

TOOLS FOR SEED BUYING DECISIONS

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There are certain types of information that are important to any type of purchase that you make. When purchasing seed potatoes it is important to know how seed agencies are structured, what type of documents are available and how to obtain them. It is also important to know a little about virus diseases so that you can interpret the information that you receive on the seed lot.

Seed certifying agencies in the United States operate under three basic types of systems: Crop Improvement Association, State Dept. of Agriculture, and Land Grant Universities. In the west; Idaho and California are Crop Improvement Associations; Washington operates under the Dept. of Agriculture; Montana, Colorado, and Oregon operate through the Land Grant Universities. As you go across the mid-west and the east, you will find the same type of organizations. The important thing to remember is that these agencies all perform the same two functions. The first function is to systematically inspect and rate the level of disease in a particular seed lot. The second function is to keep a paper trail on a seed lot so that its history is known.

Why do you want to know the history of a seed lot? We know that because potatoes are vegetatively propagated they can carry disease from year to year. That disease can affect yield and quality. If you know what level of disease was recorded for the seed lot and what the history of disease has been on that farm, you are in a better position to determine if the seed you are purchasing poses any risk to your operation. If you know the history of a seed area (e.g. was there late blight recorded during the previous growing season?) and that seed area is close to your production area, you may be able to get good quality seed at a reasonable price. Remember that the cost of transportation can sometimes be as much as the seed price itself. Your job then as a seed purchaser is to find the best quality seed at a reasonable price. How do you do that? The best place to start is with certified seed.

There are a few things you should know about certified seed potatoes. All seed programs have similar procedures for conducting inspections and testing. However, not all programs test every lot with winter test. In Idaho, all seed lots are winter-tested and lots with high levels of virus are rejected. Idaho is the only state in the west that winter tests every lot and applies a rejection factor. A plant health certificate is a document that has a fairly comprehensive list of information on one seed lot. The plant health certificate can be one of your most important tools.

One upcoming change to Idaho's certification rules is that seed lots tested in California will not be rejected due to the level of virus in the winter test. This is similar to all surrounding

western states. The winter test in Idaho and surrounding states is primarily used for determining which seed lots can be recertified (i.e. planted back into the seed program). Idaho will still continue to test all seed lots and the resulting information would be used between the buyer and seller to determine what level of virus they are willing to accept in the seed lot. Seed that is produced in other states is not routinely tested in a grow-out or winter test if the seed is going to a commercial potato producer. However, this will still be the case in Idaho and that information can be used along with the summer inspection readings to determine the overall health of that seed lot. Again, the plant health certificate will become a very important tool for assessing seed health.

If a grower receives a tag with his seed shipment, then why is the health certificate necessary? The amount of information on the certified seed tag varies from state to state. Some tags list only the variety, others list the variety, generation, and some even include the certification number. The certification number of the seed lot is important if you want to trace the history of a seed lot. In Idaho the tag lists the variety, class, certification number, grower, buyers name (optional), weight of the shipment, truck and trailer license, seal number, inspector name, and the date. It is important to know that seed programs keep records on each lot. All growers receive copies of those inspection records. A phone call placed to the grower or his seed agency requesting inspection reports or a plant health certificate should get you all the information you need to make an informed decision.

What information does the plant health certificate contain? The certificate shows the seed grower's name and address, the identification of the seed lot, a pedigree of where it has been grown over the last few years, the summer and winter test readings, a disease history of the farm over the last few years, and a note section for additional comments (See Figure 1).

Now that you have a plant health certificate, what do the disease readings mean and what methods are used to obtain them? Seed fields are inspected at least twice during the growing season. In Idaho the percent disease is based on a 200 plant per acre count. Other states may use 100 plants per acre. The first inspection tolerances are higher (i.e. looser); the second inspection tolerances are lower (i.e. tighter). This gives the seed grower a chance to get into a field and rogue any diseased plants they may find. Since plants emerge at different times, there can be a lag time for expression of any virus-infected tubers. This is why there are two sets of tolerances and why inspectors make two inspections on every field. If the disease percent is too high, the lot is rejected from certification.

