

Fruit Russet in the Empire State: An Industry Perspective

M.C. Heidenreich¹, T.J. Burr¹, D. Breth², S. Hoying², K. Iungerman³, C. Torrice⁴, M. Fargione⁵

¹Dept. of Plant Pathology, NYS Agricultural Experiment Station, Cornell University, Geneva, NY 14456.

² Lake Ontario Fruit Team, Cornell Cooperative Extension, Albion and Newark, NY

³ Northern NY Fruit Program, Cornell Cooperative Extension, Saratoga, NY

⁴ Oswego County Cooperative Extension, Mexico, NY

⁵ Hudson Valley Fruit Program, Ulster County Cooperative Extension, Highland NY

Fruit russet is a growing concern for the New York apple industry, resulting in increased use of preventive measures to keep russet caused losses in profits at a minimum. Recent research has demonstrated that two common apple fungal epiphytes, *Aureobasidium pullulans* and *Rhodotorula glutinis*, are probably important causes of fruit russet in New York orchards.

This work supported in part by the New York Apple Research and Development Program and the New York State IPM Program.

Recently, a survey of New York growers, packer/processors and consultants was conducted to better define industry problems with fruit russet of apple. The survey developed by researchers at the New York State Agricultural Experiment Station Department of Plant Pathology and regional Cornell Cooperative Extension personnel was distributed to individuals working with apples throughout the Empire State. The purpose of the survey was four-fold: 1) to determine which cultivars currently under production are most susceptible to russet, 2) to discover what preventive measures are being recommended by consultants or used by growers to reduce russet, 3) to determine whether a correlation may exist between site characteristics and russet incidence, and 4) to examine the economic impact of fruit russet on fruit marketability and grower profits. Over 100 people responded to the three surveys, each of which was tailored specifically for the group responding to it. Survey results confirm that fruit russet is a growing concern for the New York apple industry, resulting in increased use of preventive measures to keep profit losses due to russet at a minimum.

Fruit Russet: The Growers' Perspective

While all growers agreed that russet was neither their only concern in apple production, nor perhaps their most important concern, 82 percent indicated they had russet problems with at least one of the cultivars they were producing. Fifty-four cultivars were reported as developing either whole-fruit russet, stem-end russet, or both. Those falling in the russet "Top 10" are listed below in Tables 1 and 2. When asked which cultivar, in their opinion, was their worst russet problem, growers replied that Golden Delicious is still the best of the "worst," followed by Crispin and Cortland.

Forty-seven percent of New York apple growers are now using some sort of russet control strategies. What are they doing to reduce russet in their orchards? Control measures varied widely, and included 32 different cultural, chemical, and application strategies. Those most widely used include: avoiding pesticide applications during slow-drying conditions, applying Provide 2% or opting to use Captan as part of their normal scab control programs.

TABLE 1

Whole fruit russet		
Cultivar	Ratio of respondents reporting russet/total respondents	Percentage of repondents reporting russet
Cortland	26/47	55
Ida Red	18/32	56
Crispin	29/49	59
Jonagold	16/26	62
McIntosh	38/61	62
Empire	29/45	64
Gala	14/21	67
Rome	16/24	67
Fuji	11/15	73
Golden Del.	45/56	80

TABLE 2

Stem end russet		
Cultivar	Ratio of respondents reporting russet/total respondents	Percentage of respondents reporting russet
Cortland	26/47	55
Rome	16/29	55
McIntosh	37/64	58
Empire	29/50	58
Gala	14/22	64
Fuji	11/17	65
Ida Red	18/27	67
Jonagold	16/24	67
Crispin	29/39	74
Golden Del.	45/61	74



Russet on McIntosh fruit that was inoculated with *Aurcibasidium pullulans*.

Thirteen site characteristics were reported as possibly being related to russet incidence in New York orchards. The most frequently listed characteristics were slow-drying sites (lower land), and frost pockets. Golden Delicious, Crispin, and McIntosh figured highly among cultivars most affected by russet depending on planting site.

