SPUDLINES

DECEMBER 2003 — CONFERENCE ISSUE
VOL. 41 NO. 3

THE UNIVERSITY OF MAINE
Cooperative Extension

Dear Potato Grower,
Here is the last issue of Spudlines for 2003. This issue also marks another change. Dr. Steve Johnson is on sabbatical in New Zealand, so the baton has been passed to another (at least for the time being). I will try to maintain the high standards Steve has set and also keep the reading interesting. Your thoughts and comments are most welcome in this regard. If you would like to see some changes in topics covered or in the format of Spudlines let us know. Feedback and constructive criticism are always welcome.

This year s Maine Potato Conference and Trade Exhibit will be held on January 21 and 22 at the Caribou Inn and Convention Center. The agenda for the meeting is enclosed with this issue. Pesticide applicator recertification credits and CCA credits will be available for those attending the conference. It promises to be a good program and trade exhibit. We hope you will attend. The Maine Potato Board will holding their annual meeting on January 23 at the Presque Isle Inn and Convention Center. The Board is scheduled to meet at 2:00 PM; there will be a reception at 5:30 and dinner at 6:00.

On behalf of the folks in our office, let me extend our personal best wishes for a cheerful holiday season and a prosperous new year to you all.

Sincerely,

Peter Sexton, Ph.D., Extension Crops Specialist

This publication is in part supported by a grant from the Educational Committee of the Maine Potato Board. The potato growers, processors and brokers of Maine pay assessments. Portions of these assessments were approved for the educational purpose of keeping Maine potato growers and related Maine industry people informed.

Upcoming Programing of Interest - 2004

January 13-15	**Augusta Ag. Trade Show** Civic Center, Augusta
January 21-22	**Annual Maine Potato Conference** Caribou Inn and Convention Center, Caribou
January 23	**Maine Potato Board Annual Meeting** Presque Isle Inn and Convention Center, Presque Isle
February 4-5	**New England Regional Training for Ag. Service Providers** Holiday Inn, Portsmouth, New Hampshire

For further information, call 764-3361

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Gray Mold or *Botrytis*

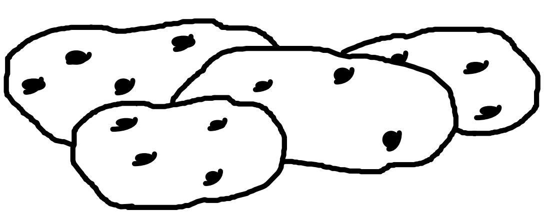
James Dwyer, Extension Crops Specialist

The past season was unusually wet, and our IPM Scouts noted many potato fields with a gray mold growing on the on the foliage. The symptoms tended to appear later in the season; especially after the potato plants dropped their blossoms. A disease called gray mold, also known as *Botrytis*, caused this gray growth. Usually *Botrytis* is of little economic significance. Identification, however, is extremely important because there are times when *Botrytis* can be easily confused with potato late blight. In general, gray mold appears as a dense, non-glistening, fuzzy mass of off-white or grayish-tan growth on potato leaves, petioles and stems, in contrast to late blight which is white, glistening, and less dense in its growth habits. Gray mold symptoms tend to become most apparent on foliage towards the end of the growing season, or on damaged tissue.

Lesions are often found on the margins or tips of leaves and may be found bordered by the leaf veins. A wide concentric zonation, initially dark brown to black but turning light tan with time, characterizes a gray mold lesion. Late blight lesions are initially small, irregularly shaped, pale green spots, which rapidly enlarge and become brown to purple-black in color. A pale-green to yellow halo is often present outside the necrotic area on a late blight lesion.

Under moist weather conditions, a white mold appears at the edge of a late blight lesion, mostly on the underside of the leaves. In contrast, gray mold grows everywhere on the lesion. Gray mold often becomes established when old potato flowers fall on the leaves. Many times you can actually see the blossom stuck to the leaflet within the lesion. Gray mold infections are initially latent but become apparent on plant parts under stress from shading, age, or excessive humidity. Spores are spread by wind and rain. A slimy, soft rot of lower leaves, petioles and stems may occur. *Botrytis* leaf lesions and stalk decay are limited by the return of dry, sunny weather. High humidity and cool temperatures favor leaf infections. Normal fungicide sprays usually prevent any serious damage from this disease.

Whenever there is doubt about pest identification, please contact your local Cooperative Extension office.



