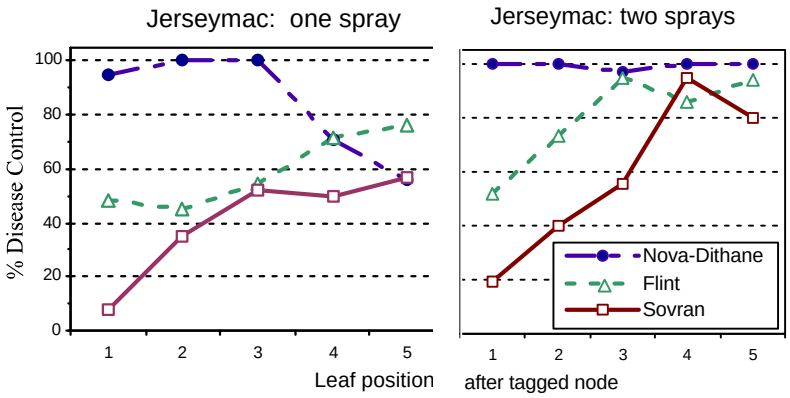


Fig. 5. Powdery mildew control following either one or two applications of fungicides, with results presented as percent disease control by leaf position for the first five leaves that expanded after the day of the first fungicide application. Disease incidence in unsprayed controls ranged from 62 to 90% of leaves infected.