SPUDLINES

APRIL/MAY 2007
VOL. 45 NO. 2

Dear Grower,

This is the April/May issue of SpudLines for 2007. We hope that you will find the articles interesting and informative. As we enter this planting season, we strongly encourage growers to monitor soil temperatures in regards to planting potatoes. Also, please remember to take time to train your workers on the EPA Worker Protection Standards.

All the best,

James Dwyer, 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.

Potato pest information will be available this season at: **http://www.mainepotatoipm.com** as well as at our new website:

http://www.umaine.edu/umext/potatoprogram

Upcoming Dates of Interest - 2007

July 16-18	**Potato Marketing Association of North America Idaho Falls, Idaho**
July 17-22	**Maine Potato Blossom Festival Fort Fairfield, Maine**
July 20	**Industry Dinner Fort Fairfield Community Center Fort Fairfield, Maine**
August 12-16	**Potato Association of America Annual Meeting Idaho Falls, Idaho**

For further information, call 764-3361

For information on license credits, Call 760-9ipm 24 hours per day

Looking Toward the 2007 Potato Crop Pests: What to Expect

James D. Dwyer, Extension Crops Specialist

As I am writing this article for the April/May issue of SpudLines, it is 0ºF with the wind blowing twenty miles per hour. That’s a wind chill factor of -22ºF and we are looking for SPRING! As we talk about spring and the upcoming growing season, many people are asking us what we expect for pest pressure this year.

The first question on everybody's mind is potato late blight. Will there be any? The best guess is that yes, there will be some late blight in 2007. The unknown is how much. With some level of late blight in all of the major potato growing areas of the state in 2006, the risk of late blight is certainly real for 2007. Growers must take extra care with seed selection again this year. Make sure that your seed has been tested by the Maine Department of Agriculture for late blight. Use the best seed treatment available and be sure that the seed treater selected contains mancozeb—this will pay you dividends. Please see our Web site for a comparison of potato seed treatment materials.

As we get into the foliar protection period of the season, please remember that rate, timing, and coverage are the keys. We strongly recommend closely following the "no blight" recommendations. This information will be available at 1-888-USE-UMCE or 207-760-9IPM. Information will also be available at www.mainepotatoipm.com and www.umaine.edu/umext/potatoprogram, as well as in the *Pest Alert* newsletter. As we plan for the approaching season, please remember that if you find late blight on your farm, share that information with your neighbors. You would want to know if your neighbor had it. By sharing information, the industry will be able to better protect itself and reduce further spread and potential impact.

All growers and packers will also need to carefully manage cull piles. Cull pile management is critical, considering that there was some late blight in the area last season. All cull piles should be controlled by June 10, 2007. Uncontrolled cull piles place the entire industry at risk.

In 2006, the Maine Department of Agriculture's seed inspection staff discovered a dramatic increase in the incidence of bacterial ring rot. Please remember to clean and disinfect seed storage/receiving areas, as well as all seed handling, cutting, and planting equipment. Keep all dip pans clean with fresh solution. Disinfecting between seed lots and fields is always a great idea. Watching the details will prevent future problems, especially with a disease like this.

Colorado potato beetle populations have appeared to be rising slowly over the last few years, and we expect that this trend will continue. We also know that some CPB populations within the state have developed resistance/tolerance to neonicotinal insecticides. Resistance to neonicotinal insecticides initially means shorter control periods for the in-furrow and seed treatment products. It also means that growers using a seed treatment or in-furrow neonicotinoid material should **not** use a foliar neonicotinoid material later in the season. When selecting a beetle control strategy, be sure what class of insecticide you are choosing. There are several new names on the market; several are generic neonicotinoids, and some represent new chemistry, so it will be important to know what you are using to ensure a sound resistance management strategy.

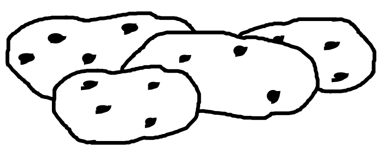
Another question that has been asked is what impact has this odd winter had on the European corn borer population. The mild although wet conditions during late fall and early winter did little to hinder European corn borer survival. The cold weather of February and March arrived after a good snow cover that protected the larvae, so those temperatures probably had little negative impact. University of Maine Cooperative Extension will be trapping and scouting for ECB, and we strongly encourage all growers to be doing the same in 2007.

