MUCK AND MINERAL

May 2010

Onion Spacing to Reduce Bacterial Rot of Fresh Market Onions

Christy Hoepting, Cornell Cooperative Extension Vegetable Program

Small-scale diversified fresh market vegetable growers who grow onions intensively are constantly challenged by yield losses due to bacterial bulb rots, which greatly compromise the profitability of the crop.

Bacterial Rot of Onions

In New York, Sour Skin caused by *Burholderia cepacia*, is the most common cause of bacterial bulb rot, but *Pantoea ananatis* has also been identified, and several others are likely part of the complex. Bacterial diseases first appear as leaf blight symptoms on the center leaves of the plant, resulting in yellowing or bleaching and wilting of these leaves. The infection progresses down the leaves and the neck, and eventually into the bulb. Affected bulb scales eventually become soft and yellowish-brown in appearance. Additional losses can occur during storage when outwardly asymptomatic bulbs at harvest continue to breakdown. It is possible that a bacterial infection may be stopped in the leaves before it reaches the bulb, but once it is in the bulb, there is nothing that can be done.

Bacteria persist in soil, water, crop debris, weeds and other crops. Infection generally occurs through a wound (caused by pelting rain, hail, thrips, herbicide or mechanical injury) when free water from rain, irrigation or flooding, causes water congestion in the host tissue. Bacteria enter the plant via contaminated water during irrigation or splashing soil during heavy rainfall events, when it settles in the leaf axils, and directly through the green neck tissue when onions are topped during harvest.

Infection may occur at any time during the growing season, but, often plants do not show symptoms until after bulbing. Bacteria spread more rapidly in water-soaked tissue, and survive, infect, develop and spread over a wide temperature range (32° to 105°F). Bacterial diseases are favored by excessive nitrogen fertilization.

Chemical tactics have failed to control bacterial diseases

Attempts have been made by several growers to control bacterial diseases in onions with copper bactericides and other chemicals such as Oxidate. However, in Pennsylvania, it has been reported that weekly sprays of various bactericides starting as early as when onion plants have just 5 leaves and continuing until the pre-harvest entry interval of the bactericide still resulted in unacceptably high incidence of bacterial disease (i.e. >30%). In order for bactericides to work, they need to be part of an Integrated Pest Management program that incorporates various cultural tactics such as plant spacing.

How does plant spacing affect bacterial rot?

Essentially, wider plant spacing produces larger plants with more leaves, thicker necks and delayed maturity. Large bushy plants are more conducive to holding water in the leaf axils and whorls, which can favor bacteria entering into the plant. Thick necks take longer to dry and remain succulent and greener for a prolonged period of time, which provides ideal conditions for bacterial diseases to spread from the leaves into the bulb. Delayed maturity interferes with proper lodging and curing of the neck and bulbs, allowing for increased risk of bacterial infections in the leaves to spread into the bulbs. It is possible for a bacterial infection that is in a leaf to be stopped before it makes its way into the bulb, if the neck tissue is no longer conducive to its spread (i.e. the tissue is dry and not green and succulent). Since narrow plant spacing produces smaller plants with thinner, tighter necks that mature on time, theoretically, these plants would have less bacterial disease and improved storability.

In an on-farm trial that we conducted in New Holland, PA in 2009, we found that compared to the grower's standard spacing (6" plant spacing, 4 rows/bed), plants grown on narrow spacing (4" with 4 rows/bed) had significantly 1 less leaf per plant, a thinner neck by 0.08" and twice as many lodged plants (narrow: 86% vs. std.: 44%) at harvest on July 16 (Table 1). Plants grown with wider plant spacing (10" with 3 rows per bed) had significantly thicker necks by 0.07" and only 7% lodged plants (Table 1).

Narrow plant spacing reduced incidence of bacterial rot to one third

In an on-farm trial that we conducted in Interlaken, NY in 2009, the grower's standard planting configuration (8" plant spacing with 4 rows/bed) resulted in 37% incidence of bacterial bulb rot at harvest compared to the narrow 4" plant spacings with 4 and 3 rows per bed, which had 13% and 14% disease incidence, respectively (Table 2). Consequently, these narrow plant spacings also had significantly higher marketable yields and economic return despite higher input costs, as a result of more marketable jumbo and colossal sized bulbs (Table 2). Although, wide plant spacings yielded more colossal weight, it was these large sized bulbs that tended to rot (data not shown).

The cost of transplants in the narrow plant spacings were 1.5 to 2 times more than for the standard planting configuration (Table 2 & 3). Despite this, the net economic return was 1.4 and 1.5 times more than the standard ($277 per 100 ft bed) for the 4 inch plant spacing configurations with 3 ($384 per 100 ft bed) and 4 ($419 per 100 ft bed) rows per bed, respectively, when the price was $0.90 per lb, irregardless of bulb size. Even in markets where the jumbo and colossal sized bulbs yield higher prices, the economic return of the narrow plant spacings was still 1.4 times more than the grower's standard plant spacing (Table 3), because many of the colossal sized bulbs were rotten and unmarketable.

Recommendations

- If you are experiencing economic losses due to bacterial rots in your onions, consider experimenting on a small scale with narrow plant spacing (i.e. 4"). Please let Maire

Table 1. Evaluation of plant spacing on small-scale fresh market sweet onions (cv. Candy) for plant size and lodging at maturity, New Holland, PA, July 16, 2009 (Hoepting, 2009).

Planting Configuration					***Plant Size[4]***		***Maturity***
Planting Density ($inch^2$/bulb)	**Number Rows per Bed[1]**	**Row Spacing (inch)**	**Plant Spacing (inch)**	**No. plants per 100 ft bed[1]**	**Number Leaves per Plant**	**Neck Diameter (inch)**	**% Lodging[3]**
24 $inch^2$	4	6	4	1200	7.86 b[2]	0.66 d	86.4 a
32 $inch^2$	3	8	4	900	8.16 b	0.69 cd	68.3 ab
36 $inch^2$ Standard	**4**	**6**	**6**	**800**	**8.83 a**	**0.74 bc**	**44.3 b**
60 $inch^2$	4	6	10	480	9.16 a	0.78 ab	7.5 c
80 $inch^2$	3	8	10	360	9.18 a	0.81 a	7.0 c
				P value:	***0.0001***	***0.0001***	***0.0004***

[1]bed width = 3 feet. [2]numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, $p > 0.05$. [3]percent lodging was estimated visually. [4]number of leaves per plant and neck diameter were counted and measured, respectively, from 10 randomly selected plants per replicate.

Table 2. Evaluation of planting configurations of small-scale pungent yellow fresh market onions (cv. Nebula) on marketable yield and grade, quality and economic return, Interlaken, NY 2009 (Hoepting 2009).

Planting Density ($inch^2$/bulb)	Planting Configuration: No. rows /bed[1]	Planting Configuration: Row spacing (inch)	Planting Configuration: Plant spacing (inch)	No. plants per 100 ft bed[1]	Total Marketable yield (lb per 100 ft bed[1])	Onion Grade (lb per 100 ft bed): Small <2.5"	Onion Grade: Medium 2.5-3"	Onion Grade: Jumbo 3-4"	Onion Grade: Colossal >4"	Bacterial Bulb Rot: lb per 100 ft bed[1]	Bacterial Bulb Rot: % by weight	Economic Return ($ per 100 ft bed): GROSS[3]	Economic Return: Cost of transplants[4]	Economic Return: NET[5]
24 $inch^2$	4	6	4	1200	510 a[2]	10.0 a	36.0 a	330 a	130 b	70	13.3 b	$459	$40.50	$419
32 $inch^2$	3	8	4	900	460 a	2.00 b	10.0 b	190 b	270 a	70	13.8 b	$414	$30.38	$384
48 $inch^2$ standard	4	6	8	600	330 b	0.00 b	6.00 bc	50.0 c	270 a	180	37.3 a	$297	$20.25	$277
60 $inch^2$	4	6	10	480	220 bc	1.00 b	0.00 c	20.0 c	200 ab	170	41.5 a	$198	$16.20	$182
80 $inch^2$	3	8	10	360	160 c	0.00 b	1.00 c	10.0 c	130 b	190	53.6 a	$144	$12.15	$132
P Value:					***0.0001***	***0.0046***	***0.0000***	***0.0000***	***0.0352***	***NS[6]***	***0.0064***			

[1]Bed width = 3 ft. [2]numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, $p > 0.05$. [3]GROSS = marketable yield x $0.90 per pound. [4]cost of transplants = $1.35 per 40 plants (=$0.03375 per plant). [5]NET = GROSS minus cost of transplants, all other expenses equal. [6]NS = not significant.

