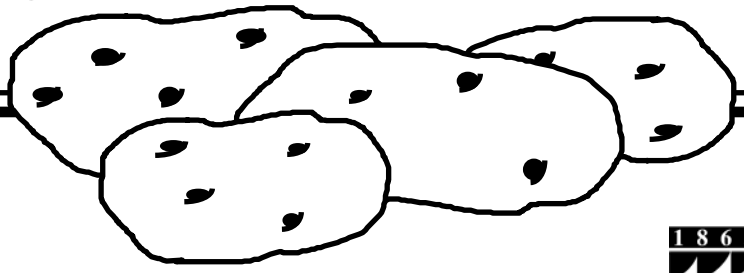
SPUDLINES



MARCH 2002
VOL. 40 NO. 1

SEED ISSUE

THE UNIVERSITY OF MAINE Cooperative Extension

Dear Potato Grower,

This is the first issue of SPUDLINES for 2002 with another issue scheduled in April/May. In this issue, articles are presented on the current readings from the Florida test. I want to put in a push for Maine seed. The virus levels are some of the lowest that have ever been seen. This and the risk of importing late blight or worse, potato wart, should make buying Maine seed an easy choice. Peter Sexton reports on an extensive survey micronutrients he performed.

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

March 11-12	**NE Potato Technology Forum** Sheraton Fredericton Hotel Fredericton, NB
March 19	**Irrigation Symposium** Caribou Inn and Convention Center, **Caribou**
March Monday	**Agriculture Winter School** SJV Technology Center, Frenchville
March Tuesday	**Agriculture Winter School** Houlton High School, Houlton

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2001 MICRONUTIRENT SURVEY

Peter Sexton, Ph.D.
Crops specialist

There are eight micronutrients that are essential for growth in higher plants: boron, copper, iron, manganese, zinc, chlorine, molybdenum and nickel. While the amount of these elements taken up by the potato crop is small (less than 1 lb per acre for most of the micronutrients), lack of an element within the plant will disrupt normal metabolism and lead to yield losses. Research work on Aroostook Farm has shown potato yield improvement in response to boron, and there are reports of similar responses to zinc in Maine. A preliminary survey was conducted last season, in which complete leaf and soil analyses were conducted in order to determine which micronutrients, if any, may be most commonly limiting potato yields. Leaf samples were collected in late July and early August and soil samples were collected in September. Twenty-four fields were sampled. Micronutrients were applied to 17 of the 24 fields. Soil and leaf analyses were conducted at the Maine Soil Testing Service Analytical Laboratory. Chlorine and nickel were not considered because they are rarely, if ever, yield limiting. Molybdenum will be the subject of future analyses.

Lab Analyses Results

Soil Analyses: Twenty-two of the 24 sites (92 percent) showed signs of boron deficiency, and 17 sites (71 percent) showed signs of zinc deficiency, based on critical values of 0.5 ppm for boron and 1 ppm for zinc. There were also a few fields where soils tested low in manganese and iron. However, given the relatively acidic soils of northern Maine, it seems unlikely that a deficiency of these elements would limit production here.

Leaf Analyses: Seventy-five percent of the fields showed signs of boron deficiency in the leaf analyses (*Table 1*). Of the 24 fields, nine had boron concentrations of less than 15 ppm, and nine had concentrations between 15 and 20 ppm. Only six of the fields had boron concentrations greater than the critical value of 20 ppm. None of the other micronutrients were below literature critical values. There were several fields that approached the critical values for zinc, and a couple for copper. Because zinc concentrations drop over time, sometimes higher values (closer to 45 ppm) for zinc may be recommended, especially during early season growth. Ten of the sites in the survey had zinc concentrations less than 40 ppm and 14 sites had zinc concentrations greater than 40 ppm. Table 1. Average, minimum, and maximum concentrations of boron, zinc, copper, manganese, iron and aluminum in potato leaf samples collected from 24 fields across Aroostook County in 2001