There is no real way to predict what aphid populations will look like for the coming year; however, if spring comes early, seed growers may want to scout early for early-season buckthorn aphids. Luckily virus readings in the 2006 season were excellent and that should bode well for the coming season.

This season appears to have the potential for strange weather. Violent storms in the middle and southern portions of the country, if the pattern continues, could result in an increased potential for leafhoppers and green peach aphids. Only time will tell.

Also, as we prepare for the 2007 growing season, please remember that EPA Worker Protection Standards require that records be kept for all pesticide applications, and that all workers be trained. Providing the training and maintaining the proper records will prevent any difficulties if and when you are inspected.

Looking toward the coming season and trying to anticipate the pest situation is in all honesty a best guess. If you put a pest management plan in place and scout on a regular basis, you will be prepared to respond quickly and appropriately to whatever pests we have to deal with in 2007.



Potato Field Soil Testing Trends and Water Quality Concerns

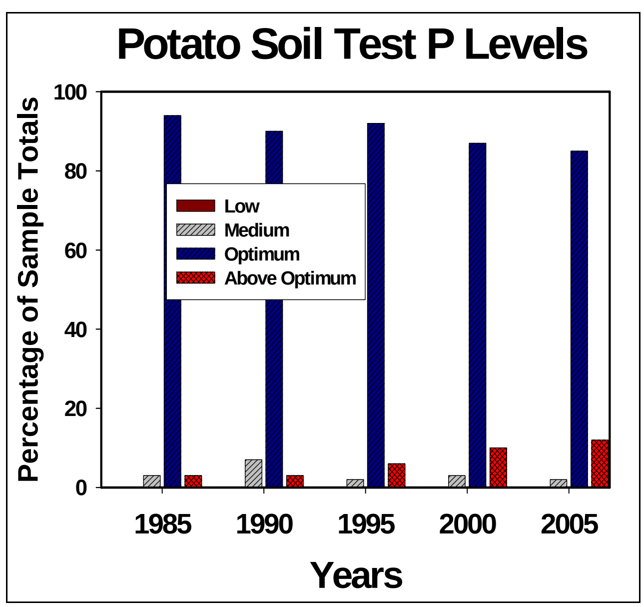
John Jemison
Extension Water Quality and Soils Specialist

When I studied soil fertility in graduate school, one key soil fertility principle was to build up the soil nutrient level to the optimum range and maintain it. This concept is as important today as it was when I learned it more than 20 years ago. We generally supply potatoes or rotation crops with fertilizers to meet most of their production needs, but we also want the soil to have a good bank of nutrients, should environmental conditions cause soil nutrient loss or growing conditions result in temporary nutrient shortages. When we look at our soils, some nutrients, for example potassium, are very necessary for potato yield and quality, and overapplication poses no real environmental risk. Overapplying nitrogen or phosphorus is another matter.

The effects of overapplying nitrogen (N) are quite well understood by potato producers, and with the recent spike in cost of N fertilizer, growers are probably looking at how to refine and trim N application, not increase it. Phosphorus (P) is a bit trickier. It is hard to show an agronomic downside to having too much P in your soil. Likewise, if your soil stays in place and doesn't find its way to a water body, there is not going to be much leaching loss of P either. But, the reality is that soil frequently erodes off our fields, and P is finding its way into our beautiful northern Maine lakes and rivers. Combine this source with increasing development around lakes, increased road building, and more impervious surfaces, and we have an increasing problem.

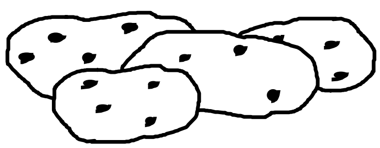
I recently looked back over the past 20 years of soil test data to see if there were discernable trends or changes in soil test information. There have been significant decreases in the number of soil samples submitted by the potato industry. In 1985, more than 3000 samples were submitted. In recent years, far fewer samples have been submitted, averaging from 1500 to 2000 samples a year. I expect that this reflects the decreasing potato acreage over that time period.

Soil test P levels were very interesting and extremely consistent. Over time, there has been a slight increase in the number of tests showing soil test P levels rising from optimum to above optimum (Figure 1). Again, while it is difficult to find an agronomic reason not to have an above optimum P level, we can find water-related reasons for concern.



I think any respectable agronomist would think of these data as a success story. We want growers to have fertile soil, and that is what I see above. My concern is that some of these fields may erode and as a result, impair lake water quality.