Table 3. Evaluation of planting configurations of small-scale pungent yellow fresh market onions (cv. Nebula) on economic return, using variable pricing of PA sweet onions, 2009 (Hoepting 2009).

Planting Density ($inch^2$/bulb)	Planting Configuration: No. rows /bed[1]	Planting Configuration: Row spacing (inch)	Planting Configuration: Jumbo 3-4"	No. plants per 100 ft bed[1]	$ per size class (per 100 ft bed[1])[2]: Small $0.20/lb	Medium $0.40/lb	Jumbo $0.50/lb	Colossal $0.55/lb	Economic Return ($ per 100 ft bed): GROSS[3]	Economic Return: Cost of transplants[4]	Economic Return: NET[5]
24 $inch^2$	4	6	4	1200	$2.00	$14.40	$165.00	$71.50	$252.90	$24.00	$229
32 $inch^2$	3	8	4	900	$0.40	$4.00	$95.00	$148.50	$247.90	$18.00	$230
48 $inch^2$ standard	4	6	8	600	$0.00	$2.40	$25.00	$148.50	$175.90	$12.00	$164
60 $inch^2$	4	6	10	480	$0.20	$0.00	$10.00	$110.00	$120.20	$9.60	$111
80 $inch^2$	3	8	10	360	$0.00	$0.40	$5.00	$71.50	$76.90	$7.20	$70

[1]Bed width = 3 ft. [2]size class distribution from Table 1. [3]GROSS = sum of $ per size. [4]cost of transplants = $0.02 per plant. [5]NET = GROSS minus cost of transplants, all other costs equal.

Ullrich know if you are interested in trying narrow plant spacing, as we would be very interested in seeing it on your farm.

- Practice good field sanitation by not leaving rotten cull onions in the field. Even if you practice good crop rotation, the bacteria will build up in your fields over time.
- Do not apply nitrogen after bulbing has begun, as this can increase bacterial problems.
- Say tuned! Plans are underway (funding pending) to continue this research in 2010 and 2011 in NY and PA.

Acknowledgements

Funding for this project was provided by a NESARE Partnership Grant, for which CVP's Christy Hoepting was project leader and Judson Reid and Katie Klotzbach were collaborators. We'd like to thank our grower cooperators, Eli Stoltzfus in Interlaken, NY and Amos Lapp in New Holland, PA, and Agriculture Educator in Lancaster Co., PA, Jeff Stolzfus.

Editor's Note: I know this is a bit late for this year but....you can apply some of the other recommendations and keep this in mind for next year as more trials are done. MU

Because a romaine outbreak occurred this month:

Consumers' Response to the 2006 Foodborne Illness Outbreak Linked to Spinach

Following a Government warning to avoid bagged spinach because of possible *E. coli* O157:H7 contamination, spinach sales fell but expenditures for total leafy greens remained unchanged.

Carlos Arnade, Linda Calvin, Fred Kuchler, USDA Economic Research Service,
Amber Waves*, March 2010*


Charles Dharapak, Associated Press

- Consumers responded to the Food and Drug Administration's September 2006 warnings to avoid eating spinach because of possible contamination with *E. coli* O157:H7.
- While spinach expenditures fell, consumers turned to other leafy greens as substitutes.
- The longer term drop in retail expenditures on fresh spinach products was almost matched by gains in expenditures on other leafy greens.

It has been over 3 years since an outbreak of *Escherichia coli* O157:H7 prompted the U.S. Food and Drug Administration (FDA) to issue warnings about the safety of fresh bagged spinach and to advise consumers not to eat it. FDA's announcement had the potential to prevent additional illness, and the shortrun consequences were clear. Less certain, however, were how long consumers would avoid spinach, the impact on consumption of other leafy greens, and the cost to the produce industry. While other foodborne illness outbreaks may provide some insight into consumer response, the actual response varies with the characteristics of the commodity, outbreak, and information consumers receive (see "Peanut Processing and Sales Hold Steady After Peanut-Product Recalls" for an example of consumer response to another outbreak).

The human costs of the outbreak linked to spinach were relatively easy to count. Consumers in 26 States and one Canadian Province fell ill, resulting in 204 illnesses, including 104 hospitalizations, 31 cases of hemolytic-uremic syndrome (a serious complication), and 3 deaths. It is now possible to look back at the outbreak and examine how consumers responded to the surprising news that eating spinach—a food recommended by nutritionists—was linked to an outbreak. Did consumers make fine distinctions among foods based on new safety information?

ERS research revealed that consumers generally responded specifically to FDA's announcement; spinach sales plunged, but consumers did not panic about other vegetables. The short-term impact was a drop in demand for all leafy greens, as consumers briefly substituted other vegetables for leafy greens. Over the long term, consumers shifted purchases among leafy greens, but total expenditures for leafy greens did not change.

FDA Acted Quickly To Contain Outbreak

On September 14, 2006, FDA announced that consumers should not eat bagged spinach. Epidemiological evidence pointed to bagged spinach (fresh ready-to-eat spinach that comes into retail stores already in bags) as a possible cause of an ongoing multistate foodborne illness outbreak of the potentially deadly bacterium *E. coli* O157:H7. The next day, FDA expanded the warning to include all fresh spinach—both bulk and bagged. Bulk spinach refers to fresh spinach sold in bunches or loose for consumers to bag.

FDA had never made such a sweeping statement about U.S.-grown produce. Stores and restaurants immediately removed spinach from their shelves and menus. Spinach harvesting and marketing ceased, and there was no U.S. fresh spinach on the market for 5 days until FDA announced spinach grown in some areas was safe to consume. The main spinach production area was off the market for an additional 10 days until cleared by FDA.

FDA's announcement was unique in several ways. Typically, by the time an outbreak associated with fresh produce is detected and the contaminated item is identified, the outbreak is over and the product in question has long since been consumed or discarded. As a result, there is usually no benefit to warning consumers about consumption of contaminated fresh fruit and vegetables, and such warnings are rare. In contrast, the spinach warning occurred while the outbreak appeared to be ongoing and, in effect, created a daily conversation between FDA and the public that continued for weeks.

On September 29, FDA announced that "spinach on the shelves is as safe as it was before this event." At that time, the contaminated product was no longer in the marketplace. While the FDA had identified the contaminated product—one brand of bagged spinach—it could not determine exactly how the spinach had become contaminated. It was not obvious that consumers would view the "all clear" as a call to return to their initial consumption patterns.

Uncertainty About Consumer Response to the Outbreak

In the wake of the outbreak, spinach growers faced considerable uncertainty, not knowing how far sales would fall, whether consumer demand would return to previous levels, and, if so, how long it would take. Amid massive publicity and temporary closure of the U.S. fresh spinach market, total fresh spinach sales declined. The magnitude and duration of consumers' response to the outbreak would depend on how consumers perceived their risk had changed.

It was even less certain how the spinach warning would affect consumption of lettuces, such as iceberg, leaf, and romaine, which make up the bulk of the leafy greens market. Consumers typically substitute one product for another based on relative prices; when spinach is expensive but romaine is cheap, consumers may buy romaine. However, consumers may also substitute based on food-safety characteristics. The FDA announcement surprised consumers and acted as a market shock that disrupted typical purchase patterns. In such a case, consumers may turn from spinach to another leafy greens product they think is safer—the other leafy greens product could be considered a shock substitute.

Although other leafy greens were not implicated in the outbreak, other bagged leafy greens have similar packaging and brand names and are displayed on the same shelves in grocery stores. Those attributes could have led consumers to conclude that the similar-looking products were equally risky. Consumers might have reasoned that all other leafy greens were produced under similar growing and packing conditions, and consumption of these products would have fallen along with spinach. Similarly, the reputation of other bulk leafy greens might have also been tarnished by the spinach problem. In such a case, these products could be considered shock complements.

Total Consumer Expenditures Were Nearly Constant But Shifted Among Types of Leafy Greens

To investigate how consumers responded to the 2006 spinach food safety announcement, ERS used retail market scanner data for 2004-07—140 weeks before the spinach shock and 68 weeks after (including the week of the outbreak announcement). Researchers developed a model of consumer demand for six categories of leafy greens, including bagged and bulk spinach, and used standard statistical techniques to determine how consumer demand changed in response to the FDA warnings.

Many factors affected consumer behavior—new information on food safety, prices, seasonal patterns of leafy greens purchases, and long-term trends in the industry. The model results isolated the impact of the food safety warning about spinach and were used to simulate expenditures if the food safety shock had not occurred, as well as to simulate expenditures with the shock (see box, "Researchers Model Leafy Greens Demand"). With two consistently generated simulations, it was possible to calculate the changes in expenditures due to the outbreak.