Foliar Analysis	critical value (ppm)	average (ppm)	min	max	sites below critical value
Boron (B)	20	19.8	8.0	61.4	75 %
Zinc (Zn)	20	54.4	25.8	135.0	0
Copper (Cu)	5	18.7	8.2	50.3	0
Manganese (Mn)	25	414.0	103.0	759.0	0
Iron (Fe)	35	146.0	81.0	533.0	0

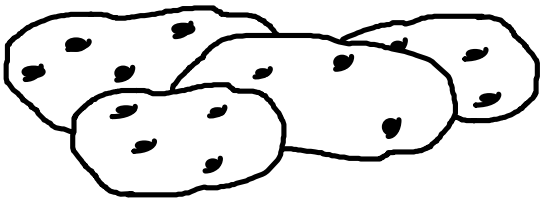
Published for whole leaves are as follows: boron, 80 to 180 ppm; zinc, > 250 ppm; copper, > 50; manganese, > 450; iron, > 500. In Maine, we only need to worry about toxicity in cases of over-application of boron, and in very low pH fields where high manganese concentrations may be symptomatic of a need to apply lime.

A primary question is, of course, how boron and zinc concentrations were related to potato yield and quality in the survey. However, because so many management and environmental factors (like drought stress this last season) vary across farms, it is difficult to draw accurate conclusions by making comparisons across farms. Tubers at irrigated sites without drought stress tended toward specific gravity decrease at boron levels less than 20 ppm. Trends with zinc were less clear, but it appeared that the specific gravity of tubers tended to decrease, and percent hollow heart to increase, at zinc levels less than 40 ppm in the leaf. However, these are only trends and should be viewed as such, given that other variables are changing across farms. The better the growing conditions, the more likely a micronutrient deficiency will affect yield and/or quality.

Applying Boron and Zinc

More than 90 percent of the fields tested low in available soil B and more than 70 percent tested low in boron within the plant. Boron is very mobile in the soil and it poses a toxicity hazard to the crop if too much of it is present (studies here in Maine and in Washington have noted yield declines with applications of 4 lb per acre or more). Apply only enough for the coming season: what is not used will probably be leached, and excessive boron may also decrease yield. Preplant application rates would be one to two lb per acre broadcast, two pounds per acre being a use rate for use on coarser soils. One pound is probably sufficient on heavier soils, where leaching is less of a problem. Post-emergence applications may be made at rates of 0.5 to 1.0 lb per acre. Boron uptake appears to cease in mid-season; therefore, an early-season application is suggested. If banded, rates should be about 0.5 lb per acre. Banding is the most effective way to get boron in the plant, but banding requires the use of a lower rate to avoid toxicity, and uniform application. When leaf sampling for boron, values over 50 ppm are high, and values over 80 ppm may be detrimental. The critical value for whole leaves and petioles is 20 ppm B. The best way to track the need for boron, or to see if there is a hazard of over-application, is to take leaf samples.

Zinc is more stable in the soil than boron, and it is also much less likely to cause a toxicity problem. One could apply enough zinc to last several seasons all at once, broadcasting 10 lb per acre ahead of planting. Or one could band zinc at planting (2 to 5 lb per acre), or apply foliar (0.5 lb per acre) if leaf analysis indicates a deficiency. High soil phosphorous concentration is known to bind zinc movement within the roots. Given that potatoes may receive up to 200 lb per acre of banded P, the practice of banding zinc comes into question. Probably the best approach is to soil sample and fertilize with Zn accordingly and then follow with a leaf sample to be sure it got in the plant. The Maine Soil Testing Service Analytical Laboratory considers a value of 0.5 to 0.9 ppm Zn as medium, and 1.0 to 2.0 as optimum in the soil. In our survey, among fields where Zn was not applied, a level of 1 ppm Zn in the soil was associated with a leaf analysis of about 55 ppm Zn in the leaf—indicating that the 1 ppm level of Zn should be adequate. The most common sources of zinc are zinc sulfate and chelated zinc. Other sources of Zn include ACA (at a 32 oz rate this would deliver about 0.23 lb Zn per acre) and zinc applied in fungicide formulations. Repeated use of fungicides containing Zn has been reported to bring Zn concentrations within the leaf up approximately 7 ppm over plants sprayed with fungicides lacking Zn.