Tim Griffin and others at the USDA-ARS lab in Orono have evaluated the effect of spreading barley or another small grain on the soil surface before harvest. The harvesting process incorporates the seed, and small grains can grow at temperatures almost down to freezing. Even though the growth may not be enough to add to organic matter by the time it is incorporated into the soil, it should be enough to hold the soil in place and prevent erosion. Bare ground is where most of the P loss occurs. Simply put, planting something is better than open ground. If necessary, you can do this in specific parts of the field that are most likely to erode instead of the whole field, reducing the cost of the exercise.



Summary of the International Potato Common Scab Conference

Lauchlin W. Titus, CPAg
AgMatters, Inc.

I traveled to Guelph, Ontario in early March 2007 to attend the International Potato Common Scab Conference. Organized by Dr. Eugenia Banks, this was an excellent conference, with speakers from Australia, South Africa, Scotland, the United States, and Canada. Attendees included potato growers, researchers, consultants, and industry representatives. A common theme of presenters was the difficulty that farmers all around the world have in dealing with this problem. There is no silver bullet approach to reducing or eliminating common scab—if there was, there would not be a need for so many people to travel so far to discuss and learn about the issue. I will try in this summary to tell you about some of the strategies that seem to work as well as some that don't.

It was reported that a survey of Canadian potato growers rated common scab of potato as their third priority disease of concern—with late blight first and bacterial ring rot second. With late blight, we all know we can get it, but we also know how to monitor for it and manage it pretty well. Not many growers see ring rot now—but everyone fears it. It is a good example of a disease that has been greatly reduced by sanitation and good management. Common scab is a disease of concern because it is poorly understood and seldom managed. Ask five folks like me how to manage common scab and you will probably get six answers! What works in one field may not work in an adjacent field on the same farm. There is no single factor that consistently works in your town, in Maine, throughout North America, or the world.

Common scab of potatoes is caused by several species of the genus *Streptomyces.* The most common species is *S. scabies,* but there are also other species that cause the problem. These species that cause common potato scab exist in all the agricultural soils of the world and are also found in forest soils and other nonagricultural areas. There are thousands of species of *Streptomyces* and there may be as many as two hundred species present in any one field. Many of the antibiotics used today are derived from various *Streptomyces* species; *Streptomyces spp.* is filamentous spore- and toxin-producing bacteria. The toxin that causes the common scab symptoms that many of us are all too familiar with is called thaxtomin. It disrupts the development of cell walls and results in scab lesions. The balance of *Streptomyces spp.* in a soil may be such that the scab-causing species are suppressed. Factors that disrupt this balance may cause a field that never produced scabby potatoes to suddenly produce potatoes with so much scab that potato production in the field may be abandoned. The opposite has happened as well. Examples cited were two Midwestern U.S. university sites that were used repeatedly to screen potato varieties for scab resistance. The crop of scabby potatoes was turned back into the soil every year. Then a year came in which, surprisingly, there was virtually no common scab present on even highly susceptible varieties. In both cases these soils had become scab suppressive and remained so. Soils that are compacted, have poor soil structure, and are low in organic matter tend to have a higher incidence of scab. Some of the practices described later may work largely due to the improvements that they make to soil health and quality.

Practices that reduce the incidence of common potato scab are numerous. These include the use of resistant varieties, rotations with various cover crops, certain nutrient and fertility practices, and fumigation. No one practice generally works alone: a holistic approach that incorporates several of them is probably the best way to manage for common scab. I will attempt to explain in a bit more detail each of these management tools.

Resistant-variety development is probably the area of most benefit to growers with persistent common scab problems. There was an excellent display of more than 100 potato cultivars at the conference. They ranged from highly resistant to highly susceptible and were rated on a scale of zero (resistant) to five (susceptible). Even highly resistant varieties like Russet Burbank can get common scab, though. Some of the Australian work is to find and develop strains of Russet Burbank that are even more highly resistant to the problem.

A couple of our presenters at the conference talked about their work with crop rotations and the use of various cover crops. A common theme was that brassica crops, or brassica cover crops (mustard, canola, rape, broccoli), before potatoes tended to reduce the incidence of common scab more than other materials. Sorghum-sudan grass looked pretty good too. They probably work for different reasons though. The brassicas work as a result of the bio-fumigant activity of the breakdown of the crop—many of us have heard Peter Sexton talk about this at the winter potato seminars in Caribou. The sorghum-sudan grass, on the other hand, produces a lot of sugars and other components that are readily digested by soil microbes, thus feeding the “good” species to the detriment of the “bad” species (*Streptomyces).* Neither winter rye nor annual rye effectively suppresses common scab.