The analysis showed that consumers slightly reduced total leafy greens expenditures in favor of other vegetables but returned to their previous total leafy greens expenditure levels by 16 weeks after the outbreak was announced. The major change was a shift in expenditures among the six categories of leafy greens. Expenditures on all commodity groups except bagged salads without spinach showed a substantial immediate response, mostly in the first few weeks after the announcement. The magnitude and duration of the impact varied by commodity.

Shifts in consumer demand for leafy greens were occurring before the 2006 *E. coli* outbreak

Commodity	Share of leafy greens sales volume, 2005	Change in sales volume	
		2004-05[1]	2005-06[2]
	Percent		
Bagged spinach	7	7	11
Bulk spinach	2	-8	-3
Bagged salads without spinach	47	1	-6
Bulk iceberg lettuce	24	-3	-6
Other bulk lettuce	13	-2	-3
Romaine hearts	7	13	10
All leafy greens	NA	1	-3
All other vegetables	NA	3	0

NA=not applicable.
[1]Comparison of January through December data.
[2]Comparison of January through August data.
Source: USDA, Economic Research Service using data from Information Resources, Inc. and FreshLook Marketing.

Bulk spinach expenditures rebounded, but bagged spinach expenditures lagged

Commodity	Week[1]	Difference in expenditures[2] *Percent*
Bagged spinach	Maximum difference—week 3 Difference at week 26 Difference at week 68	-63 -17 -10
Bulked spinach	Maximum difference—week 1 Difference at week 26 Difference at week 68	-32 -2 -15
Bagged salads without spinach	Maximum difference—week 11 Difference at week 26 Difference at week 68	-4 3 3
Bulk iceberg lettuce	Maximum difference—week 1 Difference at week 26 Difference at week 68	13 7 5
Other bulk lettuce	Maximum difference—week 1 Difference at week 26 Difference at week 68	20 6 0
Romaine hearts	Maximum difference—week 1 Difference at week 26 Difference at week 68	13 5 -7
Total leafy greens	Maximum difference—week 1 Difference at week 26 Difference at week 68	-7 0 0

[1]The outbreak announcement was made on Thursday of week 1. A week is defined as the Monday through Sunday sales week.
[2]Difference in simulated expenditures (with and without a shock) as a percent of simulated expenditure without a shock.
Source: USDA, Economic Research Service model results.

The maximum gap observed between simulated expenditures with and without the shock was for bagged spinach. Simulated expenditures fell 63 percent below where they would have been without the shock in the third week after the FDA announcement. Even after 26 weeks, simulated expenditures were still 17 percent below simulated spending if the *E. coli* outbreak had not occurred. By week 68 (the last week of data), simulated expenditures on bagged spinach were still down 10 percent, but the gap was narrowing.

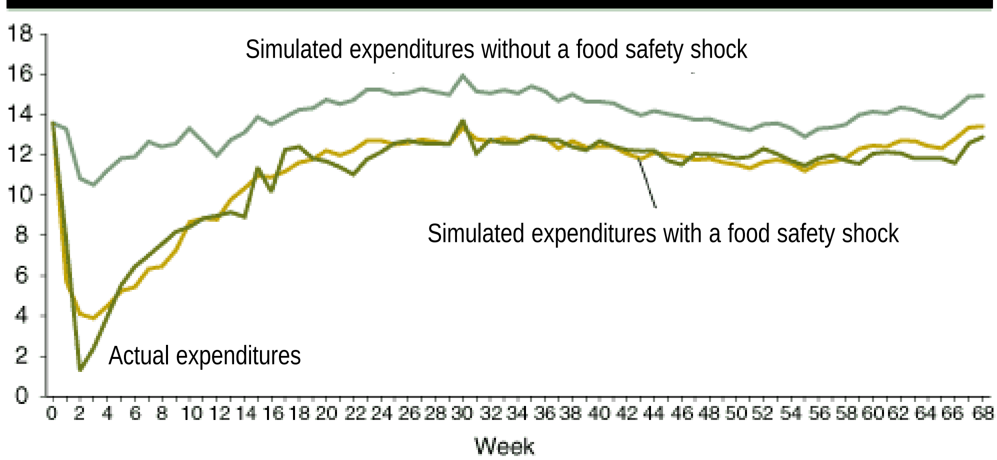
In the first week of the outbreak, simulated expenditures for bulk spinach were 32 percent below what they would have been in the absence of the announcement. At week 26, simulated expenditures were still down 2 percent. By week 31, however, simulated bulk spinach expenditures were above what they would have been without a shock.

Consumers seemed to have faced two concerns—the safety of spinach in general and, more specifically, of bagged products. Although FDA warned about eating bagged and bulk spinach, the contaminated product was bagged spinach. Following the FDA announcement, several scientists were widely quoted in the media saying that the bagged salad production process was risky. Whether the statement was true or not, some consumers appeared to have viewed bulk spinach as the less risky of the two products. Sales of bulk spinach had been showing a long-term decline prior to the outbreak, but this trend was at least temporarily reversed following the *E. coli* outbreak. At the end of 68 weeks, simulated bulk-spinach expenditures were 15 percent above where they would have been without the outbreak.

Bulk iceberg lettuce, other bulk lettuce, and romaine hearts were clearly shock substitutes, as consumers spent more on these products following the announcement than they would have if there had not been an outbreak. In the first week of the outbreak, simulated expenditures for these three products were 13-20 percent above what they would have been without a shock. By week 26, they were still 5-7 percent higher.

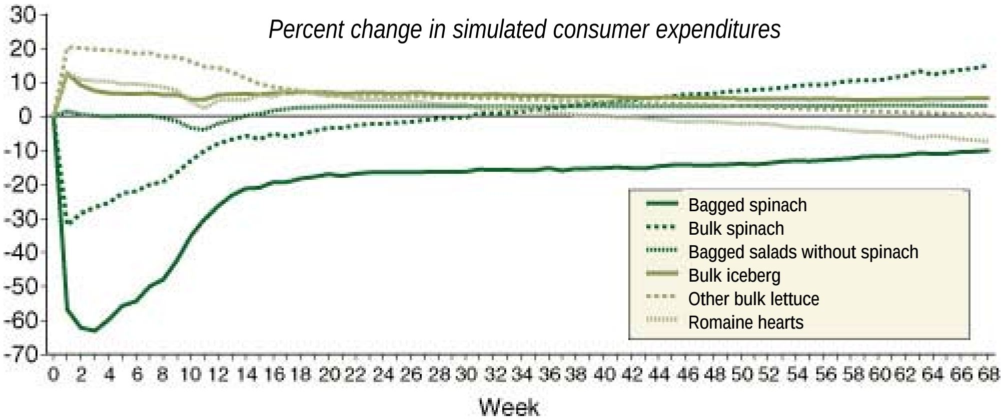
By the end of the 68-week period, consumer expenditures on bulk iceberg lettuce appeared to hold steady at about 5 percent above where they would have been without

Bagged spinach expenditures plunged in response to FDA announcement, Sept. 2006 - Dec. 2007



Note: Week zero is the week prior to and week 1 is the week of the announcement. Since the data are weekly and the 5 days when there was no spinach on the market were spread over weeks 1 and 2, the figure does not show actual expenditures falling to zero. Source: USDA, Economic Research Service model results.

Consumer response to FDA announcement varied by type of leafy greens, Sept. 06 - Dec. 07.



Note: Week zero is the week prior to and week 1 is the week of the announcement. Source: USDA, Economic Research Service model results.

Bagged salads without spinach were the only nonspinach product with declining expenditures shortly after the announcement, indicating that consumers were concerned about bagged products in general, not just spinach. By week 14, consumer expenditures for bagged salads without spinach increased above the no-announcement scenario, again becoming a shock substitute. Expenditures quickly settled into what appeared to be a longer term increase of about 3 percent.

the shock. Consumer expenditures on other bulk lettuces continued a slow but persistent decline from their peak just after the outbreak; at the end of the 68-week period, simulated expenditures on these products were virtually unchanged from what they would have been if the outbreak had not occurred.

Bagged salads without spinach showed the most complicated response to the shock. In the first week of the outbreak, expenditures were up 1.5 percent—just barely a shock substitute. The change in expenditures hovered around zero for the first 7 weeks followed by 6 weeks of expenditures below expected levels—a shock complement.