Prices of Poplar and Other Wood At High Levels

By Larry Park and Peter Sexton

According to our information, supplies of wood at some mills are low and prices for poplar and some other trees are at very high levels. Farmers with woodlots would be well-advised to investigate this potential source of extra income. At this writing, prices for wood delivered to the mill are at or near record levels. The price of orientated strand board has increased greatly in the last year, and the price mills are willing to pay for raw materials reflect this. If you hire the work done, be sure to check on the insurance requirements of the loggers. Growers are encouraged to talk with a licensed forester who can help make sure insurance rules are complied with, in getting a notification number, and in making a forest management plan, if desired. For more information contact the Maine Forest Service (in northern and central Aroostook call Dave Rochester 435-7963, in southern Aroostook call Dan Jacobs at 463-3653).

There will be an adult education class for small woodlot owners, or anyone interested in forestry, offered at the Presque Isle High School starting on Tuesday, Feb. 24. The course will last 10 weeks. Call Larry Park at 764-0582 for details.

SPUDLINES is published by the University of Maine Cooperative Extension to provide information for the Maine Potato Industry. The annual subscription rate is $5.00. The Educational Committee of the Maine Potato Board provides sponsorship of growers they represent and the allied industry needed to support their growers. For further information, contact: **Peter Sexton, UMCE, PO Box 727, Presque Isle, ME 04769; (207) 764-3361 or toll free in Maine 1-800-287-1462 or via email at: psexton@umext.maine.edu**

A view of December Shepodys in New Zealand. Photo compliments of Dr. Steven B. Johnson, on sabbatical working with spuds south of the equator.

Aphids and Potato Virus Transmission

James D. Dwyer, Extension Crops Specialist

In Maine, there are four principal aphid species involved in virus transmission in potatoes: foxglove, buckthorn, potato and green peach aphids, with other aphids such as the melon aphid occasionally being found within the state.

Aphids transmit two types of viruses:

1. Those that are carried only on the mouthparts of the aphid. The mouthpart of an aphid is called the stylet. These stylet-borne viruses are called non-persistent because the virus does not stay with the aphid for a long period of time. These viruses can be transmitted to potatoes easily and spread rapidly.

2. Those viruses that are carried within the aphids' circulatory system are called persistent. Once an aphid has acquired a persistent virus, the aphid is contaminated for life and can then transmit the virus from plant to plant.

Virus	Major Method of Transmission
PVA	Aphids (non-persistent); infected sap
PVX	Mechanical; biting insects
PVY	Aphids (non-persistent)
PVS	Aphids (non-persistent); mechanical
PLRV	Aphids (persistent)
PSTV	Mechanical; chewing insects
PVM	Aphids (non-persistent); mechanical

Virus Transmitted

Aphid	Potato Leaf Roll	Potato Y	Potato A	Potato M
Green Peach	+	+	+	+
Buckthorn	+	+	+	+
Potato	+	±	±	+
Melon Complex	+	+	+	+
Foxglove	+	±	±	+

(+) indicates that it has the ability to readily transmit the virus.
(±) indicates that it has an inefficient ability to transmit the virus.
(-) not known to transmit the virus.
(adapted from *Hooker*, 1981)

The green peach aphid is the most efficient vector of common potato viruses, which is why the potato industry has placed so much emphasis upon recognition and control of the green peach aphid. Growers should not, however, have a false sense of security that viruses will not be spread as long as green peach aphids are not present. Other aphids have the ability to transmit viruses; and when significant populations are present, virus spread can occur readily.

Over the last few years, aphid populations in Maine have been generally very low compared to the populations that we experienced in the 1980s. Aphid populations in recent years have tended to build during the later part of the season. This has been the pattern in the last few years; however, growers should be aware that this has not always been the pattern and is not something we can depend upon. Regular field scouting, beginning when the plants emerge and continuing through vine killing, is the best way to avoid being surprised by sudden aphid build-ups.

Growers should be aware that significant aphid populations can occur rather early in the season. Please note the following actual IPM scouting reports from Aroostook County in 1991.

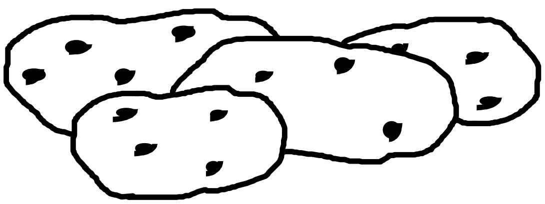
Percent of Plants with Aphids

Grower	Date	Potato	Green Peach	Buckthorn
Grower 1	6/25	2%	0	22%
Grower 2	6/26	2%	0	36%
Grower 3	6/25	2%	0	92%

Buckthorn aphid populations that occur at these levels in June, if left untreated, have the potential to produce significant virus spread. Research on Aroostook Farm, part of the University of Maine Agricultural Experiment Station, has documented that PVY has the potential to be spread by buckthorn aphids early in the season. Considering this information, a comprehensive scouting program should begin when the plants come through the ground and continue until the vines are completely dead.

