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CROP PRODUCTION ISSUE

Dear Potato Grower,

This is the second issue of SPUDLINES for 2002. In this issue, articles are presented on soil test summaries, and articles on Boron and Potassium. It is our hope that this information will be of value in the upcoming season. Andrew Plant has an article on trapping European corn borers. Also included is the latest Potato IPM fact sheet on European corn borer.

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.

Sincerely,

Steven B. Johnson, Ph.D.
Crops Specialist

Upcoming Programming of Interest
Upcoming Programming of Interest

July — **Rouging School**
Cooperative Extension Office,
Presque Isle

For further information, call 764-3361

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

SUMMARIES OF SOIL TESTS, 2002

Steven B. Johnson, Ph.D.
Crops specialist

During 2002, the University of Maine Soil Testing Laboratory processed 1,434 soil tests for soils to be planted to potatoes in Aroostook County. The yearly summaries provide a good general picture of the soil fertility and pH conditions in Aroostook County. I have produced charts of the CEC, pH, phosphorous, potassium, calcium, organic matter and magnesium levels of the soils tested by the University of Maine lab.

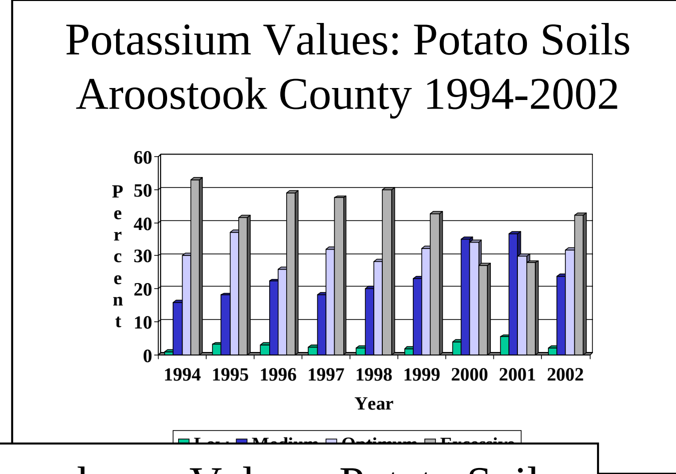
The chart of the pH ranges in Aroostook County shows that 72 percent of the soils tested are between 4.6 and 6.0, with 25 percent of them from 5.1 to 5.5, and 39 percent of them from 5.6 to 6.0. I think that the growers are doing well maintaining the pH at a level most desirable for potatoes. This is just about the same across the board compared to 2001.

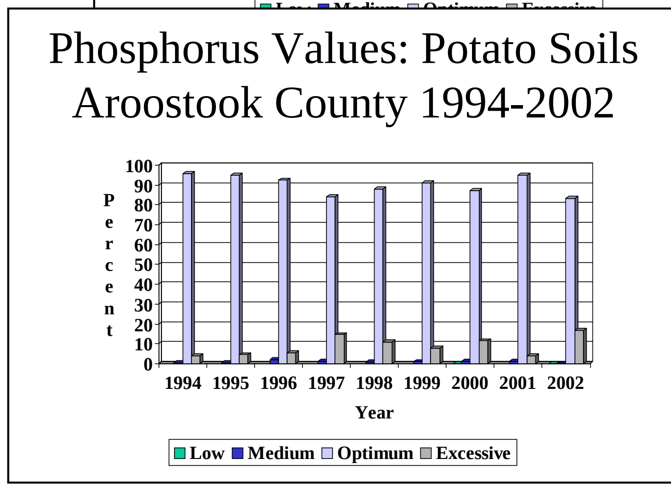
The charts of the nutrient levels of the soils show a tendency toward overfertilization with potassium. Fertilizer sold as 10-10-10 means that it is 10 percent by weight of N-P-K or nitrogen-phosphorous-potassium. One thousand pounds of 10-10-10 would add 100 pounds of nitrogen, phosphate, and potash to the soil. Soils with excess phosphorous or potassium do not need the addition of these elements for the next crop. Over 42 percent of the soil tests showed excess levels of potassium. This is down from over 50 percent just six years ago. Reduction of potassium in the fertilizer may be appropriate for some of these soils.

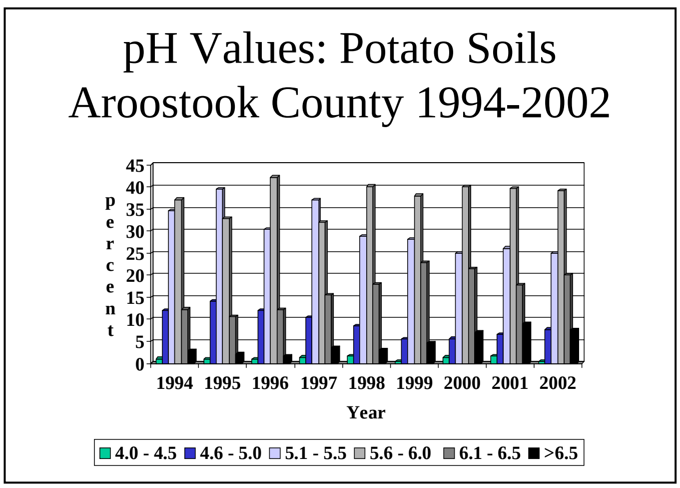
Fifteen percent of the soil samples tested excessive for calcium. Trying to accomplish a major pH shift in one year is not the best approach.