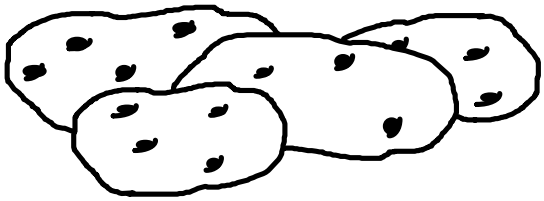


SEED PROMOTION EFFORTS CONTINUE

Steven B. Johnson, Ph.D.
Crops Specialist

The Maine Potato Board continued its seed promotion efforts in marketing the 2001 seed crop. Seed growers Dale Henderson and Robert Bartlett traveled to Florida in November to visit markets and Florida growers. In East Palatka, at the Putnam County Agricultural Center, Steve Johnson presented an educational program on Potato Seed Handling to growers. Robert Bartlett gave a growing season review and promoted the high quality of Maine seed to the audience. Field and storage visits with the Florida growers proved very informative. Several seed dealers also made the trip and took the opportunity to visit customers. It was a pleasure to hear all of the positive comments about the high quality of Maine seed.

In a separate trip to North Carolina, seed growers Kendall Shaw and Robert Shaw visited potato growers in the Elizabeth City area. At the Pasquotank County Annual Potato Conference, Steve Johnson presented an educational program on Potato Seed Handling to about twenty-five growers. Kendall Shaw presented a growing season review and promoted the high quality of Maine seed. North Carolina growers are very supportive of Maine seed and are pleased with the quality they are receiving. It was also very pleasing to learn about the cooperation between the researchers from the University of Maine and North Carolina State University on plant breeding.



HIGH VIRUS LEVELS IN SEED CAN LEAD TO BIG PROBLEMS

Steven B. Johnson, Ph.D.
Crops Specialist

Mitch Murphy, the Agriculture and Forestry Minister of Prince Edward Island, announced that there will be a limit of three percent of PLRV and no limit on PVY levels for potatoes being planted for the 2002 season. **That's right, no limit on PVY levels for potatoes being planted for the 2002 season.** Last year, the limit on total virus was five percent for seed potatoes and ten percent for tablestock and processing potatoes, and the intent was to reduce the cap to five percent on all potatoes being planted in 2002. Reports are that less than 20 percent of the lots for some varieties have less than five percent total virus.

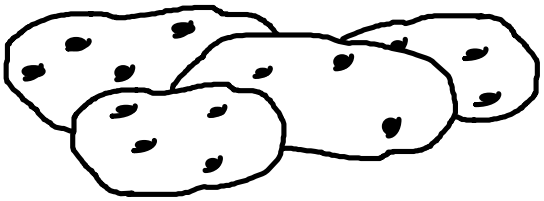
PVY is spread by aphids in a nonpersistant manner. The virus is borne on an aphid stylet and can be transmitted in a matter of a few seconds. The virus can also be spread mechanically by human activity. PLRV, on the other hand, can be acquired in a few minutes' feed but generally requires 24-48 hours to be able to transmit the virus. I feel that PLRV is far easier to manage and control than PVY.

Dave Stewart from *The Guardian* reported: "You have to remember that Prince Edward Island Opposition Leader Ron MacKinley said he warned government in May 2000 that this was going to happen. "I'm a farmer and I knew the seed (quality) was going downhill every year since 1996,' MacKinley said Friday night. "In 1999 the seed was not good but this particular government just wanted to sweep it under the rug." MacKinley said the province has spent $14 million to ensure high-quality seed over the past five-and-a-half years and now it's all wasted money. "I've been farming for 36 years and I've never seen the seed test as high as it was this year and I've never seen them use as many excuses about aphids coming in from the grain because the grain ripened too soon." MacKinley said seed growers are going to have to spray more to keep the aphids from coming in.