When scouting for aphids, the entire plant should be examined on a regular basis. If scouting after a pesticide application, please remember to observe the reentry regulations. Also be aware that with some of the newer aphicides it may take up to three days after application for the aphid to die; however, shortly after application the aphids will stop feeding—and transmitting viruses—thus controlling potential virus transmission.

When planning control strategies, please remember that pesticides alone will not control viruses. Pesticides can be used to control aphid vectors, hence reducing virus spread. Prevention is the best strategy. Prevention is best accomplished by planting seed with low virus content, which reduces the amount of inoculum and thereby the chance of spreading the virus. This, coupled with a good scouting program to determine if and when insecticide applications are merited, can reduce the impact of virus diseases.



Canola: Update on Soil Fertility Issues and Costs

Peter Sexton, Extension Crops Specialist

Canola response to applied N, P, K, and S
Research trials conducted for the last two seasons at the Aroostook Research Farm by Dr. Greg Porter and his crew have not shown any benefit to fertilizing with P, K, or S in canola following potatoes. Potatoes are generally well fertilized with both P and K, so it is not surprising that these elements did not limit yield in the following canola crop. The lack of response to sulfur may be related to the common practice of including ammonium sulfate in potato fertilizer mixes (ammonium sulfate contains more S than it does N), and/or to atmospheric deposition of S from acid rain. In any case, it appears that P, K, and S are probably present in adequate amounts for canola in most potato rotations. Canola showed a positive, though weak, response to applied N. Application of N up to 75 lb per acre boosted yield enough to justify the cost of the fertilizer, but not by much. The average yields for each year are shown in the following table:

Table 1. Average canola yields under different amounts of applied N. Trials were conducted at the Aroostook Research Farm in 2002 and 2003.

Applied Nitrogen	**2002 Yield**	**2003 Yield**	**Average Yield**
----------- (lb per acre) ----------			
0	2,150	860	1,500
75	2,430	1,100	1,760
150	2,380	890	1,640

An on-farm trial conducted near Presque Isle in 2003 gave similar results. The crop showed a yield response of 6 bushels per acre in response to applied N. That trial showed an average yield of 1,300 lb per acre.

Canola response to soil pH and manure
An experiment was conducted by Dr. John Jemison at the University of Maine research farm in Orono to evaluate the response of canola to soil pH varying from 5.0 to 7.0. Canola yields increased sharply as pH increased from 5.0 to 5.5 (Fig. 1). There was a trend for yield to continue to increase as pH increased above 5.5, but the response was weak and the points did not differ much from a straight line drawn through the average yield at pH's between 5.5 and 7.0. Optimum pH in this trial occurred at a value of 6.2. The regression line predicts canola yield would drop to zero at pH 4.3.

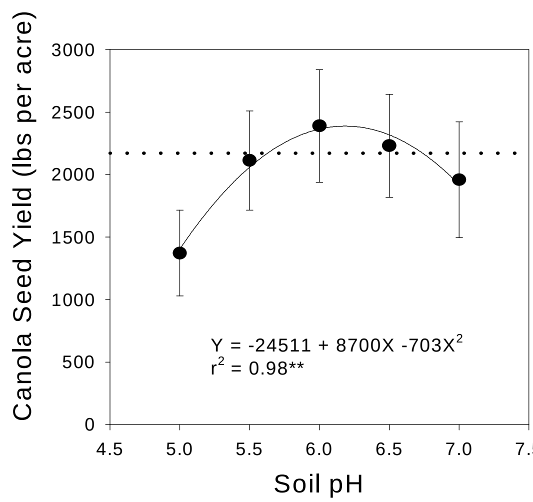


Figure 1. Canola seed yield versus soil pH from a trial conducted in 2002 at Rogers Farm, the University of Maine's research farm in Orono. Yield values are averaged across manure treatments at a given pH. The dotted line shows the average yield for treatments with a pH of 5.5 or greater.

The work in Orono also included a component to measure the effect of manure application on canola yield. The manure was applied the previous spring at a rate of 24 tons per acre to half of the study area. Averaged across pH levels, the canola showed a strong positive response to manure application (Fig. 2).