Declining Spinach Expenditures Nearly Balanced by Increases in Other Leafy Greens

ERS researchers looked at the cumulative effect of the shock on expenditures over 68 weeks—from the FDA announcement to the end of the data series. Expenditures were discounted over time to reflect a January 1, 2008, value.

- Total retail expenditures on bagged spinach declined $201.9 million in the first 68 weeks after the FDA announcement—20 percent below simulated expenditures without a shock.
- Bulk-spinach expenditures fell $0.6 million (1 percent), with a $3.8 million loss over the first 30 weeks of the outbreak, followed by a gain of $3.2 million in the last 38 weeks.

RESEARCHERS MODEL LEAFY GREENS DEMAND

The ERS analysis used national, weekly point-of-sale retail scanner data, including weekly total expenditures and quantities purchased, and per pound prices. The data included large grocery stores but not mass merchandisers, such as Wal-Mart and Costco, farmers' markets, or natural food stores. Retail scanner data included all food items scanned by grocery clerks. Because there is a wide range of products that vary by packaging, manufacturers, and degree of value added (bulk lettuce vs. ready-to-eat bagged salads), the scanner data was aggregated into six leafy greens products: bagged spinach, bulk spinach, bagged salads without spinach, bulk iceberg lettuce, other bulk lettuce, and romaine hearts. Bagged spinach includes bagged spinach intended as salad; bagged salads with spinach, including bagged spring mix, which often contains spinach; and bagged spinach that may have been intended for microwaving but could have been consumed as a salad. Bulk spinach includes bulk spinach and bulk spring mix.

The data covered a 4-year period, 140 weeks before the *E. coli* announcement and 68 weeks after (including the week of the outbreak announcement). Using a long data series allowed for separating the effects of prices and trends in leafy greens consumption and isolating the impact of the FDA announcement. ERS researchers used a demand model to estimate the effect of the shock and develop simulations of both expenditures following the shock and the expenditures if the shock had not occurred. The simulation comparison provides estimates of how far expenditures varied from what they would have been without the shock.

Including variables to represent the consumer response to the outbreak was challenging. Consumer response to the announcement could take many forms. Since the exact form the response might take was not known beforehand, the model was designed to be flexible enough that market data would reveal the form. To that end, the model employed a set of five shock variables that together could highlight the effects of the FDA announcement on retail food demand. The response could be permanent or transitory. One permanent shock variable was included. Transitory responses could begin decaying immediately or could grow before decaying. Each type of transitory variable was included twice—one with a rapid decay rate and one with a slow decay rate.

◆ Expenditures for bagged salads without spinach increased $63 million, or 2 percent, including a net loss of $3.9 million in the first 13 weeks of the outbreak (larger than the total loss of bulk spinach in 30 weeks), followed by a $66.9 million gain. Expenditures on bulk iceberg increased 6 percent; other bulk lettuce, 7 percent; and romaine hearts, 2 percent.

◆ The sum of all changes in expenditures yielded a loss of $60.6 million, a 1-percent decline in leafy greens expenditures below simulated expenditures without a shock.

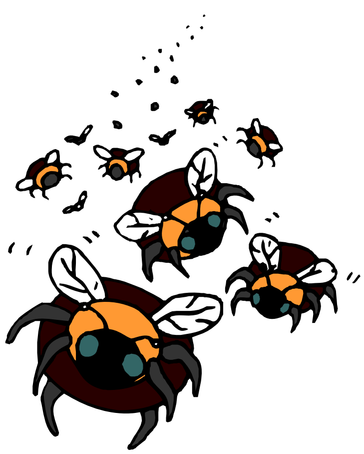
The ERS analysis suggests that many consumers can and do use all the information they are given about product contamination to make fine distinctions among food products. The analysis of retail sales suggests that consumers rapidly responded to FDA's information. Understanding and using the relationship between information released by public health authorities and consumer behavior has important health as well as financial consequences. To minimize sales losses at the retail level, public health authorities may need to act as quickly as possible to provide consumers all the information they have about which products are risky and which are not.

Pollinator Toolkit Available for Organic Farmers

Organic farming offers many benefits to pollinators but some common organic-approved pesticides and practices can be potentially just as harmful to bees and other pollinators as conventional farming systems. The Xerces Society has developed Organic Farming for Bees, a tool kit for organic growers that includes guidance on how to minimize disturbance to pollinators from farm activities, and how to provide nest sites and foraging patches. In particular, two fact sheets provide information on toxicity to native pollinators for all major organic-approved insecticides and about pollinator-friendly organic farming practices. To learn more visit *www.xerces.org/organic-farms/*.

Managing Alternative Pollinators: A Handbook for Beekeepers

A new book, Managing Alternative Pollinators: A Handbook for Beekeepers, Growers, and Conservationist, is now available from NRAES. The handbook is a first-of-its-kind, in-depth, full-color guide to rearing and managing bumble bees, mason bees, leafcutter bees, and other alternative to honey bee pollinators. The 162 page book features 130+ color photos, 10 chapters, 7 appendices, nest construction details, parasite and disease management guidelines, and much more. For more information about NRAES visit www.nraes.org or phone 607-255-7654.



New Series on Economics of Growing Alternative Crops

Thinking about trying a new enterprise? Before taking the plunge, you'll want to check out the capital, labor and management requirements for the alternative agricultural production possibilities. A new series of crop and livestock enterprise budgets available from the Leopold Center for Sustainable Agriculture and the Beginning Farmers Center at Iowa State University gives farmers a quick overview of when alternative operations might work for them and how. Enterprise budgets for sweet corn, sorghum, popcorn, sheep and beekeeping are provided initially. Budgets covering Christmas trees and raspberries will appear soon. The crop budget sheets can be download at *www.leopold.iastate.edu/pubs/enterprise.html.*

2009 Elba Muck Soil Nutrient Survey Results Summary, Part III: Calcium, Magnesium and Micronutrients

Christy Hoepting, Cornell Cooperative Extension Vegetable Program

Introduction

This is the final part of a 3-part newsletter article that describes the general nutrient status of the Elba muck land, based on a survey conducted in spring of 2009. In response to a finding that the Elba muck land was a major source of pollution into its local water shed, the Oak Orchard, delivering excessive amounts of phosphorus and nitrogen, free soil nutrient tests were conducted for Elba muck growers in hopes that they would apply nutrients according to the needs of their soils. In total, soil samples were taken from 21 "fields" or "blocks" which were approximately 10, 25, 50 or 100 acres in size, and often consisted of several fields. Two to 20 sub-samples were taken per "field/block" for a total of 160 sub-samples. Samples were analyzed by the Cornell Nutrient Analysis Laboratory (CNAL).

All of these soil test results were summarized by Christy Hoepting, Onion Specialist, Cornell Cooperative Extension Vegetable Program (CCE-VP). In addition to calcium, magnesium and micronutrients, all information from the soil tests including organic matter, pH, phosphorous, nitrogen and potassium, were reviewed and opportunities for improved nutrient management for onion production suggested. It is hoped that this will mark the beginning of collaborative efforts among onion growers, CCE-VP, Soil and Water Conservation Districts and EPA to reduce nutrient loading into the Oak Orchard and other water sheds, but also to improve onion yield and profitability by optimizing nutrient management.

In Part I and II of this article, opportunities for improved soil management were identified:

1) 13% of the soil sub-samples had less than 20% OM with the lowest reading being 2.4%. As OM decreased, pH increased. Some of this ground is being used to grow onions and should be managed differently with respect to fertility and certain pesticide applications.
2) A shift towards higher pH has occurred in the Elba muck land: 65% of the fields/blocks had pH higher than the optimum. Above pH 5.8 to 6.0, manganese (Mn), zinc (Zn), boron (B) and phosphorus (P) are tied up and can become deficient.
3) It is not possible to reduce soil pH by applications of sulfur on the calcareous/marly muck soils of the Elba muck land. Instead, pH, Mn and P need to be managed by using acidifying fertilizers applied in a band and foliar sprays.
4) 25% of fields had excessive levels of phosphorous, growers could cut P fertilizer for 3 years!
5) Phosphorous can become deficient where soil pH is greater than 7.0, which needs to be remedied by banding an acidified fertilizer and using foliar sprays.
6) Soil levels of potassium were generally excessive with some fields not likely needing additional K inputs for several years.
7) There is much opportunity to improve the efficiency of N use in onion production by using PSNT tests, experimenting with using less N fertilizer in the spring and adding more if necessary according to a PSNT, experimenting with controlled release fertilizers and nitrogen inhibitors, and planting cover crops in the fall to capture N that is not used up by the onion crop. Ultimately, growers can save money on N input costs while reducing environmental pollution.