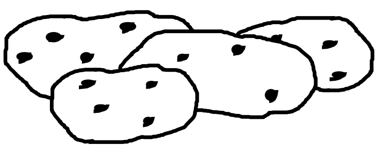
The nutrient and fertility discussion was of particular interest to me, as that is an area that I do a lot of work in. There was a lot of science presented as to why the following suggestions work and I am not going to go into those details here. Instead I will cut to the chase and tell you what has proven useful in reducing common scab. Lime spreading got a bad rap by several presenters, to the chagrin of my friend Glen Swallow of Brookville Lime. Adequate lime to provide calcium and magnesium is important, but spreading high levels of lime just prior to potatoes may cause some short-term soil chemistry changes that can result in increased scab incidence. Remember, scab is a result of cell wall disruption, so adequate calcium to build strong cell walls may be helpful. Gypsum can be also be used to provide calcium.

There were several nutrient and fertilizer messages that I think may be useful for some growers:

- Have adequate soluble phosphorous in your fertilizer. Foliar applied phosphorous in one trial reduced scab by 20 percent.
- Use an ammonium source of nitrogen.
- Have adequate magnesium.
- Do not have excessive potassium. The ratio of potassium to magnesium percents of base saturation should be less than 0.5. A range of 0.3 to 0.4 seems to provide both increased yield and scab reduction. (This information was from A & L Labs.).
- Have adequate manganese. The speaker indicated that high carbon residues (small grain straw or corn stover) can bind up manganese in the short term and this micronutrient may need to be considered for inclusion in the fertilizer material.

The work with fumigation in Michigan generated the most questions and discussion (quest for a silver bullet?). A banded application of chloropicrin in the fall or spring prior to planting dramatically reduced the incidence of common scab and resulted in some good yield increases as well. Similar results came out of Ontario research. There are some management challenges to fumigation. Soil temperatures need to be over 50ºF and potatoes cannot be planted for about two weeks after a spring application. Potatoes need to be planted over the treated band with minimal disturbance to the treated soil. Fumigation with Vapam (metam sodium) does not control scab, so not all fumigation products work on all soil organisms.

And of course, there are lots of things that don't work. We fondly refer to many of these items here as "snake oil" products. The speaker from Scotland told me that their term for similar materials is "muck abouts." Most growers have tried one or more of these types of products in the quest for something, anything, that may help to control common scab. I know this to be so because I have sold and/or recommended some of these materials in an earlier phase of my career! Several of our speakers at the conference told about products in this category that they have trialed in their work. Most did not work and some produced more scab than the untreated control. Try to remember the old adage, "If it sounds too good to be true . . ." This is especially true for this complex, difficult-to-manage disease, common scab of potato.



Variable Speed Drives and Potato Storage Ventilation Fans –Managing Them to Improve Quality and Save Power

Steve Belyea, Project Engineer
Potato Market Improvement Program
Maine Department of Agriculture Food and Rural Resources

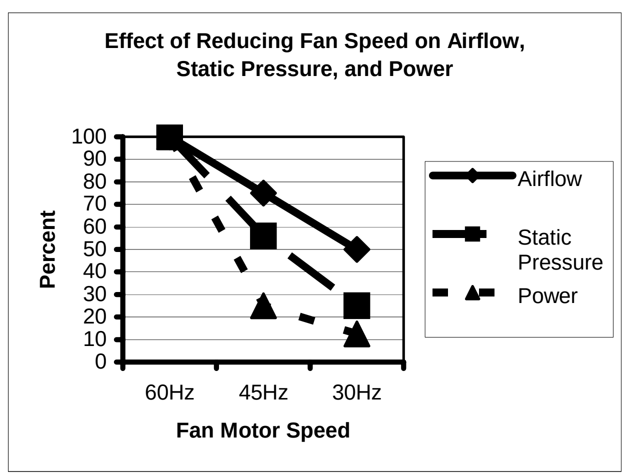
Variable speed drives (VSD), also known as variable frequency drives (VFD), are rapidly becoming a standard component of potato storage ventilation systems. Used to adjust fan motor speeds, VSDs are a valuable tool that can improve potato storage management and dramatically reduce electrical costs for ventilation.