The fact that high virus levels in the seed lead to higher levels at the end of the season is not really new information. Dr.

Robert Coffin from Cavendish Farms in PEI reported at the 2000 Northeast Potato Technology Forum on research he performed during 1998-1999. In a trial, Coffin planted 13 acres of seed reading less than 1 percent PLRV near a 200-acre planting of seed that was in the range of 45 percent PLRV. Despite eight applications of insecticides, the field that started with less than 1 percent PLRV was harvested with over 80 percent PLRV, simply as a result of the proximity to a heavily infected field. He reported that the first aphids were collected from yellow pan traps on August 3, the first green peach aphids were collected August 11, and 23 percent of the tubers were infected with PLRV by mid-August.

Planting seed with high virus levels is devastating to seed growers in the area or anywhere in Maine. In addition, it can take many years to reduce the virus levels in subsequent potato crops. Thinking about planting high virus seed lots? Think again.



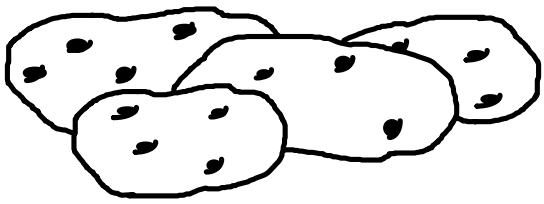
AN AUTOMATED DIAGNOSTIC SCREEN OF POTATO PATHOGENS

Michael E. Vayda, Ph.D.
Professor of Biochemistry

Michael Babcock
Research Assistant in Biochemistry

Routine screening of potato seed and seed plots for pathogens is an expensive but essential element in maintaining the internationally recognized high quality of Maine's seed potato industry. Current screening techniques rely principally on antibody-based recognition assays, or growth in culture. The goal of my laboratory has been to develop alternative diagnostic assays based on nucleic acid recognition (DNA or RNA, the genetic material of the pathogen). Past work by ourselves and others had developed and assessed feasibility of a "polymerase chain reaction" (PCR) assay that could be used to screen for PVY, PVX, and PLRV potato viruses in a single test.

Over the past two years, we have developed a superior test that is more applicable to use by regional seed testing laboratories. This approach, termed the 'molecular padlock' approach uses crude leaf extracts in a two-hour series of reactions to detect viral RNA. The system is coupled with fluorescent analysis of products, so that cumbersome gel analysis is avoided. The assay requires minimal sample preparation and handling. We have demonstrated that the assay works to detect PVY in crude leaf extracts. The operator simply runs a test sample through a leaf squeezer, dilutes the sap, runs a three-step reaction in a single microcentrifuge tube, transfers the samples to a 96-well plate, and reads the result in a fluorescent plate reader. The operator is presented with a simple "yes" or "no" output for each of the samples relative to positive and negative controls. In our side-by-side tests, the 'molecular padlock' assay is approximately four- to eight-fold more sensitive than ELISA assay. This high sensitivity allows the screening of larger pools of leaves per assay, and thus has potential to cut assay costs significantly. We are currently refining this assay to increase sensitivity, and plan further field testing this summer.



POTATO DORMANCY

Steven B. Johnson, Ph.D.
Crops Specialist

Most potatoes undergo a dormant or resting period. Dormancy of potato tubers is not consistent between varieties, nor from year to year within varieties. Growing season stress, storage temperature and time can all affect physiological age of seed and therefore have an impact on dormancy. Growing season stress can have a marked influence on the physiological age of seed the following planting season.