Calcium and Magnesium are abundant, foliar applications of Ca are not necessary

Calcium (Ca) and magnesium (Mg) are secondary plant nutrients that are abundant in the Elba muck land. An early Cornell study conducted in the Elba muck land showed that a single 450 cwt per acre onion crop removed 60 and 5 lbs of Ca and Mg, respectively. According to the Cornell recommendations, Ca soil levels are considered low when there is less than 1000 lbs per acres, soil levels are medium when there are 1000 to 2000 lbs per acre, and are high when there is more than 2000 lbs per acre. According to the 2009 Elba muck soil survey, the majority (67%) of the fields/blocks had calcium levels between 20,001 and 30,000 lbs per acre; an additional 19% had levels higher than this with the highest recording of a sub-sample being 48,380 lbs

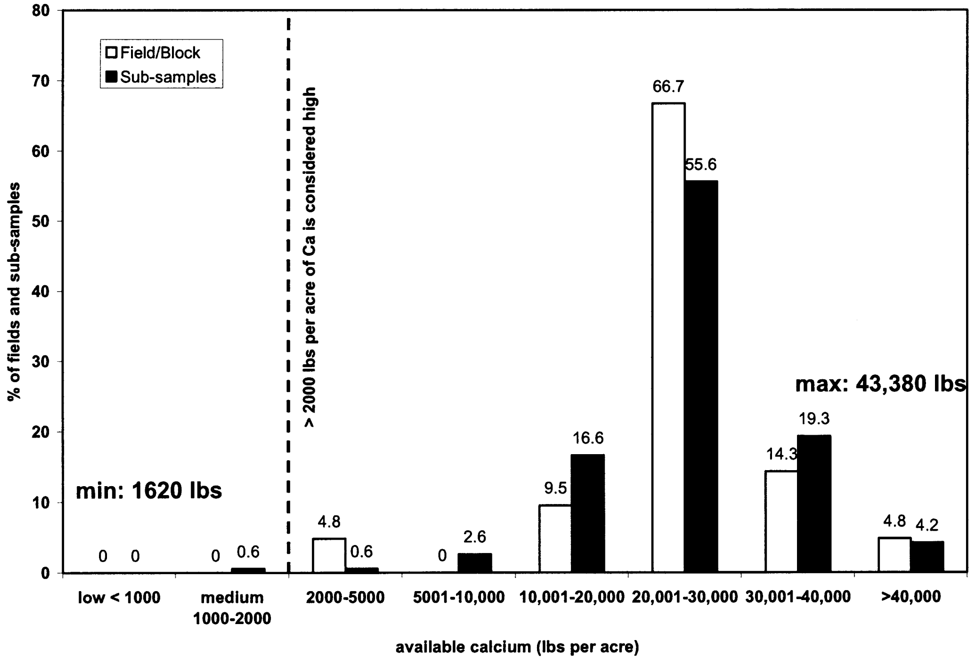


Figure 1. Soil survey, Elba muck, Spring 2009: Available calcium for 21 fields/blocks and 160 sub-samples.

Ca per acre (Figure 1). No fields/blocks had Ca levels less than 2000 lbs, although the lowest sub-sample was 1620 lbs per acre.

According to the Cornell recommendations, Mg is considered high when it is between 200 and 500 lbs per acre. In the Elba muck soil survey, the lowest recording of Mg was 220 lbs per acre (Figure 2)! The majority (86%) of the fields/blocks had Mg levels between 1000 and 3000 lbs per acre with the highest recording of a sub-sample being 3700 lbs per acre!

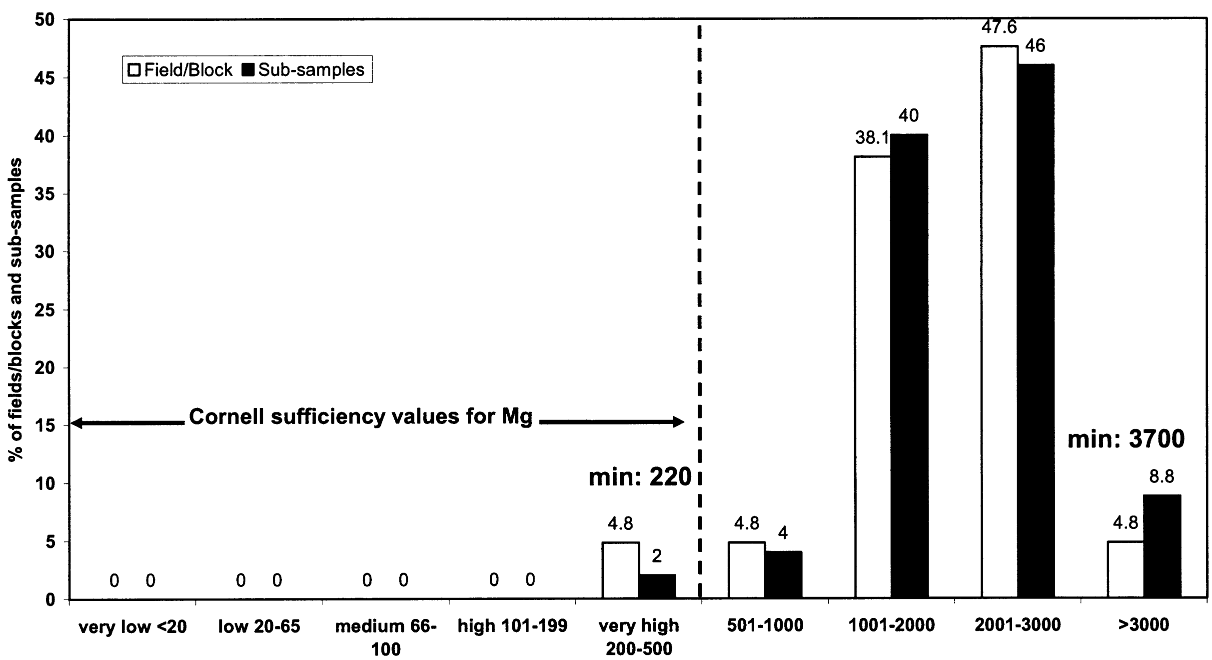


Figure 2. Soil survey, Elba muck, Spring 2009: Available magnesium for 21 fields/blocks and 160 sub-samples.

As organic matter is decomposed, Ca and Mg are released and levels may nearly double over a 10 year period. With the Elba muck land having been farmed for almost 100 years, and the underlying material being marl, such high levels of Ca and Mg may actually not be as surprising as they first seem. In the Elba muck survey, there was a trend that as organic matter (OM) increased, Ca increased. The lowest Ca levels in the survey (< 5000 lbs per acre) occurred where the soil OM was less than 10%.

Calcium and Mg bind very strongly to the exchange sites on organic matter in muck soils, and compete with binding sites with K. In the 2009 Elba muck land survey, it did not appear that the high levels of Ca and Mg reduced the availability of K, due to the generally excessively high levels of K (see Part II). Instead, there was a slight trend that as Ca and Mg increased, K also increased. Where the soil level of K was low (<200 lbs per acre), the Ca levels ranged from 10,000 to 30,000 lbs per acre (data not shown). In the soil sample that had the highest level of K (6790 lbs per acre), the Ca was >35,000 lbs per acre.

The availability of Ca and Mg can be reduced when pH falls below 5.0 or rises above 6.0. With the excessive soil levels in the Elba muck land, there was no relationship between pH and Ca and Mg. In the sub-sample where the pH was the lowest (4.6), Ca and Mg were 23,030 lbs and 1450 lbs per acre, respectively. Above pH 6.0, soil levels of Ca and Mg were evenly distributed from very high to extremely high. Calcium and Mg are moved to plant roots in water; if at all, a deficiency would more likely occur when soil conditions are very dry.

Although foliar application of Ca has proven beneficial in places where onions are grown on sandy loam soils, such as in Georgia, this was not the case in several studies conducted on muck soil in Michigan. Three foliar applications of 36% calcium chloride applied at 10, 20 and 30 gal per acre at the 4-5 leaf stage followed by 2 subsequent applications 2 weeks apart, did not improve onion yield or bulb size. In fact, any more than 2 applications of the 10 gal per acre rate reduced yield and the highest rates caused severe leaf injury. The recommended rate of 10 gal of 36% calcium chloride in 30 gal water supplies 15 and 27 lbs per acre of calcium and chloride, respectively, per application; the chlorine may be what is causing the injury. Given the very high soil levels of Ca in the Elba muck land, it is very unlikely that an onion crop would benefit from foliar applications of Ca, unless, perhaps soil conditions were extremely dry. Caution should be used when using calcium chloride as a source of Ca, because it can cause foliar injury.