Constant ventilation airflow through a bin can improve potato quality out of storage by maintaining a constant temperature throughout the bin. Timed run management of the ventilation system will allow temperatures within the bin to stratify, becoming cooler on bottom and warmer on top between fan operating times. During periods when there is no air circulating through the bin, conductive heat loss through exterior walls and ceiling will create cool spots along exterior walls and on the ceiling. Another common occurrence during periods with no ventilation is the infiltration of cold air into the plenum through intake dampers. Temperature fluctuations within the bin over time will result in uneven fry color and will hasten the onset of sprouting.

Carbon dioxide (CO2) is a byproduct of respiration proven to have a negative effect on fry color. Elevated CO2 levels will develop rapidly if not effectively flushed from the bin. Since CO2 is a gas heavier than air, lack of ventilation airflow will result in an accumulation of CO2 that will be greatest at the bottom of the pile. The accumulation effect is worsened by the fact that tubers at the bottom of the bin also produce more CO2 due to the stress of weight above. Constant airflow through the bin will prevent CO2 from building up in layers and affecting fry color.

Understanding the Technology – Airflow and Energy Relationships

1. VSDs electronically convert 60 Hz three phase or single phase electrical power from the utility company to 3 phase adjustable frequency power. By using VSDs to change the frequency of electrical power being fed to a 3 phase motor, ventilation fan motors can be adjusted to any speed from 0 Hz (stopped) to 60 Hz (full speed). Because



VSDs can convert single-phase power from the utility to 3-phase power, it is technically possible to install VSDs even where only single-phase power is available. VSDs installed where there is only single phase power available must have increased capacity and will be more expensive to purchase and install.

2. Typical ventilation fan motors are designed to operate at 60 Hz. Lowering the frequency of the electricity delivered to the motor will change the motor's operating and energy characteristics.
3. For example, reducing fan speed to 50% (30 Hz) reduces airflow to 50%; reduces static pressure output of the fan to 25%; and reduces electricity consumption by the fan to 13%. Refer to the graph below for a broader representation of the effects due to reducing motor speed. The dramatic reduction in electrical power used by reducing fan motor speed makes variable speed drives very appealing as a storage management and cost reduction tool. Be aware of one technical reality – VSDs are about 95% - 97% efficient in their use of electricity. Operating fans at full speed (60Hz) with a VSD will actually use slightly more power than without the VSD.
4. Potatoes in storage require an airflow rate of 10-15 cfm / ton just to remove normal heat of respiration during the holding period. Heat of respiration production varies significantly, depending upon storage temperature, variety, and physiological age of the potatoes in storage. If your ventilation system is not designed to deliver more than 15 cfm / ton you will not normally be able to reduce fan speed and will not realize any power savings.
5. Variable speed fan motor drives are a management tool with the potential to improve potato quality out of storage and reduce electricity costs. However, proper management is vital if you are to maximize the benefits from installing VSDs.

Optimizing Storage Management During Fall Cool Down

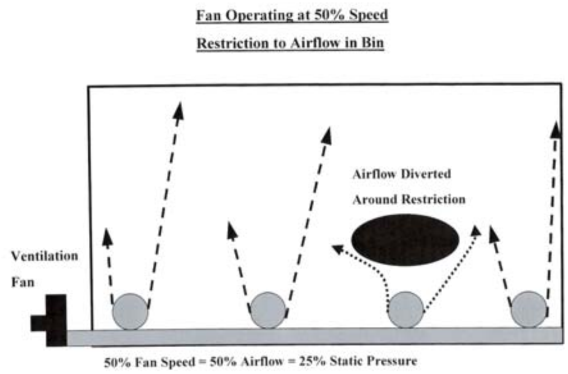
VSDs usually will not provide any advantage during fall cool down. Limited availability of outside cooling air and high tuber respiration rates require high to maximum fan speeds and airflow to achieve bin cooling goals. However, sometimes when potatoes are harvested cool and bin temperature is correct, fan speed may be reduced during fall cool down. Carefully monitor bin temperatures if using reduced fan speed during cool down. Maximum airflow rates must be used if there is any question of crop storability. Storage diseases (such as Pink Rot and soft rot), field frost, or damp tubers must be managed aggressively and early in storage. Aggressive and early management to dry diseased or damp tubers will minimize subsequent breakdown and quality losses. *Management strategy for healthy tubers* – operate fans to maintain a maximum differential of 2F – 3F between plenum temperature and return air temperature. Keeping the bin temperature differential within this range will minimize tuber weight loss and related quality issues.