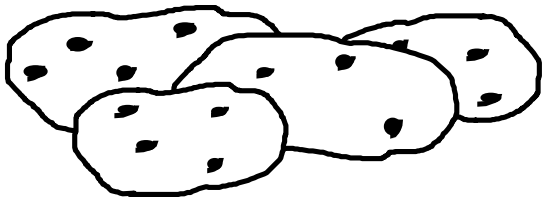
Dormancy is gradually lost during storage and potato tubers sprout. Piping is the breaking of dormancy followed by sprout elongation. Once sprouting has begun, it will continue. The longer the tuber has been sprouting, the more advanced its physiological age.

A portion of the research conducted in Dr. Greg Porter's program at the University of Maine includes potato dormancy. The table below includes some information from the Maine Agricultural and Forest Experiment Station bulletin, *Performance Evaluations of Potato Clones and Varieties in the Northeastern States*, which is published annually.

Crop Season	Storage season	Days to Pip	
		Superior	Russet Burbank
2001	2001-2002	xxx	xxx
2000	2000-2001	154	177
1999	1999-2000	128	167
1998	1998-1999	128	170
1997	1997-1998	68	53
1996	1996-1997	99	84
1995	1995-1996	114	65
1994	1994-1995	104	83

1993	1993-1994	114	119
1992	1992-1993	106	112
1991	1991-1992	126	130

I have attempted to correlate long or short dormancy with heat unit accumulation and rainfall, but no clear-cut conclusions appear. Generally, the more stress during the growing season, the more physiologically aged the harvested tubers and the shorter the dormancy. Drought stress appears to have more influence than heat unit accumulation, but quantification of the relationship is elusive.



MAINE'S POST-HARVEST TEST RESULTS

By Terry L. Bourgoin, Director
Maine Department of Agriculture

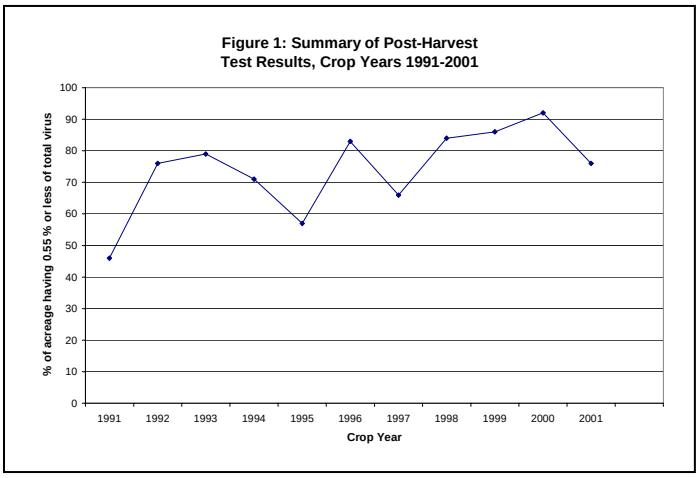
The Post-Harvest Test results are in, and once again they show that Maine's seed potato producers have done an excellent job controlling virus disease in their seed crop. However, the results are not quite as good as previous years, and the industry must remain vigilant to prevent the buildup of virus levels in future years.

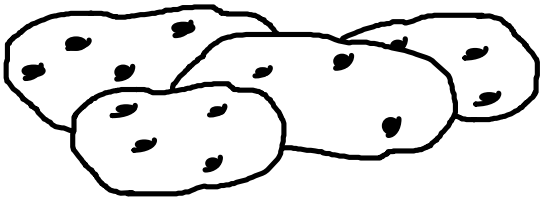
In looking at the overall results of this year's Post-Harvest Test, approximately 76 percent of all the acreage represented by the samples evaluated in Florida had 0.5 percent total virus or less. In other words, three out of every four seed acres planted in Maine last year had 0.5 percent total virus or less. Many seed lots had no virus at all! This is great news with respect to the initial level of inoculum in Maine seed as we approach the 2002 growing season. The percentage of acreage meeting the 0.5 percent cutoff for Foundation tolerance is less than the previous three years, however, indicating that some spread of virus occurred last season. *Figure 1*, which summarizes the percentage of acres that met Foundation tolerance over the past 10 years, shows the decline in acreage meeting Foundation tolerance in the 2001 crop.