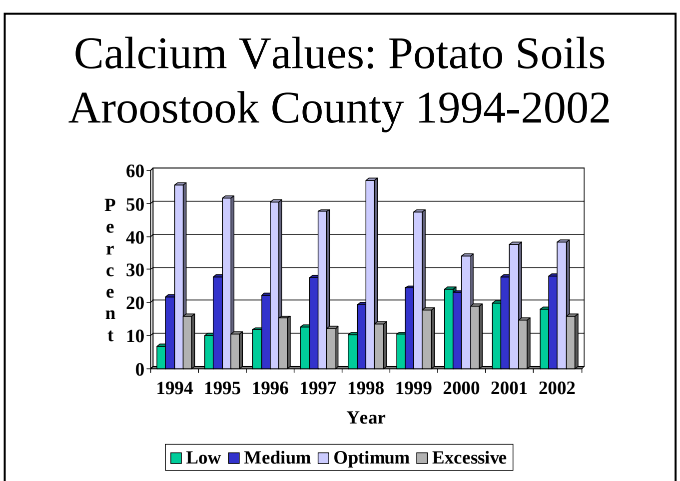
If your soil test results are at the extremes of one or more of the charts, it is possible that you could save some money by adjusting your potato fertilizer usage.

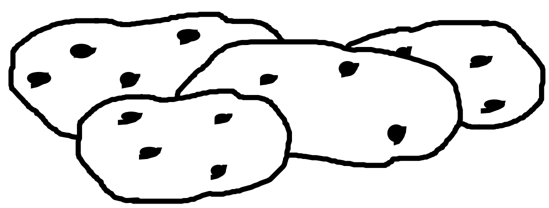
For further information on soil tests, or to have your soil tested, contact the University of Maine Cooperative Extension (764-3361 or 1-800-287-1462).











POTATO PEST MONITORING

Andrew Plant
Pest Management Professional

Trapping for potato insect pests allows you to determine the presence of certain pests without surveying fields every day. Traps differ in their utility in that some act merely as an indicator of presence, while other traps can effectively detect presence and abundance. Trapping for potato pests is an important and integral part of an IPM program. Traps are based upon two factors: insects move and the trap will hold the target pest. Potato pests commonly monitored with traps include European corn borer (ECB) and aphids.

Trap types differ by the target pest. Traps can be *attractive* or *passive* in how they collect the target pest. Attractive traps lure pests by using a chemical or physical stimulus; passive traps rely on incidental occurrences.

ECB populations may be monitored using chemically attractive pheromone traps or physically attractive black light traps. Pheromone traps utilize female sex pheromone mimics to attract the male moth. Black light traps, emitting ultraviolet light, attract both sexes of these nocturnal flying moths. Pheromone traps are preferred due to species specificity and relative ease of use, as compared to the black light traps, which catch many different species and are rather cumbersome to handle.

There are two different pheromone ecotypes observed in ECB: E and Z. The separation of the ecotypes is due to the general ratios of two similar forms of a sex pheromone chemical emitted by the female moth, E form and Z form. The E pheromone type, containing a 99:1 ratio of E:Z forms, is the New York strain; commercially available lures label this strain as ECB II. Z pheromone type, containing a 3:97 ratio of E:Z forms, is the Iowa strain; commercially available lures label this strain as ECB I. Having two distinct pheromone ecotypes results in having separate sexual communication systems. Generally speaking, Z females attract Z males, and E females attract E males.

Two different pheromone traps are widely used in ECB trapping: the sticky trap and the Heliothis-style trap. These traps, used to detect male adult moth flight, employ a mimic of either the E or Z sex pheromone as a lure. Z strain (Iowa) ECB is the predominant pheromone ecotype observed in our growing area and therefore is the focus of most trapping efforts. Trap placement is very important. Both types of traps should be placed adjacent to monitored potato fields in dense vegetation, so that the pheromone is slightly below the top of the vegetation canopy. Height adjustment of the traps is needed throughout the season to comply with the growing vegetation canopy.

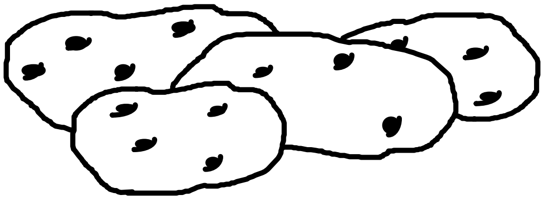
Sticky traps use a capsule containing the synthetic sex pheromone mimic placed within the trap to attract the moths to the glue-like trap bottom. Once lured in, the moth sticks to the glue and is unable to escape. Pheromone capsules should be replaced every other week to ensure freshness, and the sticky trap bottoms should be replaced when their condition deteriorates. Sticky traps should be monitored on a weekly basis for ECB moth occurrence. This trapping system has not been shown to have a good correlation with larval ECB infestation levels. Moths trapped in this method should serve only as a “flag” that the moth is present in the field.

Heliothis-style traps are similar to the sticky traps in that they use the same synthetic pheromone capsules, but differ in that they employ a cone-shaped net to capture the ECB moths. The pheromone lure is placed at the bottom of the trap and hung slightly below the top of the vegetation canopy. It should be elevated as the height of the canopy increases. The top cone of the Heliothis-style trap is removable from the rest of the trap and contains an insecticide kill strip. Moths are collected in this top cone and are protected from the rain and wind by covering with a plastic bag. Pheromone capsules should be replaced every two weeks and kill strips should be replaced every three weeks. Heliothis-style traps should be monitored on a weekly basis for ECB moth occurrence. This style trap has been shown to be highly effective in trapping ECB moths. ECB moths trapped are an indicator of presence, and there is data that supports that Heliothis-style trap counts may provide a good estimate of larval ECB infestation levels.

Aphids may be apterous (wingless) or alate (winged). With the apterous form having a limited spatial range, in-field scouting is the best monitoring system. Alate forms, with the capabilities to move large distances, are best monitored through a combined system of in-field scouting and trapping. Alate aphids are attracted to yellow; a very specific shade of yellow has been observed to be most attractive. The trap used is a 9- x 13-inch yellow pan, filled to three-quarters with water. Aphids fly to the yellow pans, land in the water and drown. This type of trap is non-specific, with the potential to catch many aphid species, including Green peach aphid, *Myzus persicae*; Potato aphid, *Macrosiphum euphorbiae*; Buckthorn aphid, *Aphis nasturtii*; and Foxglove aphid, *Aulacorthum solani*. Yellow pan traps serve as an indicator of presence and should be used in combination with field scouting to ensure that recommendations are warranted.