Magnesium can become deficient if the ratio of Ca: Mg is greater than 10:1. In the Elba muck survey, 81% of the fields had a Ca: Mg ratio between 10 and 15, 10% had a ratio higher than 15, while only 6% had a ratio less than 10. Despite this disproportion between Ca and Mg, and the shift towards the muck having a pH above the optimal range, available Mg occurs at extremely high levels in the Elba muck, and a Mg deficiency would be very rare. In most situations, addition of calcium and magnesium is not necessary. When calcium or magnesium is in a fertilizer used primarily to supply another nutrient its effect would be non consequential.

Manganese is abundant in the Elba muck - are additions of Mn fertilizer really beneficial?

Onions are sensitive to manganese (Mn). A Cornell study conducted in the Elba muck land showed that a single 450 cwt per acre onion crop removed 2.8 oz per acre of Mn; thus, it would take about 6 years to remove 1 lb. According to Cornell recommendations, the potential for plant toxicity from Mn is considered low, medium and high when soil concentrations are less than 10, 11 to 50 and 51 to 100 lbs per acre, respectively. In the 2009 Elba muck survey, 57% and 38% of the fields/blocks had a medium and high potential for toxicity, respectively (Figure 3). Sixteen percent of the sub-samples had soil levels of Mn greater than 100 lbs per acre with the highest recording being 725 lbs per acre! Despite such high levels, Mn toxicity generally only occurs when the soil pH is near or below 5.0. When the pH is above 6.0 it would be quite unusual for Mn to be toxic.

Below pH 5.0, Mn availability is greatly increased and is taken up in toxic amounts. Symptoms of Mn toxicity are similar to Mn deficiency and include chlorosis, leaf die back and stunted roots. It can occur when soil levels are 70 to 100 lbs per acre, especially when Al and Fe are also high. In the 2009 Elba muck land survey, Mn availability was high (> 50 lbs per acre) in all of the 6 sub-samples where the pH was 5.0 or less (Figure 4). However, where the highest recordings of Mn (> 250 lbs per acre) occurred, the pH was within the optimal range of 5.2 to 5.8. In fact, of the 80 sub-samples that had high potential for toxicity, 67 (83.7%) of them occurred within the optimum pH range for growing onions on muck. In general, levels of Mn have increased compared to a muck soil survey of all of New York State that was conducted in 1953 and 1954. In this survey, 44% of 585 samples had low levels of Mn (compare to 0% in Elba 2009), 33% were medium (compare to 57% in Elba in 2009), 16% were high (compare to 38% in Elba 2009) and 7% had more than 100 lbs per acre (compare to 5% in Elba 2009). The abundance and apparent increase in available Mn in the Elba muck, begs the ques-

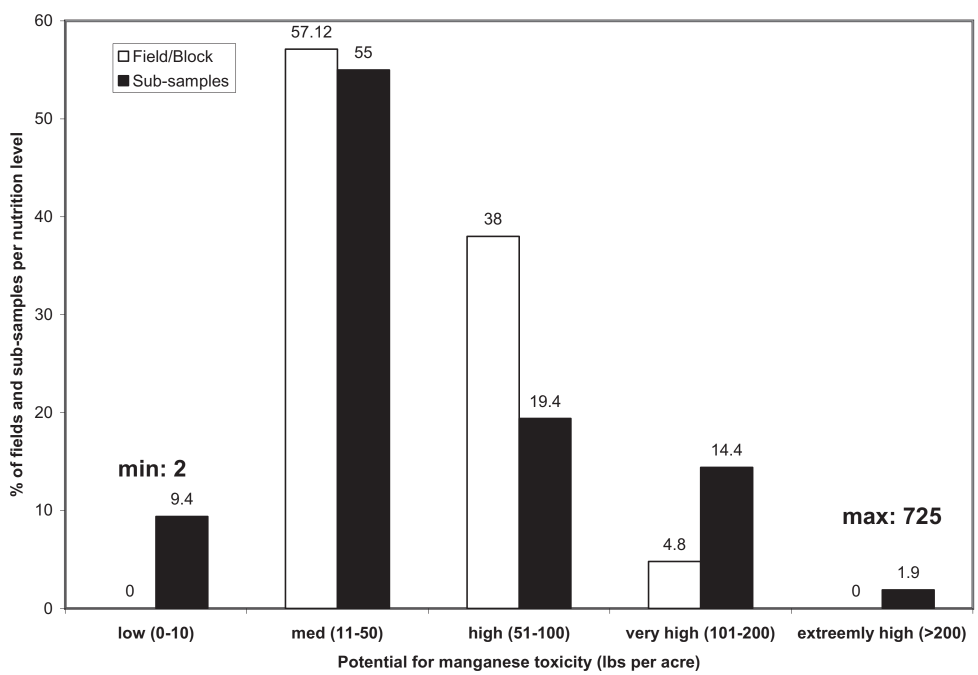


Figure 3. Soil survey, Elba muck, Spring 2009: Available manganese for 21 fields/blocks and 160 sub-samples.

tion whether additions of Mn fertilizer are beneficial? Closer attention to high soil Mn levels and the potential of Mn toxicity to onions is warranted.

Manganese can be deficient when pH is above 6.5

Availability of Mn is reduced when pH is greater than 6.0 and is most likely to be deficient in muck soils when pH is above 6.5. Manganese deficiency symptoms in onion include slow growth, curling of leaves, light colored foliage, burning of leaf tips, delayed bulbing, and thick necks. In the 2009 Elba muck survey, there was a trend that availability of Mn decreased as pH increased (Figure 4). The lowest recorded available Mn (2 lbs per acre) occurred where the pH was 6.7 and 7.2. Out of the 10 sub-samples where Mn was low (<10 lbs per acre), 9 (90%) of them had a pH of 6.0 or greater. However, the available Mn in the sub-sample with the highest pH (7.6) was high (81 lbs per acre). In the Elba muck land, higher pHs tended to occur where OM was less than 20%, or in shallow muck areas. These are the areas where a Mn deficiency would most likely occur. It is important to not assume that there will be a Mn deficiency in shallow muck or where pH is high, because this was certainly not always the case, another reason to have soils tested regularly.

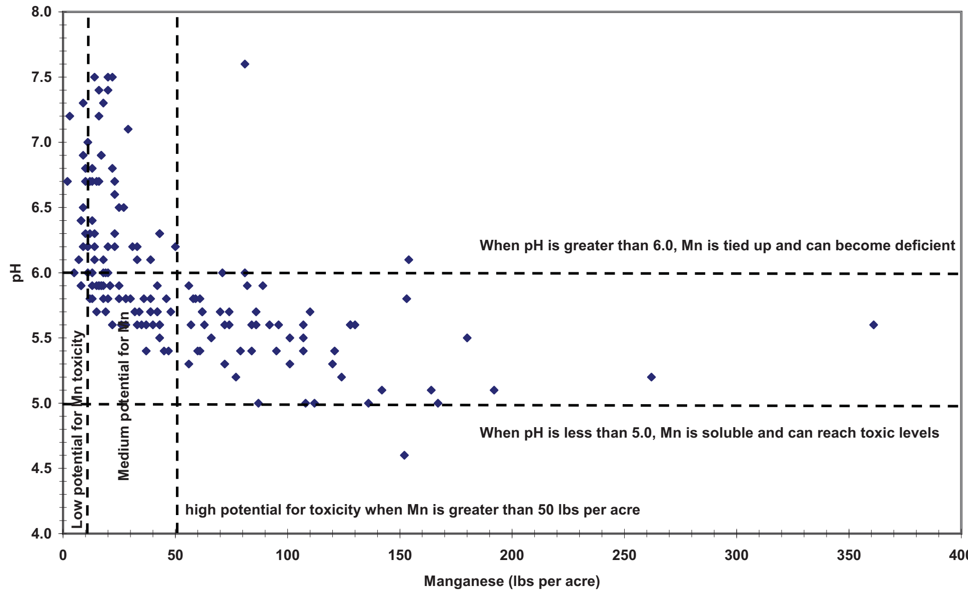


Figure 4. Soil survey, Elba muck, Spring 2009: relationship between pH and available manganese in 21 fields/blocks and 160 sub-samples.