Optimizing Storage Management During the Winter Holding Period

1. <u>Temperature differential</u> in the bin: maintain 1F – 2F differential between plenum setpoint temperature and return air temperature. A 1/2F - 1F bin temperature differential is normal for bin depths up to 16 feet, and a 1F - 2F bin temperature differential is normal for bin depths of 18 feet or more. *Management strategy* – operate fans at a speed which maintains the desired bin temperature differential. Faster fan speed = higher airflow = less temperature differential.
2. <u>Temperature differential in the bin while refrigerating:</u> to minimize the risk of evaporation coil freeze ups, maintain at least 2F bin temperature differential. Note: you will not be able to operate ventilation fans at reduced speeds while refrigerating unless your refrigeration system is so designed. Minimum airflow of 500 fpm – 600 fpm through the evaporator coil is required to prevent coil freezing.
3. <u>Restrictions to airflow</u> in the bin: a small run of tubers or dirt and debris can restrict airflow within the pile. Reducing the fan speed also reduces the static pressure output of the fan. Reducing the static pressure output of the fan in turn reduces the ability

of airflow to “push through” any restrictions within the bin. There is a strong possibility that minor restriction to airflow within the potato bin will limit ventilation airflow through the restriction or deflect airflow around the restriction. The result can be localized “hot spots” where temperature and CO2 can build up. See the representation of this situation below. *Management strategy* - make periodic temperature checks on top of the bin to locate areas not being thoroughly cooled. Increase fans to full speed periodically and observe return air temperature – if return air temperature increases, then the fans are not effectively removing heat and fan speed should be increased.

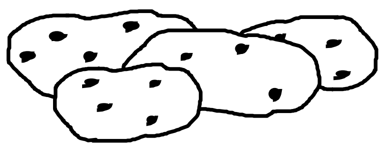
4. <u>Restrictions to airflow</u> in the bin: a small run of tubers or dirt and debris can restrict airflow within the pile. Reducing the fan speed also reduces the static pressure output of the fan. Reducing the static pressure output of the fan in turn reduces the ability of airflow to “push through” any restrictions within the bin. There is a strong possibility that minor restriction to airflow within the potato bin will limit ventilation airflow through the restriction or deflect airflow around the restriction. The result can be localized “hot spots” where temperature and CO2 can build up. See the representation of this situation below. *Management strategy* - make periodic temperature checks on top of the bin to locate areas not being thoroughly cooled. Increase fans to full speed periodically and observe return air temperature; if return air temperature increases, then the fans are not effectively removing heat and fan speed should be increased.



5. <u>Air Quality</u>: low airflow rates and low static pressures can lead to poor air quality conditions in storage. Static pressure developed by the fan at low speeds may be too low to effectively move air through the bin. Or static pressure may be too low to open the exhaust dampers. If exhaust dampers do not open, then exhaust air cannot exit the storage and fresh air cannot enter via the fresh intake damper. Low ventilation system static pressure is known to create conditions where intake dampers may be open but no fresh air is entering the storage because exhaust air cannot escape. The result is a build up of CO2 in the bin, which stresses the tubers, and in turn leads to production of reducing sugars and deteriorating fry color. *Management strategy* – run the ventilation fans at full speed periodically and observe CO2 levels in the return air. If CO2 levels increase, then there has not been enough ventilation air. Flush the storage at high fan speed until CO2 reaches the correct level (usually below 2,500 ppm) and then reduce fan speed to a new but higher speed. Keep checking CO2 levels periodically this way and adjust fan speed until CO2 is stable.
6. <u>Minimum fan speed</u>: in general, operation of ventilation fans at speeds less than 30 Hz should be approached with great caution. Because static pressure drops dramatically at low fan speeds, there is very real concern about poor ventilation air movement through the bin. Another concern is that during periods of extreme cold temperatures outside, it is possible for return air to be cooled by cold ceiling and wall surface temperatures on its way back to the fan

room. Plenum temperature could be exactly as desired but actual bin temperature could be several degrees warmer and undetected due to the cooling of return air. *Management strategy* – if you are operating the ventilation fans at speeds less than 30 Hz, be especially watchful of bin temperatures.