Placement of yellow pan traps is important. They should be set up adjacent to the monitored field and out of high vehicle traffic areas. Yellow pan traps should be monitored twice a week. Aphids should be collected out of the water with a small paintbrush and placed in a microcentrifuge tube filled with 40 percent ethanol or isopropyl for sample preservation. Cleaning of the yellow pans is necessary so that the attractiveness of the pans remains constant. Using a hard-bristled mason’s brush and water should provide adequate cleanliness. Pans should be refilled with water after every monitoring event. Adding a drop of liquid soap to the yellow pan water will aid in trapping efficiency by decreasing the surface tension of the water.

Trap collections from sticky traps, Heliothis-style traps, and yellow pan traps should be individually labeled according to date and site and sent to a diagnostic lab for verification and identification.



AUTOMATED SYSTEM FOR SOIL MOISTURE MONITORING

Peter Sexton, Ph.D.
Crops Specialist

Accurate assessment of soil moisture is critical for timing water application on irrigated fields. There are a number of methods for tracking soil moisture. You can go from a wireless system that outputs data directly from the field to your home or office computer, all the way to just going out with a shovel and rubbing the soil in your hands. The latter approach (the "hand-feel" method) is the most popular method among irrigators. It basically uses the physical properties of the soil as a measure of soil moisture. This is a valid method, and with experienced growers it works quite well. It has the advantage of not being tied to one spot. The grower can move around the field and sample different areas at will. It also can be done at any time and does not require any special equipment. The drawbacks of this method are that it can take time to sample to depth, it is difficult to quantify over time, and it can be subjective. Ultimately the interpretation of any measurement is subjective, but the hand-feel method can be biased by what a person expects to see when they walk in the field. However, I would not recommend giving up on the hand-feel method and blindly following a soil moisture monitor, because sometimes sensors suffer mechanical failure or end up being placed in a poor spot. There is no substitute for going into the field and seeing what is happening first hand. Yet it is also wise to have a second measurement of soil moisture to complement the hand-feel approach. A second method of measuring soil moisture will help decrease the risk of misjudging when to irrigate. I can well remember one time where soil moisture sensors helped avoid a problem in an irrigated clover trial I was managing in Oregon. The plants were healthy and vigorous, there was moisture in boot tracks on the surface of the soil, and the soil felt like it had adequate moisture to me. I thought there was no need to irrigate that day. Much to my surprise, the soil moisture sensors we had in the plots indicated the soil was in need of irrigation. I dug around at several points to double check it, and sure enough the subsoil did not have much moisture. This is just one example, but it shows that sometimes a backup method of monitoring soil moisture is helpful.

For the last two seasons, soil moisture monitoring on a number of fields has been conducted in cooperation with growers, the Central Aroostook Soil and Water Conservation District, McCain Foods and Cooperative Extension. In this pilot study, modified gypsum block sensors (watermark sensors) were placed in fields around the county. A student took measurements twice weekly and provided data to the growers. This system was useful, but data was limited to when the student could visit each field. In order to overcome this limitation, we also evaluated an automated soil moisture monitoring system with Mr. Keith LaBrie, of St. Agatha. The Maine Potato Board provided funds to purchase the monitoring system, and Cooperative Extension set the system up at the LaBrie's operation. Three units were placed within a quarter mile of one another. One unit was set up under a center pivot; one was set up in a dry corner of the field; one was set up under a reel-hose system (traveling gun). The monitoring system consisted of a data logger (a little bigger than a paperback novel in size) wired up to six watermark sensors. The data logger took readings automatically every eight hours and held the data in its memory. It has a small screen where it shows the readings for the last 35 days, for each sensor, at the touch of a button. Soil moisture data from the unirrigated portion of the field is shown in Figure 1. Soil moisture from areas irrigated with a traveling gun and center pivot are shown in Figures 2 and 3 respectively. The automated system we looked at has several advantages over manual measurements: 1) it provides data on current soil moisture and soil moisture over the last five weeks at the touch of a button; 2) it tracks soil moisture over the whole season; 3) it monitors six sensors, so the operator can readily compare sensors if some of the data appears to be out of line. As noted earlier, there are several options for monitoring soil moisture. The cost of the simplest automated systems start around $400 and go up from there. I would not recommend one system over another, but I do think growers who irrigate would be well advised to strategically place soil moisture sensors that will serve as a backup for deciding when to irrigate. Anyone who is interested in the automated system we tested last year is welcome to give me a call at 764-3361, or email at psexton@umext.maine.edu. I would be glad to provide more information on the system, help with placing it, and give some suggestions on guidelines to use for interpreting the data (i.e. irrigation thresholds for deciding when to irrigate).

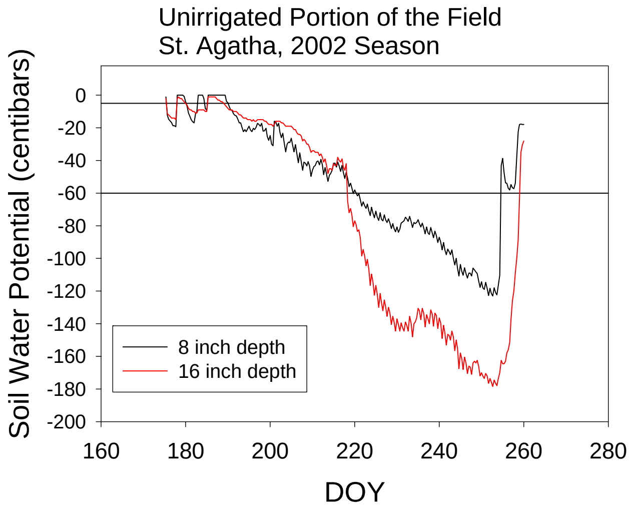


Figure 1. Soil moisture readings from an unirrigated corner of a potato field. In this graph, the lower the line, the drier the soil. A value near zero indicates very high soil moisture, and a value below –60 indicates the crop is probably going into drought stress. "DOY" stands for "day of the year". Day 220 would be August 8.