Onions are highly responsive to additions of Mn when soil tests are low. When pH is above 6.0, soil applied Mn is readily bounded into unavailable forms. Therefore, to remedy an Mn deficiency, Mn should be applied to soil only as a band in an acid forming fertilizer, such as manganese sulfate. When soil pH is high, using this technique will also increase the availability of phosphorus, boron and zinc. In addition to applying Mn to the soil in an acidic fertilizer band, foliar applications, may also be necessary. In a Michigan study of onions grown in muck soils, application of 2 lbs per acre of Mn as manganese sulfate at the 2-3 and 5 leaf stages, increased total yield by 10 to 80% and the percentage of bulbs > 2.5 inches by 10 to 90%. It is unknown how the soil levels of Mn in these studies compares to the Elba muck land, because each university uses different soil testing procedures. In 2010, we will send some soil samples to both laboratories to compare results.

High soil levels of nitrogen may also induce a Mn deficiency. This did not appear to be an issue in the Elba muck land. Out of 14 sub-samples where available nitrogen levels were very high (> 150 lbs per acre), in only one (14%) of them was the level of Mn low (< 10 lbs per acre) (data not shown).

Zinc also plentiful in the Elba muck land

Zinc is an important micronutrient to onions and when soil tests are low, onions are highly responsive to applications of Zn. A Cornell study conducted in the Elba muck showed that a single 450 cwt per acre onion crop removed 3.5 oz per acre of zinc (Zn); thus, it would take 4 years to remove 1 lb. The potential for zinc toxicity is low, medium and high when soil levels are <0.5, 0.5 to 1.0 and >1.0, respectively. Zinc can be easily built up and maintained in muck soils over time. In addition to fertilizer applications, Zn is added to muck soils via fungicide use, specifically EBDCs like mancozeb and maneb, which are applied directly to the soil as an in-furrow treatment for control of onion smut, and as a foliar application for control of leaf diseases, especially downy mildew. The 2009 Elba muck land soil survey showed that all of the 160 sub-samples had high levels of Zn with the majority (60%) being between 1.0 and 20 lbs per acre. An additional 29% of the sub-samples had 21 to 50 lbs per acre and the highest soil level of Zn recorded for a sub-sample was 1698 lbs per acre! At such high levels, it is expected that zinc would be toxic to onions.

Like Mn, the availability of Zn is reduced when the pH is greater than 6.0. In the Elba muck land soil survey, more than half of the fields/blocks and sub-samples had a pH greater than 6.0. Similarly, high soil levels of phosphorous (P), which occurred in 25% of the fields/blocks in the Elba muck soil survey, can tie up Zn and induce a deficiency. However, the very high soil levels of Zn compensate for any reduction in availability that could be induced by high pH or P. In general, there should be no need to apply additional Zn to onions in Elba. It is not feasible to try to reduce soil levels of Zn.

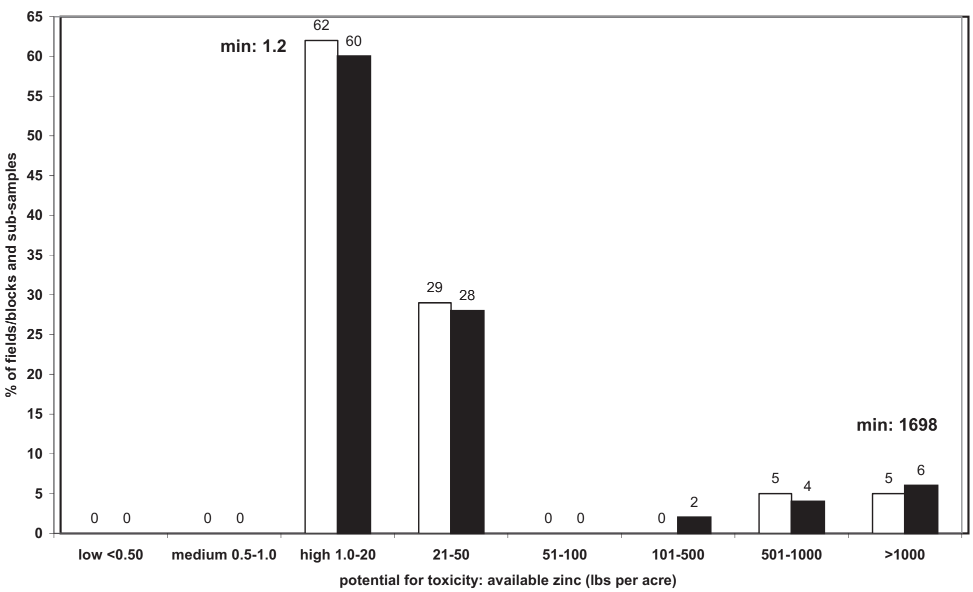


Figure 5. Soil survey, Elba muck, Spring 2009: available zinc in 21 fields/blocks and 160 sub-samples.

Iron and Aluminum

In a Cornell study conducted in the Elba muck, a single 450 cwt per acre onion crop removed 3 oz per acre of iron (Fe); thus, it would take about 9 years to remove 1 lb. In the 2009 Elba muck land soil survey, available Fe was less than 10 lbs per acre in 42% of the fields/blocks and between 10 and 50 lbs per acre in 42% of the fields/blocks (data not shown). Iron was greater than 50 lbs per acre in 16% of the fields with the highest recording in a single sub-sample being 447 lbs per acre! Even though these muck soils contain a lot of extractable iron, the iron is not readily taken up and is not very toxic even at high levels in plants.

The potential toxicity of aluminum (Al) is considered low, medium and high when soil levels are < 50, 50 to 100, and > 100 lbs per acre, respectively. In the 2009 Elba muck land survey, the potential toxicity from Al was low in 32% of the fields/blocks and medium in 58% of the blocks/fields (data not shown). Ten percent of the fields/blocks had a high potential for Al toxicity with the highest recording of a single sub-sample being 179 lbs per acre. Toxicity is a concern if Fe + Al is greater than 200 lbs per acre. In the Elba muck land survey, this occurred in only 15 out of the 160 sub-samples (9.3%) (data not shown).

When pH is below 5.0, Fe and Al become soluble in the soil and can be taken up in toxic amounts. In the Elba muck, pH occurred below 5.0 in only one sub-sample, and Fe was not especially high in this soil sample (data not shown). The highest levels of Fe (> 50 lbs per acre) occurred where pH was between 5.0 and 6.5. The lowest levels of Fe (< 10 lbs per acre) occurred where pH was between 5.0 and 7.3. Similarly, the highest soil levels of Al (> 100 lbs per acre) occurred where pH was between 5.1 and 5.8 while the lowest (< 50 lbs per acre) occurred where pH was between 5.3 and 7.5.

When Fe comes into the soil solution, it will form iron phosphates and tie up P. Out of the 29 sub-samples in the Elba muck land survey where Fe was high (> 50 lbs per acre), P was deficient in only 3 (10%) of them (Figure 6). Alternatively, when P is excessive, it may cause a Fe deficiency. Out of the 39 sub-samples where P was high (> 160 lbs per acre), 15 (39%) of them had low (< 10 lbs per acre) levels of Fe.

Copper, Sulfur, Boron and Molybdenum

Copper (Cu), sulfur (S), boron (B) and molybdenum (Mb) are other micronutrients that the standard Cornell soil test does not analyze. The most important to onion production are copper and sulfur. A Cornell study conducted in the Elba muck showed that a single 450 cwt per acre onion crop removed 0.7 oz per acre of Cu; thus, it would take 23 years to remove one pound. Clearly, onions do not need a lot of Cu, but it is an important micronutrient and onions are highly responsive to additions of Cu when soil tests are low. In virgin muck, Cu is a limiting factor. Copper deficiency results in light colored scales and is most likely to occur in a hot dry season and on well drained muck. However, it is readily built up over time via fertilizer

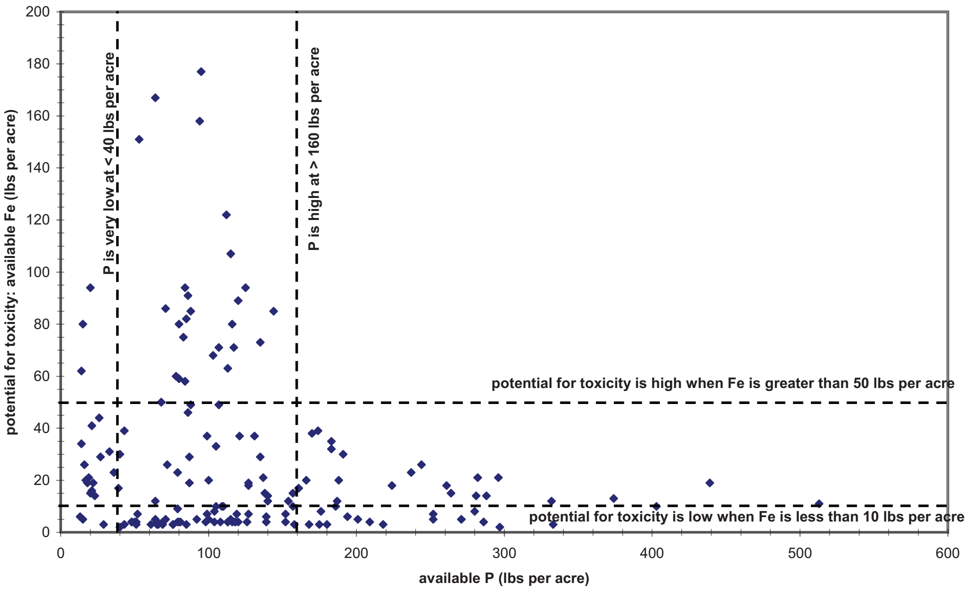


Figure 6. Soil survey, Elba muck, Spring 2009: relationship between available phosphorus and iron in 21 fields/blocks and 160 sub-samples.

and copper bactericide applications, both of which can be used judiciously, especially during wet seasons. It would be very interesting to see how soil tests read for Cu, as I would expect them to also be quite high.