7. Potential storability problems in the bin: do not reduce fan speed if the temperature differential exceeds 2F or if there is noticeable tuber breakdown, frost damage, or any questionable storing quality.



Boron

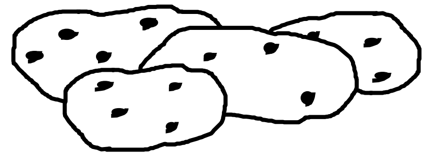
Peter Sexton, Extension Crops Specialist

While boron is an essential nutrient for crop growth, it is only required in very small quantities. In on-farm studies done with Russet Burbank potatoes in Maine, the potato crop took up about 0.12 lb of boron per acre over the course of the season. The rate of uptake per day was approximately 0.002 lb per acre per day. It appears that uptake of boron by the crop tends to slow down about two-thirds of the way through the season. Assuming this reflects boron requirements by the crop, it appears boron applications should be made early in the season.

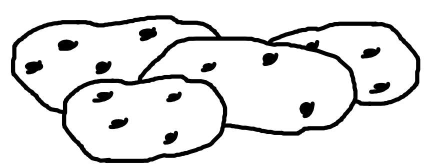
The critical level of boron in soil is considered to be 0.5 ppm (hot-water extractable boron). Levels less than this suggest that the crop would benefit from boron fertilizer. Boron could be applied several ways with the rate to apply depending on the method of application. Boron toxicity is a hazard that needs to be considered. Symptoms of boron toxicity include marginal necrosis of older leaves, decreased stature of plants, and decreased tuber set. Some research work has shown decreased yield of potatoes with preemergence applications of 4 lb of boron or more per acre. Banded boron is more efficiently taken up than is broadcast boron. This means that toxicity symptoms will occur at lower levels of boron application when it is banded versus broadcast. Probably the most forgiving approach is to broadcast boron before planting or preemergence, at a rate of 0.75 to 1.5 lb per acre. One option is to include a 0.5 to 0.75 lb boron in a preemergence herbicide application (assuming you can get it in solution which may depend on spray volume) and then apply another 0.25 lb foliar early in the season. Follow this with leaf or petiole sampling to see if you need further boron applications. If you include boron in banded fertilizer, it is probably best not to apply more than 0.5 lb boron in the band at planting, and do not apply boron in a band unless you are sure it is well mixed and evenly distributed in the fertilizer. A couple of rules of thumb for post-emergence applications are not to apply more than 0.25 lb of boron at a time and not to make back-to-back applications. Where you want to apply 0.5 lb per acre, split it into two applications; where you want to apply 0.75 lb per acre, split it into three applications. When adding boron to tank mixes follow manufacturer's instructions and it is prudent to conduct a jar test to be sure the materials in use are compatible. Boron will stabilize water-soluble packets so they won't fully dissolve (you may end up with a gooey mess). Also, foliar burn has been observed where boron was applied with crop oil. The only boron fungicide compatibility issue I have heard of is with Manzate DF – other than that, no problems with fungicide compatibility have been reported to our office. The critical threshold for boron deficiency in young leaves and petioles is considered to be 20 ppm. Leaves testing below this indicate the plants are marginal or deficient in boron. The boron concentration of young leaves (fourth leaf from the top) does not appear to change much during the course of the season. Thus, the critical value of 20 ppm can be used early in the season as well as later on in crop development.

At soil pH less than 7.0, available boron is predominately in the form of $B(OH)_3$. This molecule does not have a charge and is readily leached from the profile. It is not held by the cation exchange system of the soil. Because boron is so mobile, its concentration tends to be greater in fine textured soils than in coarse soils where it is more rapidly leached out. The majority of the boron applied in one season will most likely be leached out before the next season is underway. As noted above, boron moves with water through the soil. As water is absorbed by the roots, boron moves along with it. Factors that decrease the rate of water use by the crop will also tend to decrease the rate of boron absorption. The majority of available boron appears to be associated with the organic fraction near the surface of the soil. Because of this, dry surface soil decreases boron availability to the plant and sometimes leads to increased incidence of boron deficiency. Once inside the roots, boron again follows water movement, traveling to older leaves where most water loss is occurring. When boron is present in excessive amounts, this leads to burning of leaf margins on older leaves in severe cases, and to leaves being darker in color in milder cases of toxicity. Other symptoms of boron toxicity include decreased growth and stature of the plant, and decreased tuber set. Boron toxicity does not appear to decrease tuber size as much as it decreases tuber number. It appears that the potato plant has a hard time moving boron from older leaves to growing points (newer leaves and developing tubers). This may be because much of the boron is embedded in the cell wall. Another aspect of this is the non-polar nature of boron which may make it more difficult for the plant to compartmentalize and control boron movement. In any case, the apparent lack of mobility of boron within the plant suggests that boron should be applied to the soil to allow for uptake by developing tubers. It is not clear if potato varieties differ in their ability to take up boron, or if they differ in their sensitivity to boron toxicity.