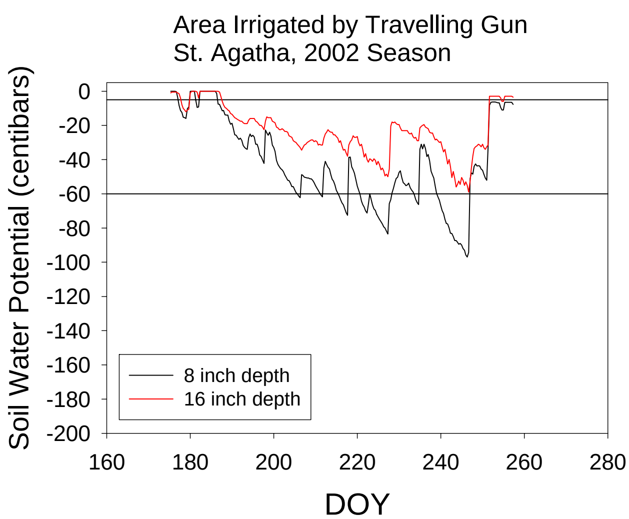


Figure 2. Soil moisture readings from a field that was irrigated with a traveling gun. Note the spikes in soil moisture, which correspond to application of irrigation water. See Fig. 1 for an explanation of the graph.

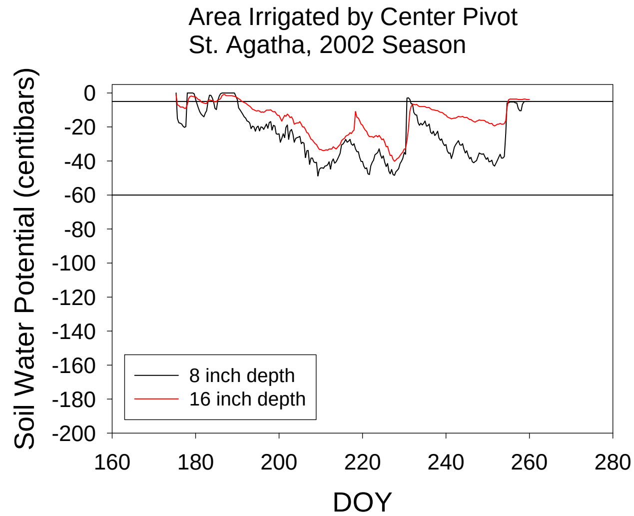
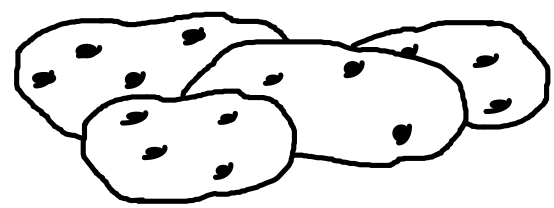


Figure 3. Soil moisture readings from an area that was under a center pivot. Note the relatively even soil moisture across the season. See Fig. 1 for an explanation of the graph.



POTASSIUM FERTILIZATION AND POTATO PROCESSING QUALITY

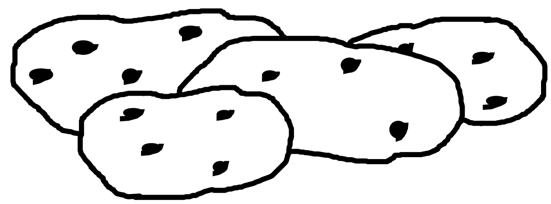
Gregory Porter, Andy Siver, and Paul Ocaya
Department of Plant, Soil & Environmental Sciences
University of Maine; Orono, ME 04469

Potassium (K) is an essential plant nutrient that can have important effects on potato yield and quality. Our research has shown that potash fertilizer, most commonly applied as potassium chloride (KCl), can have strong effects on tuber size, specific gravity, fry color, internal defects, bruise susceptibility, and tuber biochemistry.

A potassium fertilization study was conducted from 2000 to 2002 at the Aroostook Research Farm in Presque Isle using the Atlantic variety and no supplemental irrigation. We looked at how current-season (0, 200, or 400 lb/A K_2O) potash and long-term potash fertility programs affected potato yield, quality, and nutrient uptake. Soil-test K levels on these plots ranged from 116 to 201 lb/A (2.4 to 4.4 percent base saturation) depending on the long-term potash fertility program. These levels range from medium-low to medium by UMaine soil testing criteria. The current-season potash rate played the dominant role in determining yield and quality in this experiment. Yield did not increase above the 200 lb/A potash rate; while specific gravity declined dramatically up to the 400 lb/A rate. Chip color and tuber size improved dramatically as the potash rate increased from 0 to 200 lb/A and more slowly as the rate was increased to 400 lb/A. Internal defects incidence (hollow heart, brown center, and black spot bruise) declined dramatically in response to increasing potash rate. This study shows that increasing potash fertilization rates to the optimum for yield production also improves most quality attributes for processing. Increasing the potash rate to levels above those for maximum yield can provide some additional improvement of certain quality parameters (e.g. chip color, tuber size, and internal defects incidence). The exception was specific gravity, which continued to decline as the potash rate was increased; however, for non-irrigated production of this very high specific gravity chipping variety in northern Maine, the specific gravity remained at acceptable levels for processing ($\geq$1.088) even at the 400 lb/A potash rate.

We have also conducted potash fertilization studies with three other processing varieties (Russet Burbank, Shepody, and Snowden) from 1999 to 2002. The results have been generally quite similar to those reported for the Atlantic experiment. Yields have typically been maximized by approximately 200 lb/A potash; however, a few sites have required 225 to 300 lb/A, while a few others have been unresponsive to potash. Tuber size and fry color have generally improved in response to increasing potash rates, while black spot bruise susceptibility of Russet Burbank and Snowden has declined. Biochemical analyses indicate that tuber tyrosine content declines dramatically as potash rate is increased. Tyrosine is a key ingredient in pigment formation following bruising, so the change in tuber tyrosine concentration may help explain why increased rates of potash result in decreased black spot incidence and susceptibility. Over the 11 experiments conducted, each 100 lb/A of potash decreased specific gravity by about 3.5 points. The effect was strongest under irrigation and in the years with relatively high rainfall. It was lower (about 2.5 points per 100 lb) in dry years and when potash was broadcast rather than banded. For moderate specific gravity processing varieties like Russet Burbank and Shepody, potash's negative effect on specific gravity would be expected to decrease specific gravity below acceptable levels in some growing seasons. Snowden, a very high specific gravity variety, responded more like Atlantic and retained acceptable specific gravity at all potash rates.