One important point stands out from the data contained in *Figure 1*. The data shows the cyclical nature of virus levels over time. Maine has seen three cycles of virus buildup over the past 10 years, with low points in 1991, 1995, 1997, and 2001. In looking at these four "valleys" on the graph in *Figure 1*, one can see that each one is less severe than the previous one. The low points of the graph correspond to 46 percent of the acreage meeting Foundation tolerance in the 1991 crop, 57 percent meeting Foundation tolerance in the 1995 crop, 66 percent meeting Foundation tolerance in the 1997 crop, and 76 percent meeting Foundation tolerance in the 2001 crop. So, it is safe to say that the level of virus disease in Maine seed continues to decline, even though there are temporary increases from year to year.

One problem with this year's result is that certain varieties were hit harder than others with respect to virus disease. The varieties with the largest acreage rejected through the Post-Harvest Test were Shepody (130 acres, or 15 percent of the total Shepody acreage evaluated in Florida), Superior (93 acres, or 5 percent of the total Superior acreage evaluated in Florida), Russet Burbank (52 acres, or 3.7 percent of the total Russet Burbank acreage evaluated in Florida), Red LaSoda (47 acres, or 26 percent of the total Red LaSoda acreage evaluated in Florida), Atlantic (32 acres, or 1.8 percent of the total Atlantic acreage evaluated in Florida), LaRouge (27 acres, or 43 percent of the total LaRouge acreage evaluated in Florida), and Goldrush (10 acres, or 100 percent of the total Goldrush acreage evaluated in Florida).

How will this affect the supply of seed of these varieties? Is there adequate seed of these varieties available from other areas to meet the needs of our industry? Is it better to import seed with lower virus levels from areas that may have had other problems (like late blight) than to allow seed from Maine with higher virus levels to be planted? If not, how high can our virus level safely be raised to meet the needs of our industry? With high seed prices this year, will growers plant seed that is rejected from certification and consider any fine for violating the Minimum Standards for Planting (certified seed) law a "cost of doing business"? These are some of the issues that must be addressed in the coming weeks as we prepare for the 2002 planting season.
The actions taken during the next three months will play an important role in the disease status (virus and other diseases) of Maine's potato industry. Will we see a rebound in the percentage of acreage meeting Foundation tolerance like those that we saw in 1992, 1996, and 1998, or will we see a further decline in acreage meeting Foundation tolerance, such as we saw in 1995 (the second year in a row with increased levels of virus disease)? The Department and the industry must work together to address this question in a way that best meets the need of Maine growers.





SEED POTATO PRODUCTION IN THE UNITED STATES

Steven B. Johnson, Ph.D.
Crops Specialist

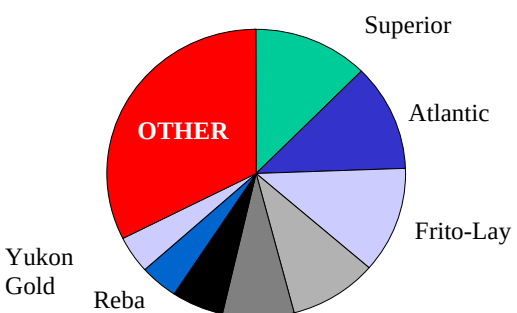
There were 137,386 acres of potato seed entered for certification in the United States during the 2001 growing season. Maine is the fourth leading state in the country for seed acreage. The eight leading states account for 93 percent of U.S. seed acreage.

As expected, the acreage of seed for processing potatoes dominates the national production. The variety *Superior* is the leading seed acreage in Maine. In fact, Maine produces 70 percent of the nation's acreage for this variety.