Rotation effects on soil quality
The effect of canola on soil quality and soil-borne diseases is a factor that remains to be fully measured.

Work done by Dr. Griffin and Dr. Larkin from the USDA-ARS over the last several years suggests that

potatoes following canola have less rhizoctonia and slightly greater yield than do potatoes following small grains. There is also a common perception that canola makes the soil “mellower,” or easier to work.

On the other hand, canola is very susceptible to white mold. This is an issue that has to be considered. Research is currently underway to try and quantify the effects of canola on white mold incidence in the following potato crop. In the meantime some precautions are in order. Canola should not be grown in a given field more frequently than once every four years. Fields that currently have problems with white mold should be avoided for canola production. ‘Superior’ potatoes are more susceptible than other varieties to white mold, so it may be best to avoid planting canola on fields where ‘Superiors’ will be grown. Probably the best solution for potential white mold problems is to follow canola with a small grain before going back to potatoes. White mold can be controlled in canola with application of an appropriate fungicide shortly after flowering.

Costs

The cost of producing canola is similar to that of barley. My estimate is that it costs about $140 an acre (Table 2). The yield of canola is roughly half that of barley. This means that in terms of cash returns, canola will be competitive with barley whenever the price per bushel of canola is more than twice that of barley. If a fungicide application to control white mold were to become an additional cost in the future, the price of canola might have to be closer to two and one-half times that of barley for the canola to be competitive.

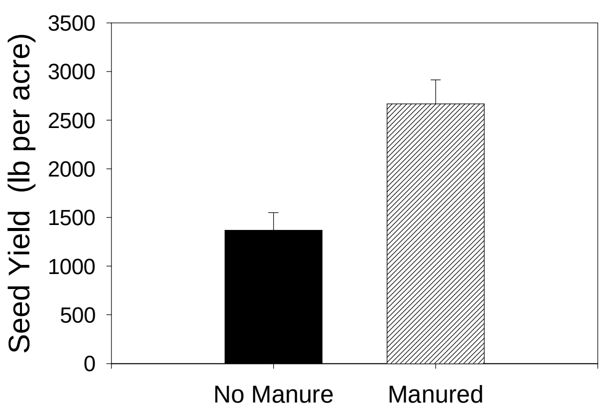


Figure 2. Average seed yield of canola with and without manure applied in the spring of the previous year. Yields are averaged across pH levels (5.0 to 7.0) for each manure treatment. This trial was conducted at Rogers Farm in Orono in 2002.

Summary

Fertilizer trials indicate that we can expect canola to respond to N fertilizer up to a rate of 70 lb of N per acre. Thus far no response has been seen to P, K, or S application. Optimum pH is near 6.2, but the crop appears to tolerate acid soil down to a pH of 5.5. Canola showed a strong response to manure application. The benefits and costs of canola to potatoes appear to be mixed. Until they are better understood it is wise to proceed with caution considering the potential for white mold. Costs of production are similar to those of barley; while yields are roughly half that of barley. Therefore if the price of canola is at least twice that of barley it will be competitive in terms of cash returns.

Table 2. Estimated variable costs for canola production following potatoes. Note that fixed costs and the costs of any fungicide applications are not included here.

Variable Costs	Price	Cost/ acre	Your Costs
Soil Test	11.00	1.10	______
Chisel Plow	12.00	0.00	______
Harrow	8.00	16.00	______
Fertilizer			
70 lb N	0.30	21.00	______
no P	0.30	0.00	______
no K	0.15	0.00	______
1 lb B	2.20	2.20	______
custom application	9.00	9.00	______
Herbicides			
Trifluralin 1.5pt/acre	29.00	5.51	______
application	9.00	9.00	______
Planting			
Seed	2.50	15.00	______
equipment + labor	10.00	10.00	______
Harvest			
custom combine	25.00	25.00	______
Miscellaneous			
Trucking $12/ton	12.00	10.80	______
Pickup, etc.	10.00	10.00	______
Interest		7.00	______
Total Variable Cost		**141.61**	______

Some Thoughts on Elephant Hide

Peter Sexton, Extension Crops Specialist

As a physiological disorder, elephant hide is not well understood, nor has it been studied to much depth. Accordingly, there is some uncertainty surrounding what factors are associated with, or cause, it to occur. In this article I will share some of my own ideas and opinions on what causes this problem.