The information that we are gathering from these studies will be used to update the soil test recommendations and tissue testing guidelines used for Maine potatoes. It should help potato growers continue to improve the quality of potatoes that they deliver for processing and other markets.



POTASSIUM FERTILIZATION AND POTATO PROCESSING QUALITY A FOLLOW UP

Steven B. Johnson, Ph.D.
Crops Specialist

The Role of Potassium in Plants

Potassium is absorbed from the soil by plants in the form K^+. Potassium is critical to photosynthesis, protein synthesis and plant metabolism. Potassium is involved in the activation of more than 60 enzyme systems that regulate the rates of major plant growth reactions. It is important in the breakdown of carbohydrates that provide energy for growth. A major function of potassium is regulation of water loss in the potato plant.

The concentration of potassium ions in the cells cause guard cells associated with stomata to open and close, thereby regulating water loss from leaves.

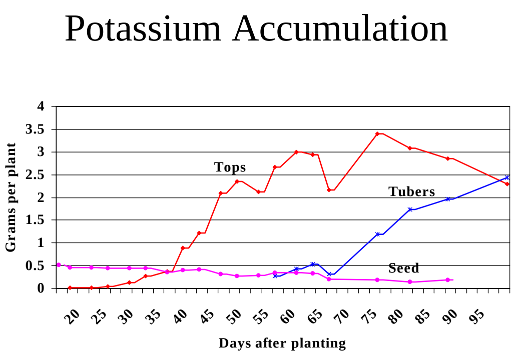


Figure 1. Potassium accumulation in potato plants

Potassium Deficiency in Plants

With potassium critical to photosynthesis, deficiency leads to reduced photosynthesis, increased respiration, lower plant carbohydrate supplies and lower yields. Potatoes show reduced growth, with poorly developed root systems, smaller leaflets and shortened internodes, giving the plant a compact appearance. The leaflets loose their smooth surface, become crinkled and droop. The appearance of abnormally dark green foliage is one of the first indications of potash deficiency. Later, the older leaves become yellowish, and a brown or bronze color develops, starting from the tip and edge and gradually affecting the entire leaf, which finally dies. Under some light conditions, a distinct purplish cast is apparent. The lower leaves may dry up at the same time, leaving a tuft of dark green leaves at the top of the plant. Eventually, the entire plant dies. The upper leaves are usually smaller, crinkled and darker green than normal. Black spot bruise and stem end rot are shown to increase with K^+ deficiency.

Potassium deficiency causes water imbalances and is especially critical in drought situations where the stomata do not close fully, thereby increasing water loss and drought stress.

Potassium Movement in Soils

Some of our soils may contain 20,000 pounds of K^+ per acre. However, this does not mean that it is available to the plants. Rarely is more than five percent of the total K^+ plant available.

Most Maine potato soils are not sandy soils or organic soils, so potassium is not very mobile in the soil solution, although water in the soil solution helps disperse potassium ions short distances. Proper placement of the started fertilizer is critical. If the roots don't grow into the potassium, it may not be available to the plant. With the root mass of potatoes contacting less than five percent of the soil, it is imperative to have the soil well supplied with potassium. Any reduction in root growth reduces potassium uptake.

Plant-Available Potassium

Available potassium is soluble potassium in the soil solution and the potassium held in the exchangeable form by soil organic matter and clay particles. The potato plant can uptake either exchangeable potassium or soil solution potassium. Soil organic matter and clay particles are negatively charged and attract cations, such as potassium. The potassium in solution is usually less than 10 pounds per acre. With the potassium needs of potato exceeding potato nitrogen needs, 10 pounds per acre is not adequate. As the potato plant removes potassium from the soil solution, exchangeable potassium is released into the soil solution. This transfer from the exchangeable sites on soil particles into the soil solution only occurs when the soil contains adequate potassium reserves for the crop. Potato removes over 100 pounds of elemental potassium per acre, so most potato soils require the addition of potassium to ensure good yields.

Greg Porter presented *Potassium Fertilization and Potato Processing Quality* at the latest Northeast Potato Technology Forum. The abstract appears in this issue of SPUDLINES. The abstract only touches on the depth of the work that Greg's program has been conducting for the past three years. He has graciously allowed me to use his slide set for this expansion of the abstract.

His study shows that increasing potash fertilization rates to the optimum for yield production also improves most quality attributes for processing, with the exception being specific gravity. His abstract states, **"The current-season potash rate played the dominant role in determining yield and quality in this experiment."** This quote bears further investigation.

His data showed that yield did not increase above the 200 lb/A potash rate (figure 2). The take-home message is that overfertilization with potash will not solve some basic soil fertility problems, but underfertilization with potash will have very detrimental effects on yield. A similar assessment can be made on the tuber sizes (figure 3).

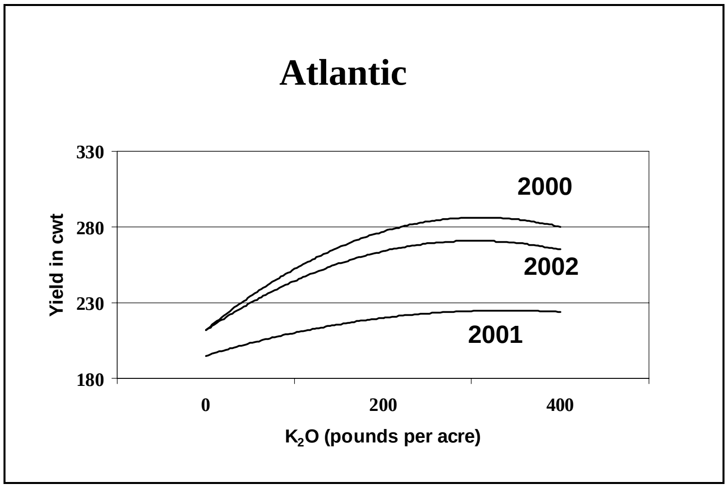


Figure 2. Yield of Atlantic in relation to K_2O.