Comments from growers were mixed depending on whether or not they had russet problems in their orchards. For

some, russet is an increasing problem; for others, as one grower commented, "Russet is not a concern for my operation, as our fruit is grown for processing." Most growers agreed that russet varied from year to year, with 1999 being a mild russet year compared to the 1997 and 1998 growing seasons. Growers theorized russet development was due in part to weather conditions during the first half of the growing season. They felt that cold, wet conditions and frost often led to russet problems later in the season. Some were of the opinion that open pruned trees with good light penetration and the capacity for rapid drying developed less fruit russet.

The Consultants' Perspective

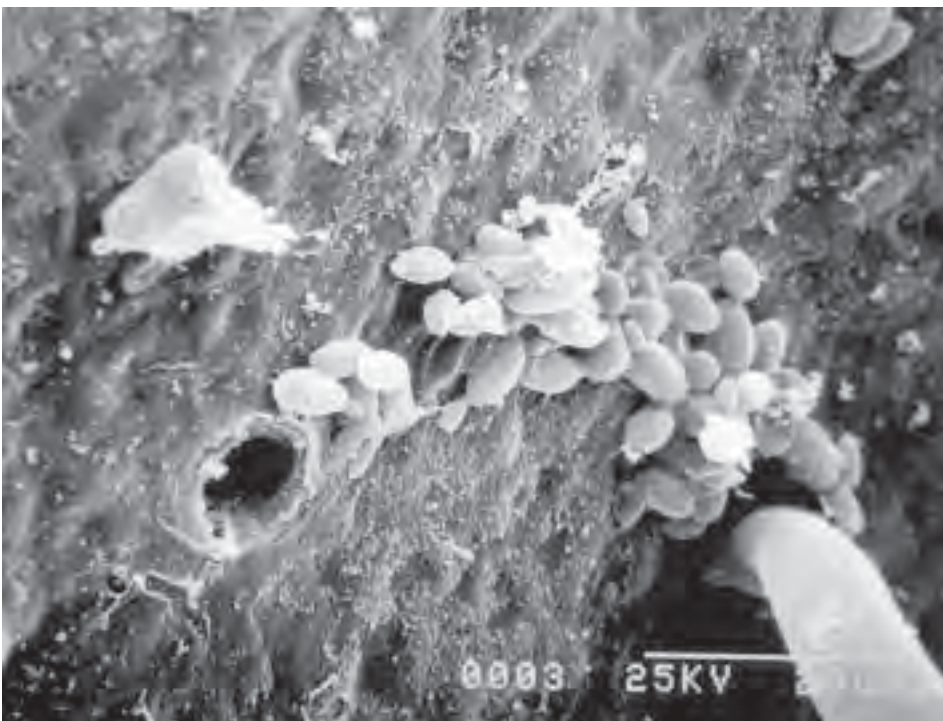
It was unanimous; all the responding consultants reported problems with fruit russet being brought to their attention by growers. Sixteen cultivars were cited as having russet problems; those listed most often fall on the grower "Top 10" list above. Golden Delicious was the worst cultivar overall for russet problems. It was clear from the responses received that growers are taking their advice in terms of russet control strategies as their top three answers on this topic were the same in both cases. Below is a synopsis of the consultants' advice:

1. Carefully select application times: avoid slow drying conditions, such as late evening; don't spray when temperatures are over 80 degrees.
2. Use Provide 2% on high-value "problem cultivars."
3. Consider the use of Captan as part of your early season scab program.
4. Avoid copper applications after 1/2" green, and oil under cool, wet conditions.
5. Always check spray mix compatibilities.
6. Avoid using emulsifiable concentrates on sensitive cultivars.

One consultant commented that russet was becoming more of a problem for several reasons: fungicides are now being applied more selectively and less frequently on a calendar type schedule; fewer fungicides are available for season-long use; and development of fungicide resistance is occurring in some orchards.

The Packers/Processors' Perspective

Responses were mixed between packers and processors. According to reports received, processing apples are rarely



Electron micrograph of *A. pullulans* spores on the surface of an inoculated McIntosh fruit. Erosion of the fruit surface was apparent within seven days.