Elephant hide and tuber growth

Growth is the result of cell division and cell enlargement. Potato tubers appear to complete most of their cell division by the time they are about two ounces in size. After this, most of their growth is a function of cell expansion. The period of cell division appears to slow down first near the stem end of the tuber and to continue longer near the bud end of the tuber—so as it grows there is a gradient across the tuber from stem end (less cell division) to bud end (more active cell division). There is also a gradient in cell division from the core of the tuber (less cell division) towards the exterior of the tuber (more cell division).

Elephant hide appears to be the result of one part of the tuber surface not growing as fast as the rest of the tuber. This may be due to localized stress that only affects one area of the tuber, while the rest of the tuber continues to grow and expand. Or it may occur when stress uniformly slows growth on the whole tuber, but after the stress ends, resumption of growth is not uniform across the tuber. If one area of the tuber surface fails to recover from the stress as fast as the rest of the tuber, it will grow slower than the surrounding tissues. Unequal rates of growth and expansion must lead to stress within the tuber tissue. If the tuber does not have a mechanism to respond to that stress, then heavy russeting or cracks could develop within the tuber structure.

Possible causes of elephant hide

Several factors have been associated with development of elephant hide:

1) Fertilizer salts near the tuber surface
2) Decaying organic matter in contact with the tuber
3) High temperature
4) Excessive soil moisture (especially if preceded by a drought)
5) Improper timing or rate of maleic hydrazide application
6) Varietal susceptibility

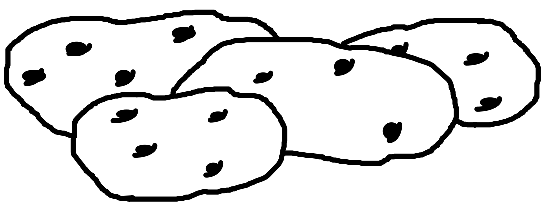
Fertilizer salts and decaying organic matter. The presence of fertilizer salts probably acts on a small area of the tuber, causing excessive osmotic tension (the salt would burn the tissue it comes in contact with). This would slow growth at the point of contact with the fertilizer salts, but would have little or no effect on the rest of the tuber. Once one part of the surface slows down, if the tissues around it and below it keep growing, heavy russeting and/or cracks will develop. Similarly, one might hypothesize that some derivative of decaying organic matter might cause localized stress on the surface of the tuber it came in contact with—again leading to the formation of cracks as the rest of the tuber continued growing.

High temperature and excessive soil moisture. I would postulate that high temperatures and excessive moisture act by slowing down growth of the whole tuber, and that elephant hide then develops when the tuber comes out of stress in a nonuniform manner. High temperatures slow tuber growth, and they also lead to thickening of the skin. When the stress is relieved and tubers begin to resume growth, if there are localized areas on the tuber that are slow to recover, then again one might expect cracks to develop as the tissues around and under it outpace its' growth.

Timing or rate of maleic hydrazide application. Uneven application of maleic hydrazide, high rates of use, and improper timing have also been associated with elephant hide. This association is difficult to sort out, but it implies that perhaps rapid of movement of maleic hydrazide through the tuber may lead to elephant hide, or perhaps that high rates of use lead to uneven distribution of the maleic hydrazide within the tuber. Application too early in the season may lead to growth cracks as cell division is blocked while the tuber continues to try and grow.

Varietal susceptibility. The remaining factor to consider is that varieties differ in their susceptibility to elephant hide. Where do the varietal differences come from? The potato tuber is an underground, enlarged stem. Like any organ on the plant, it must have coordinated growth in order to maintain its proper conformation and function. Think of your own hand: how did the cells that make up your fingers know when to grow out from the rest of your hand, when to stop growing, and how did they differentiate properly? How was it coordinated? The mechanism is unknown, but coordinated it is. On a much simpler level, there must be mechanisms guiding the growth and differentiation of the cells in a potato tuber for it to be a functional storage organ at the end of the season. Otherwise cracks and deformities would occur all the time. There may be a number of mechanisms at work that predispose a variety to developing elephant hide. One could speculate that it is related to genetic differences in the ability of cells to resume expansion, or else to restart cell division, after having been through a period of stress. There are any number of potential factors at work. The main point is that susceptibility to elephant hide *is* an inherited trait, so variety selection is one way to try to manage this problem.

In summary, it is postulated that elephant hide occurs when an area on the surface of the tuber grows slower than the tissues around and underneath it, leading to heavy russeting and/or cracks on the tuber surface. The likelihood that growth cracks and elephant hide will occur can be decreased by selecting resistant varieties and by maintaining adequate, uniform soil moisture (where that is possible), as well as nutrient levels, through bulking. If you are growing a variety that is susceptible to elephant hide, it may be helpful to take extra care with irrigation management to avoid extremes in soil moisture, and to take extra care and avoid marginal conditions when applying maleic hydrazide.