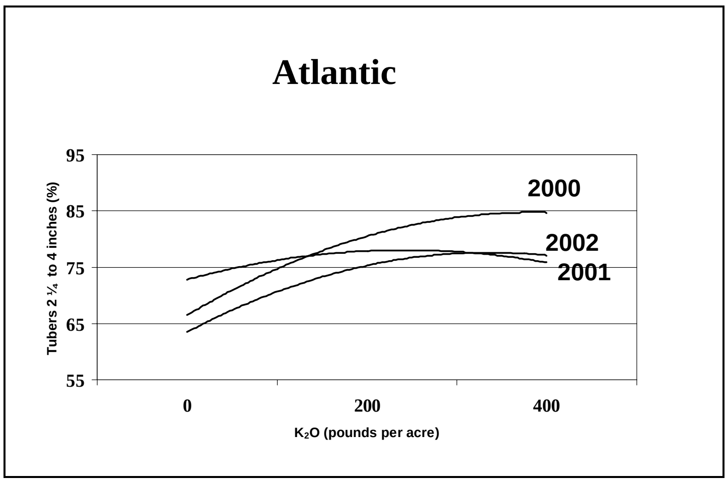


Figure 3. Yield of Atlantic larger tubers in relation to K_2O.

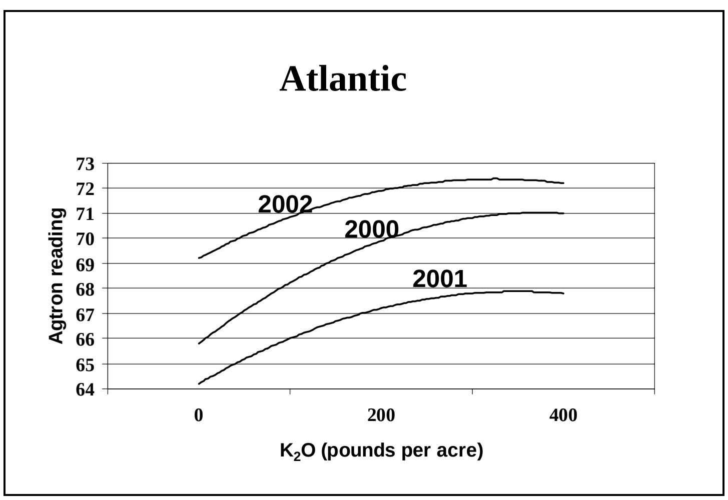


Figure 4. Agtron readings in relation to K_2O (Atlantic).

Figure 6. Hollow heart of Atlantic tubers in relation to K_2O.

Figure 4 shows chip color based on Agtron readings. Very rapid increases are obtained when potash is applied to potash-deficient soils. Increasing the potash from 200 to 400 pounds per acre did not result in the same level of increase as from 0 to 200 pounds per acre. A different way to look at this that underfertilizing the crop with potash can have very rapid and detrimental affects on color.

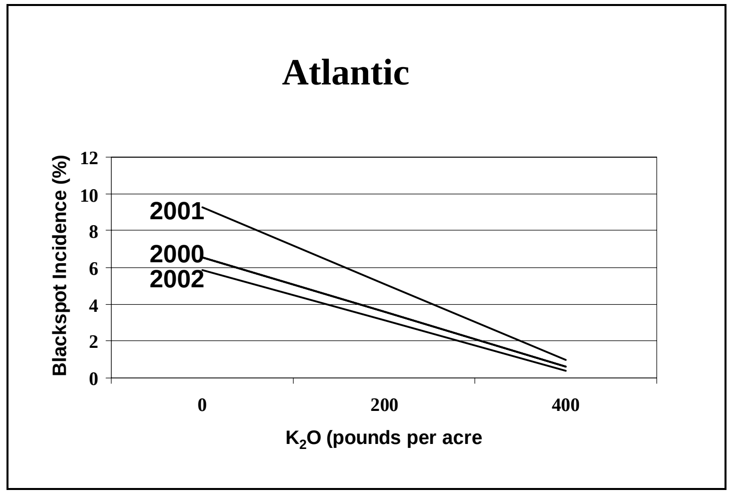
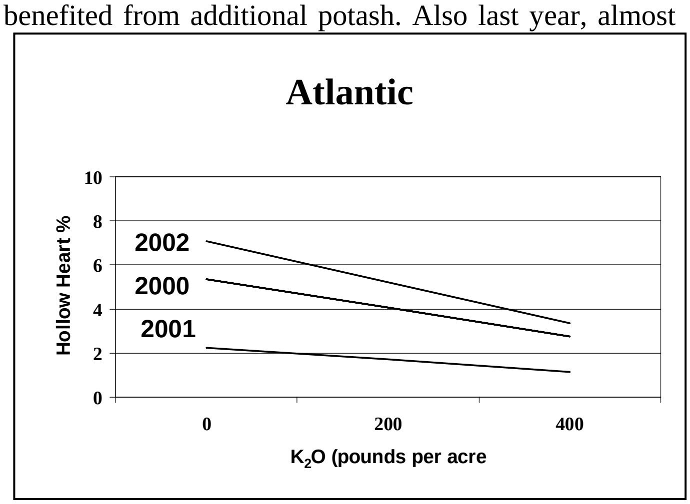


Figure 5. Blackspot bruise of Atlantic tubers in relation to K_2O.