Among its several functions, boron plays an important role in the process of cell wall formation and structure. It acts along with calcium in hardening cell walls by linking structural carbohydrate molecules together. One may think of it as a necessary ingredient in the “mortar” that holds the “bricks” of the cell wall together. Under boron deficiency this linkage is lost, and normal cell wall formation is impaired. Initial symptoms of boron deficiency tend to occur at meristems where new tissues and cell walls are rapidly developing and growing. Thus, shoot and root tips are sensitive to boron deficiency. The potato crop is less sensitive to boron deficiency than are some other crops such as canola, broccoli, and alfalfa. However, a mild boron deficiency may decrease yield on the order of 10 %. Boron deficiency is also associated with increased internal defects and with tuber discoloration.



Please visit our updated website at mainepotatoipm.com. All of the photos from our Potato Pest Field Guide are now available on this website for your viewing.



Calculating Plant Stands

James D. Dwyer, Extension Crops Specialist

Calculating potato plant stands can be a very valuable investment of time for a potato producer. Calculating potato plant stands can assist the producer in evaluating the efficiency and the cost benefit ratio of various practices. Plant stand information can be particularly useful in evaluating the efficiency potato planting equipment, seed cutters and the impacts of seed handling practices.

Within the field, choose three random 50-foot areas (one row in each section). Try not to select portions of the field that "look" the best or worst. Random selection is the key. Many times, throwing a ball or walking "x" number of rows helps to select non-biased areas. Once the area has been selected, count the number of plants within the 50 feet of row. Add the number of plants counted in each section together.

Example:	
Section 1:	53
Section 2:	58
Section 3:	58
Total:	169

Within your field information records, find the seed spacing. The seed spacing is that spacing which the planter was set for, in other words, the intended plant spacing. A typical example might be 8.5". Take the plant spacing number and divide it into 1800, which is the total number of row inches with in the three replicates. (1800 inches = 50 row feet + 50 row feet + 50 row feet x 12 inches)

1800/8.5 = 211.8

Round to the nearest whole number, the 211.8 becomes 212. This is the number of plants that would be present if there were a 100% plant stand. Divide the total number of plants found in the three sections by this number (212).

169/212 = .797

Multiply by 100 and round to the nearest whole number. This number will be the percent plant stand.

Typically, the average plant stand for round whites at an 8 to 9 inch spacing in Maine has been approximately 72 percent. Russet types planted at 14-18 inches, typically, have had a 90 plus percent stand. Growers should be aware that there is a trend for the closer the spacing the lower the plant stand. This is largely due to the efficiency of the equipment planting the seed not necessarily the variety.

Growers should analyze plant stand information to insure maximum efficiencies and proper equipment calibrations.

Extension Educator Matt Williams Retires

James D. Dwyer, Extension Crops Specialist

Matt Williams, Extension Educator for University of Maine Cooperative Extension's Houlton office, has announced his retirement from the University as of April 30, 2007. Matt began his Extension career in Aroostook County in 1985. Matt's Extension projects have had a positive impact on the people of Aroostook County, the entire state of Maine, and beyond. Matt is one of those rare individuals with a talent for working in a wide array of subject areas, from livestock to crops to equipment. His expertise—and he personally—will be missed greatly by our organization and by his clientele.

Even though Matt will be retiring from Cooperative Extension, he will remain very busy, as he will continue to farm in southern Aroostook and take time to golf and walk dogs. We want to wish Matt all the best: thank you, Matt, for 22 fantastic years!

THE UNIVERSITY OF MAINE
Cooperative Extension

PO Box 727
Presque Isle, Maine 04769
Return Service Requested

Nonprofit Org
US Postage
PAID
Presque, Isle, Maine
Permit No. 125