TABLE 3

Annual losses due to fruit downgrading as a result of fruit russet.

Cultivar	# bins downgraded	Loss/bin (\$)
Cortland	500	20
Crispin	1000	10-50
Empire	300	20
Fortune	—	10-50
Fuji	6	83
Gingergold	100	20
Golden Del.	585	20-80
Jonamac	30	100
McIntosh	—	10-50
Marshall Mac	200	20
Red Del.	400	20
Red Del. Earlibrite	—	10-50

TABLE 4

Annual losses due to fruit rejection as a result of russet

Cultivar	# bins rejected	Loss/bin (\$)
Crispin	100-1,500	10-70
Fuji	—	10-50
Fortune	—	10-50
Golden Del.	100-450	30-100
McIntosh	—	10-50
Marshall Mac	1,000	100
Red Del. Earlibrite	—	10-50
Rome, Law	500	100

downgraded or rejected due to fruit russet. The response from packing houses was quite the opposite, in fact. Eighteen cultivars were reported as having russet problems; with Golden Delicious and McIntosh being the worst cultivars overall. Tables 3 and 4 show potential losses to growers during severe russet years. Packer comments were in the same vein as growers; russet is a continuing problem and overall the incidence seems to be growing. They felt russet was a concern not only in dollar losses to growers due to downgrades or rejection, but also in sales losses at retail. One commented, "If the fruit doesn't look attractive, people don't buy it. A severe russet year can make the industry as a whole look bad—like we aren't doing our job properly."

Where Does Industry Go From Here?

Fruit russet is not a new problem for apple growers. Previous research has shown that russet is a physiological response on the part of the fruit to penetration of its outer defense, the wax and cuticle layer. When this defense is breached, a wound response is initiated in an attempt to wall off the invasion. This may happen in response to cell damage from various sources such as insect feeding,

frost injury, phytotoxicity caused by certain pesticides and others. Recent research has demonstrated that two common apple fungal epiphytes, *Aureobasidium pullulans* and *Rhodotorula glutinis*, are probably important causes of fruit russet in New York orchards.

Fruit russet research efforts are being coordinated by Dr. Tom Burr and Cathy Heidenreich, from the Department of Plant Pathology, New York State Agricultural Experiment Station, Geneva, New York. Both basic and applied research are currently underway. Dr. Martin Goffinet, from the Department of Horticultural Sciences, along with his assistant Mary Jean Welser, are looking at the infection process of these fungi to determine how they initiate russet with both light and electron microscopy. Plant pathologists Dr. Wolfram Koeller and Diana Parker are also involved in the multi-disciplinary research project. They are spearheading efforts to look at the ability of the fungi to digest wax and cuticle. Along with the orchard research efforts of Burr and Heidenreich at the Experiment Station, Debbie Breth and Steve Hoying are coordinating efforts with growers to look at russet management and environmental conditions that may trigger infection periods in the orchard.

The New York State Apple Research and Development Program, a grower supported organization, and the New York State Integrated Pest Management Program have helped to fund research efforts on fruit russet in the state. Both groups provided funding for the russet survey.

Cathy Heidenreich is a research technician who works with Dr. Tom Burr. He leads Cornell's research efforts in bacteriological diseases of fruit crops in the Plant Pathology Department at Geneva. Debby Breth is a Regional Extension Educator with the Lake Ontario Regional Fruit Team, and located in Albion. She specializes in integrated pest management. Steve Hoying is a Regional Extension Educator with the Lake Ontario Regional Fruit Team, and located in Newark. He specializes in horticultural management. Kevin Iungerman is a Regional Extension Educator with the Northern NY Regional Fruit Program, located in Balston Spa. He specializes in fruit crop management. Caleb Torrice is a county extension educator who conducts a two-county fruit program in Oswego and Onondaga Counties and is located in Mexico, NY. Mike Fargione is a county extension educator who conducts a five-county regional fruit program in the Hudson Valley. He is located at the Hudson Valley Lab in Highland.