Figures 5, 6 and 7 show that with increasing potash rates, there is a decline in incidence of blackspot bruise, hollow heart and brown center, Figure 8 contains further information on blackspot bruise reduction with potash fertilization. The three varieties, Russet Burbank, Snowden and Shepody, are composited for the graph. Note the increase in bruise-free percentage, and the corresponding decrease in serious bruise, in response to potash fertilization. Last year, forty percent of the 1,146 potato soils tested yielded low to medium levels of potash. It's safe to say that most of those soils may have benefited from additional potash. Also last year, almost 28 percent of the 1,146 potato soils tested yielded excessive levels of potash. There is limited yield gain from these levels of potash.



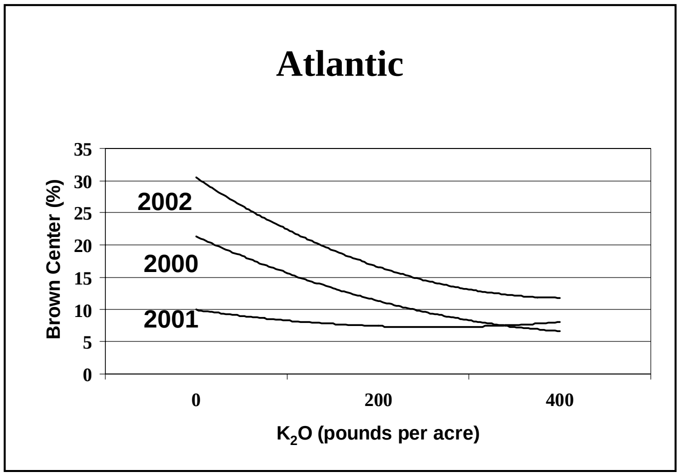


Figure 7. Brown center of Atlantic tubers in relation to K_2O.

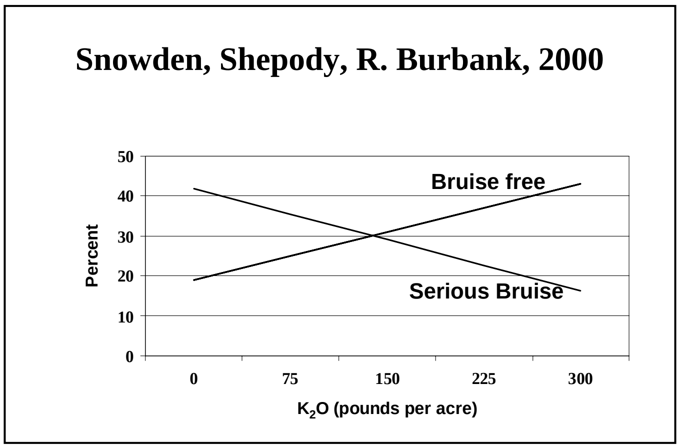
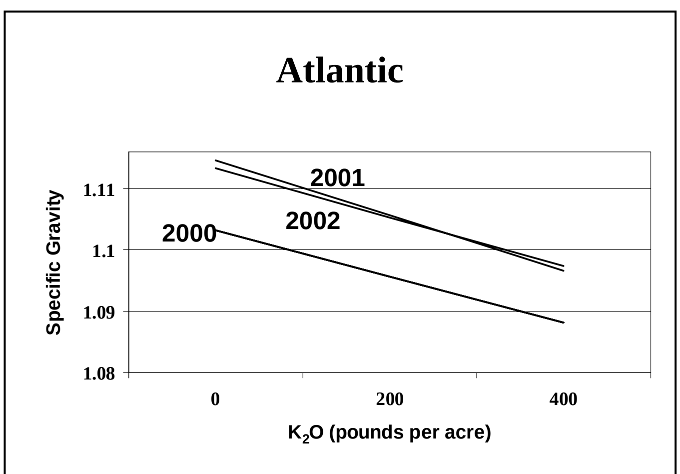


Figure 8. Blackspot bruise in relation to K_2O.

Specific gravity declined across the entire study with increased potash (figures 9,10). While this is not a new phenomenon, the supplied data can help in fine-tuning some circumstances. For the variety Atlantic from dry land production in Maine, the specific gravity can almost be too high for processors in some years.

Over the range of experiments conducted, there was a linear decrease in specific gravity. Over the range of conditions included in the study, each additional 100



pounds of potash lowered the specific gravity by about 2 points (figure 9). The results were similar for irrigated potatoes, but the rate of decrease was nearly double of that of dry land production for the equivalent potash addition.

Figure 9. Specific gravity of Atlantic tubers in relation to K_2O.

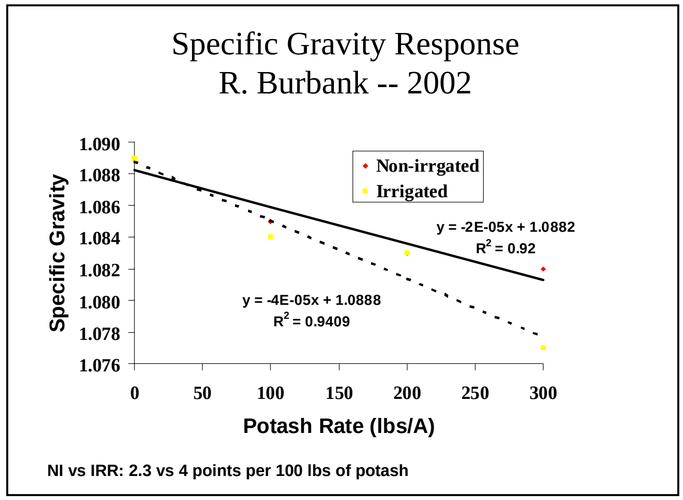
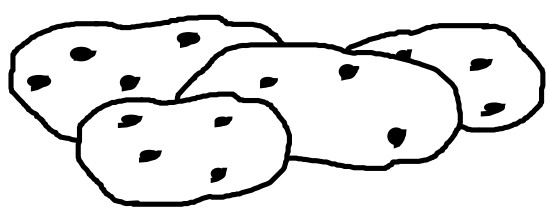


Figure 10. Specific gravity of Russet Burbank tubers in relation to K_2O.