Onions use and accumulate large amounts of S, as it plays an important role in flavor and pungency. Muck soils contain more than adequate amounts of S, which is mostly bound in the organic materials and just like N, it is released as microorganisms decompose the organic matter. Onions grown on muck soil are of superior quality compared to onions grown on mineral soil, because the high S content of muck soils improves onion flavor, cooking quality and storability. It would be interesting to see what the soil levels of S are on muck soils with low organic matter (i.e. 20-30%). Ever wonder what the whitish salt-type looking stuff seen on the surface of drying mucks is? It is calcium sulfate, which is formed when S and Ca react with each other in muck soil.

Onions are not very responsive to B; they are generally tolerant to toxicities and deficiencies are seldom. The Cornell study conducted in the Elba muck showed that a single 450 cwt per acre onion crop removed 1.7 oz per acre of B; thus, it would take 9 years to remove 1 lb. Boron is subject to leaching loss with high rainfall. Deficiency may also occur under dry conditions, because like Ca and Mg, it is moved to the root zone in water. On a soil test, less than 0.5 lbs per acre is considered deficient, and greater than 0.75 lbs per acre is sufficient. Molybdenum deficiency is most likely to occur in very acid soils, pH below 5.2; liming usually solves this problem. If deficiencies occur, B, Cu and Mo may be applied as foliar sprays at rates of 0.1-0.3, 0.5-1 and 0.06-0.1 lbs per acre, respectively.

Summary:

◆ The Elba muck land has been identified as a major source of pollution into its local water shed, delivering excessive amounts of phosphorus and nitrogen.

◆ In response to these results, free soil nutrient tests were conducted for Elba muck growers in hopes that they would apply nutrients according to the needs of their soils. Together, the soil test results made an extensive database, the summary of which, is being presented in these three (Part I, II and III) newsletter articles.

◆ Calcium and magnesium consistently occurred at very high levels in the Elba muck land. Foliar applications of Ca are rarely necessary.

◆ Despite deficiencies of Mg and K that could be induced by high Ca, levels of these nutrients in the Elba muck land are high enough to compensate for any reductions caused by high Ca.

◆ Similarly, levels of Ca and Mg in the Elba muck land are too high to become deficient when pH falls below 5.0 or above 6.0.

◆ Generally, Mn occurs at very high levels in the Elba muck land; fertilizer applications are generally not necessary.

◆ Watch out for Mn deficiency where soil pH is greater than 7.0, which can only be remedied by an application in a band with an acidifying fertilizer such as manganese sulfate, plus foliar applications.

◆ Soil levels of zinc were consistently very high in the Elba muck land, a likely accumulation from inputs of fertilizer and Zn-containing fungicides, mancozeb and maneb. As is the case with Ca and Mg, levels of Zn are too high to become deficient when pH is below 5.0 or above 6.0. Zinc can be reduced from fertilizer applications without having any impact on yield. In some cases, zinc may even be toxic to the onions.

- ◆ Iron occurs at high levels in the Elba muck land. Concerns for toxicity occur when levels of Fe+Al are greater than 200 lbs per acre, which occurred in only 9.3% of the sub-samples.
- ◆ Copper is deficient in virgin muck, but accumulates easily with the judicious amount that is added over the years in fertilizer and copper bactericides. Sulfur, B and Mo are also generally not expected to be deficient in muck soils for onions.

Regular soil testing is a great way to efficiently manage the fertility needs of your onion crop, while increasing profitability and reducing pollution of the waterways!

Cold Storage Facilities Now Eligible for USDA Facility Loan Program

Producers Can Expand Market Opportunities, Build New Capacity

WASHINGTON, March 17, 2010 - Agriculture Secretary Tom Vilsack today said that the Farm Storage Facility Loan program has been amended to allow producers to build cold storage facilities to store their fresh fruits and vegetables. This program is part of USDA's 'Know Your Farmer, Know Your Food' initiative and uses discretionary authority provided by the 2008 Farm Bill authorizing the eligibility of cold storage facilities for fruits and vegetables.

"Expand the Farm Storage Facility Loan program will provide our nation's fruit and vegetable producers with new storage and marketing opportunities," Vilsack said. "On-farm storage may cost a lot to build, but it can help farmers to maximize profits. USDA's program will help these producers to finance the purchase, construction, or refurbishment of these important farm storage facilities."

USDA's 'Know Your Farmer, Know Your Food' initiative emphasizes the need for a fundamental and critical reconnection between producers and consumers. The effort builds on the 2008 Farm Bill, which provides for increases and flexibility for USDA programs in an effort to revitalize rural economies through the promotion local food systems. Aimed at strengthening the connection between farmers and consumers, the initiative also supports local and regional food systems, to increase economic opportunities for local farmers and expand access to healthy food for Americans.

To be eligible, cold storage facilities must have a useful life of 15 years and include:

- ◆ New structures suitable for a cold storage facility;
- ◆ New walk-in prefabricated permanently installed coolers suitable for storing fresh fruits and vegetables;
- ◆ New permanently affixed cooling, circulating and monitoring equipment;
- ◆ Electrical equipment integral to the proper operation of a cold storage facility; and must be
- ◆ An addition or modification to an existing storage facility.

USDA will not make cold storage facility loans for portable structures, portable handling and cooling equipment, used or pre-owned structures or cooling equipment or structures not suitable for a fresh fruits and vegetables' cold storage facility.

The maximum loan amount for a Farm Storage Facility loan is $500,000 per loan. One partial disbursement of up to half the anticipated total cost is available when that portion of the structure has been completed. The final disbursement will be made when the entire structure has been completed and inspected by a USDA representative.

All Farm Storage Facility Loans require a down payment of at least 15 percent. Applications must be approved before construction can begin. Loan terms of 7, 10 or 12 years are available depending on the amount of the loan.

Loans applications should be submitted to the administrative FSA county office that maintains the records of the farm or farms to which the application applies. If the commodities are produced on land that does not have farm records established, the application must be submitted to the FSA county office that services the county where the facility will be located.

For more information on this program or other FSA farm programs please contact your local FSA county office or *www.fsa.usda.gov.*

Announcements:

2010 Summer Twilight Series
for Vegetable Crops

Sweet Corn Pests
6-8 pm, Tuesday, June 8th
Frankie's Produce Farms
Intersection of Round Hill Rd and Big Island Rd., Florida, NY

Tomato Diseases (Late Blight)
6-8 pm, Thursday, July 8th
Hepworth Farms
Across from Marlboro Town Hall, Rt 9W, Milton, NY

Late Season Vegetable Diseases
6-8 pm, Monday, August, 2nd
Lawrence Farms
Frozen Ridge Road, Newburgh, NY

$15 per program, $35 for all 3, preregistered by 6/4/10
$20 per program, $50 for all 3 after 6/4/10
any number of farmers/employees from the same farm can attend for a single fee.

NYS DEC Recertification Credits have been applied for.
Questions? Call Maire Ullrich at 845-344-1234 or Teresa Rusinek at 845-340-3990

MUCK & MINERAL

Vegetable Crops Educator/Editor: . . . . . .Maire Ullrich
Contributor: . . . . .Teresa Rusinek
Ag. Dept. Secretary . . . .Cathy Hughes
Printer: . . . . .Jerry Reinhardt
Layout & Graphics: . . . . .Maire Ullrich
Masthead Design: . . . . .Nancy Karp

Cooperative Extension
Orange County
18 Seward Ave., Ste. 300, Middletown, NY 10940-1919