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: **Steven B. Johnson, UMCE, PO Box 727, Presque Isle, ME 04769; (207) 764-3361 or toll free in Maine 1-800-287-1462 or electronically at:**

sjohnson@umext.maine.edu

VARIETIES OF MAINE POTATO SEED PRODUCTION



SEED POTATO RESULTS FROM THE FLORIDA TEST

Steven B. Johnson, Ph.D.
Crops Specialist

One of the requirements for potato seed planted in Maine is that it has to be certified. The Division of Plant Industry, with the Maine Department of Agriculture, is the agency responsible for confirming that standards have been met. After passing field inspections, the next part of the potato seed certification process is a winter test. This is commonly known as the "Florida Test," in which seed is grown in November, December and January. In fact, the state of Maine has a farm in Florida where these tests are performed. The virus levels are recorded and published annually in the Maine Florida Test Directory. Seed coming into Maine must be winter-tested, or have a waiver, in order to be admitted without a winter test. Seed inspectors also plant 20-pound (approximately 100 seed pieces) samples of seed imported into Maine in a specific plot on the Aroostook Farm. These samples are also rated for virus content as a double check.

From the Florida Test for the 2001 crop season (planted in 2002), four percent of the Russet Burbank and fifteen percent of the Shepody lots from Maine were rejected based on the virus levels. These data are the lines headed “Maine” in the table and represent seed that will be planted this year.

I have reviewed the data from both the imported seed plots and the Maine Florida Test. Maine imports many varieties of potato seed from many areas. I chose to look at only one seed area and only two important varieties, Russet Burbank and Shepody. These data are the lines headed “Imported” in the table and represent seed that was planted last year.

Bear in mind that lots with virus levels over five percent are rejected as . For the upcoming season, four percent of the Russet Burbank and fifteen percent of the Shepody lots from Maine’s 2001 crop were rejected based on the Florida Test. Of the ten leading varieties by acreage, Maine’s 2001 crop of seed had just 98 acres rejected beyond that of Russet Burbank and Shepody. **Maine seed looks strong again this year.** If you were not happy with the performance of Shepody seed planted in 2000, consider that 24 percent of the lots entering Maine from this one seed area might have been rejected if they had been inspected in Maine,. There are times the “devil you know” may be preferable to the “devil you don't know.”

Russet Burbank

Source	# of tests	VIRUS LEVEL 0-0.55 %	0.56-5.0 %	>5.0 %
01				
Maine	**115**	61	35	4
00				
Maine	**140**	86	13	1
Imported	**21**	29	47	24
99				
Maine	**111**	66	34	1
Imported	**9**	11	89	0
98				
Maine	**65**	49	42	9
Imported	**19**	32	63	5
97				
Maine	**74**	27	61	12
Imported	**14**	21	57	21
96				
Maine	**55**	53	42	3
Imported	**20**	50	50	0

Shepody

# of tests	VIRUS LEVEL 0-0.55 %	0.56-5.0 %	>5.0 %
80	22	62	15
82	84	16	0
14	72	21	7
72	63	35	3
10	20	80	0
72	40	54	6
22	5	41	55
92	70	19	11
10	0	40	60
84	60	38	2
17	29	41	29

IRRIGATION SYMPOSIUM

Peter Sexton, Ph.D.
Crops specialist

You are invited to attend a symposium on irrigation of potatoes, to be held at the Caribou Inn and Convention Center on March 19 from 9 a.m. to 4 p.m. Issues that will be addressed include acquiring permits for storage ponds, construction of storage ponds, disease problems, yield responses, costs of center pivot systems, and irrigation strategies. There will be a panel discussion in which irrigated growers will share their experiences with potato irrigation. We also hope to have a panel discussion with representatives of some government agencies, to talk about acquiring permits for construction of storage ponds. The symposium is free and lunch will be provided for all attendees who are preregistered. Call Pam at 764-3361 by March 13 to preregister.

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