Potato varieties that have high gravities could maintain processor acceptance with increased potash. For table stock and seed potatoes where gravity is of little concern, the decreased bruise susceptibility and increased yield would certainly make the potash levels at planting worth investigating.



BORON DEFICIENCY AND TOXICITY

Peter Sexton, Ph.D.
Crops Specialist

Although it is taken up in very small quantities (less than two tenths of a pound per acre over the whole season), boron is an essential nutrient for the potato crop. 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. 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. In seed crops, the development of pollen is sensitive to boron deficiency. Cell membrane integrity and cell division are also impaired under boron deficiency. The potato crop is less sensitive to boron than are some other crops such as canola, broccoli, and alfalfa. However, a mild boron deficiency may decrease yield on the order of 10 percent. Boron deficiency is also associated with increased internal defects and with tuber discoloration.

Potato soils in Maine appear to be low in boron. In soil nutrient surveys conducted over the last two seasons, more than three quarters of the fields tested were deficient in boron. Boron is very mobile in the soil. 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. Boron applied in one season will probably be leached out before the next season is underway. At pH greater than 7.0, available boron tends to be found in the form of $B(OH)_4^{-1}$. This form tends to make complexes with minerals in the soil, which decrease its availability. Therefore, as soil pH increases, boron availability tends to decline.

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 the 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 plant growth and stature 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 nonpolar 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.

The critical threshold for boron deficiency in young leaves is considered to be 20 ppm (Fig. 1). Leaves testing below this indicate the plants are marginal or deficient in boron. The boron concentration of young leaves 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. The critical level of boron in soil is often considered to be 0.5 ppm (hot-water extractable boron). Levels less than this suggest that the crop would probably benefit from boron fertilizer. Boron could be applied several ways, with the rate to apply depending on the method of application. If it is broadcast preemergence, then a rate of 0.75 to 1.5 lb per acre should be adequate. If banded at planting, a rate of 0.5 lb boron per acre would be recommended. To avoid poor distribution of boron in the field, you need to be sure it is well mixed and evenly distributed in the fertilizer if you band it in. Where foliar applications will be made, a rate of 0.5 lb boron per acre in two applications (0.25 lb per application) is recommended. Boron fertilizer trials are in progress to further refine the most efficient amount and timing of application for potatoes grown in Maine.

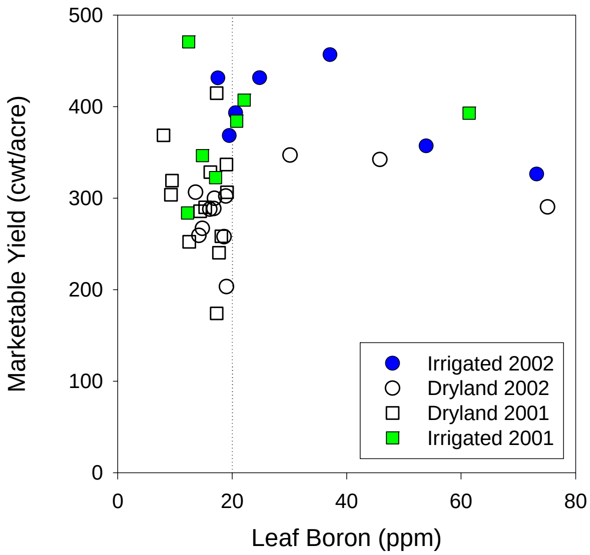
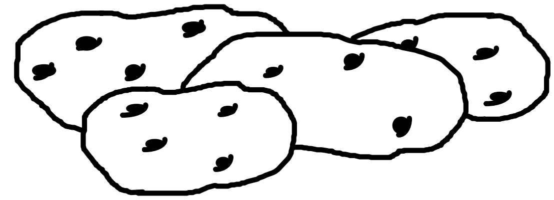


Figure 1. Marketable yield versus boron concentration of leaves. Whole leaf samples were taken in late July from 24 fields across Aroostook County in both the 2001 and 2002 seasons. Yield data is from the "Cropmet" program and was generously provided by Mr. Bart Bradbury of McCain's Foods. The dashed line at 20 ppm indicates the critical level where boron deficiency begins to affect yield.

Looking at boron uptake over the course of the season, it appears that most of the potato crop's boron is taken up early in the season. Data we collected this past year suggests that boron uptake slows down after mid-season. If resources and time permit, we will continue looking at boron movement in the plant. For now, it seems that foliar boron applications should be made early in the season to meet crop demand. This also facilitates getting it on the ground where it can move to developing tubers.

Boron toxicity is a hazard that needs to be considered. As mentioned earlier, symptoms of boron toxicity include marginal necrosis of older leaves, decreased plant stature 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 B. This means that toxicity symptoms will occur at lower levels of boron application when it is banded versus broadcast. To be conservative, it is probably best not to apply more than 0.5 lb boron in the band at planting. A rule of thumb for foliar applications is not to apply more 0.25 lb of boron at a time. So 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.



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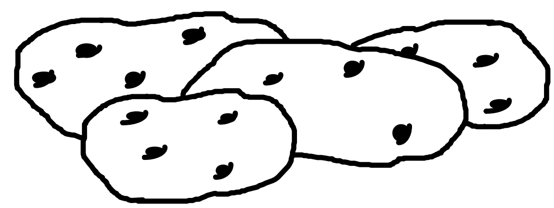

2003 Maine Potato Pest Control Recommendation Guide

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2003 MAINE POTATO PEST CONTROL RECOMMENDATION GUIDE TO BE RELEASED

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Crops specialist

After May 1, 2003, the 2003 Maine Potato Pest Control Recommendation Guide will be available at the Internet site:

http://www.mainepotatoipm.com

This is an updated format from the past. Recommendations, rates, REI, PHI, as well as other information will be included. We will not distributing printed copies with this issue as has been the case in past years. If you do not have Internet access and wish to have a copy, please contact the office and one can be printed and mailed to you.

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