Maine Potato Harvest Anti-Bruise Campaign

Vernon Delong, Agricultural Bargaining Council

The 2003 Anti-Bruise Program was conducted during the last half of September and the first part of October. Three inspectors rated 490 samples of potatoes for skinning injury and slight or serious bruising with a catechol solution. They also made an effort to detect embedded stones. Two more inspectors, using electronic potatoes, tested 162 pieces of equipment, 76 harvesters, and 86 windrowers for bruising. The inspectors worked under the supervision of the Agricultural Bargaining Council. The program was financed by a grant from the Maine Potato Board. The inspectors were assigned to all of Aroostook County.

The standard practice for testing with catechol is for a 10-pound sample of potatoes to be taken from a given point in the harvest operation. The tubers are dipped into a catechol solution. Once bruised areas react to the catechol, the tubers are rated for slight or serious bruise.

Typically, a bruise that can be removed with one swipe of a carrot peeler is considered a slight bruise. A serious bruise requires two or more swipes to be removed and thus is related to the amount of waste that can be experienced by a processor or consumer. After weighing the bruised tubers, percent loss due to slight or serious bruise can be calculated. The results are in this report along with skinning injury. Injury from skinning is a judgment call by the inspector along with a visual guide.

The electronic potato is readily accepted by our growers and is a faster and more precise way of detecting problem areas in the harvest equipment. I believe in the future we need to consider moving the program away from catechol and to electronic potatoes, to better serve our industry. Our growers do a fine job and are very sensitive to the problems relating to bruising, so they continue to request this service. This last season (2003) had lower percent skinning and lower percent severe bruise injury than did any other season in the past 16 years (Fig. 1).

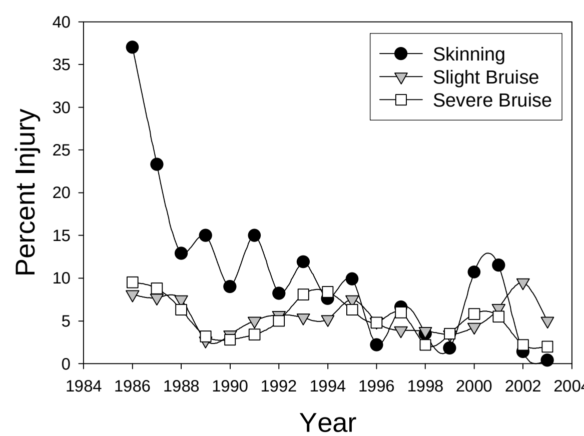


Figure 1. Percent injured tubers (skinning, slight bruise, and severe bruise) over time for the last 16 seasons as measured by inspectors in the anti-bruise program. The values shown are averages for each category across all the samples recorded in a given season.

Acknowledgements: On behalf of the industry, I would like to thank McCain Foods for providing one of their electronic potatoes for the Anti-Bruise Program this year. It doubled our ability to serve growers with electronic equipment in 2003. Inspectors for each area were as follows**:** Northern – Gilbert Fortin; Central – Thaxter Ryder; Southern – Karla Harrison; Northern

Half – Craig MacFarline; Southern Half – Geremy Sjoberg.

Late Blight A Reflection

Peter Sexton, Extension Crops Specialist

Late blight is a plague
that has killed its millions.
In the field it goes in rage,
leaving tragedy like a villain.

It travels from year to year
and place to place,
living in the seed
of the crop it wants to erase.

Misery loves company, so they say.
This disease accordingly makes way,
to spread itself far and wide,
along hill top and riverside.

Take care of your seed,
or to disease it may lead.
Preventive action is the way,
to keep this wild beast at bay.

Use not the seed from sources unknown,
or else the sweet deal once it is sown,
may yield a bitter crop of trouble and cost,
so that all thought of profit and gain are lost.

Our humble hero is the potato crop,
from his efforts he does not stop.
Feeding millions through quiet work,
of his duty he will not shirk.

So let us all then kith and kin,
act like noble citizens.
Do your best to avoid this disease,
that does approach with so much ease.

While the problem is still small,
now is the time to prevent it growing tall.
If we take the path of "lets wait and see,"
we may pay a heavy price for our complacency.

Late blight may seek our crop to ravage,
but with some thought, we can stop this rotten savage.

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