Tolerances for disease levels in the summer field inspections are zero for the crop's first year in the field. Each succeeding year, the tolerances are higher. The highest tolerance that is allowed is 1 percent for mosaic virus and 0.2 percent for leafroll virus. If a seed lot has a higher reading during an inspection, it is rejected from certification. After the same seed stock has been saved for seed to grow more seed for 5 to 7 years (depending on the state program), it is flushed out and a grower has to start with a new seed stock. This is called a limited generation system or flush-out program. Seed starts clean and as long as it meets certification tolerances each year it can be planted back until it reaches the end of the generation system. Each year in the field can translate into more exposure to disease and risk of infection. The

flush-out system helps keep an overall certification program healthy. Once a lot passes the summer inspection readings, a sample is collected at harvest and sent for a winter grow-out test.

In the grow-out test, the samples are planted in early November and the inspections are done in January and February. The three locations used for grow-out tests are Southern Florida, Southern California, and Hawaii. Idaho samples, as well as some from Montana, Colorado, and California are grown in Oceanside, California. In the grow-out, early generation lots are tested at a higher level than later generation lots. The main purpose of the grow-out is to get an assessment of what lots are acceptable to plant back into a seed program and still give the seed grower a chance of meeting certification tolerances the following year.

The summer and winter inspections are done for two different reasons and the disease percentages are not comparable. The summer inspection tells us about how much tuber-borne virus is in the seed lot. The winter grow-out tells us how much spread of current season virus occurred in the summer. Again, the summer inspection is based on 200 plants per acre, so one positive plant in a 50 acre field would be 0.01 percent disease. In a winter test, the results are based on a 400-tuber sample or multiple 400-tuber samples depending on the generation and acreage size of the lot (again, early generation lots are tested at a higher rate than later generation lots). One diseased plant in a 400-tuber sample would result in a percentage of 0.25 percent. This percentage is not comparable to the summer percentage because of the very different number of plants counted in each. However, used together the summer and winter percentages can give you an idea of how virus was in the lot to start with and if there was a large or small spread of virus during the growing season.

How much mosaic virus causes a significant yield loss? Recent work shows that PVY-Mosaic virus has a slightly higher yield loss effect on Russet Burbank than on other varieties (Table 1.). Knowing the level of mosaic virus in a lot will give you an idea of the possible amount of yield loss. Although specific figures are not available, leafroll virus levels do not have to be very high if they cause net necrosis in the tuber. Too much net necrosis will cause a lot to be rejected at the processor because of internal defects.

Again, the purpose of conducting the winter test is to catch problems that are not evident during the current growing season. Virus that is spread during the season does not usually show up in the plant, but the virus can still move to the tubers. Chemical damage that occurred during the growing season is also detected during a grow-out test.

Table 1. Effect of PVY-Mosaic virus on three cultivars.

10% PVY-Mosaic Virus	Yield Loss
Russet Burbank	4.28%
Shepody	3.25%
Russet Norkotah	3.44%

P. Nolte *et. al.* 1998

LEAFROLL VIRUS

In the summer, virus that is found during an inspection usually comes from an infected tuber. A good example to use is leafroll virus. If a leafroll-infected seed tuber is planted, the virus multiplies as the plant grows. The infection that results is *seed borne*. The plant is chronically infected and the lower leaves show the symptoms first by rolling at the base of the leaflet. As the plant gets older the leafrolling symptoms continue on up the plant. There is a slight color change to a lighter or lime-green in most varieties.

Green peach aphids (GPA) are the most efficient and about the only aphid that can transmit leafroll virus although potato aphids have been shown to transmit leafroll. When a 'clean' GPA lands on an infected plant, it takes several minutes for it to acquire the virus, the virus then circulates through the aphid's gut and then the aphid has become infective and can spread leafroll to other plants and fields. Since this process takes a while, insecticides are effective for controlling spread of leafroll virus. When an infective aphid lands on a clean plant and transmits virus, the plant now has *current-season* leafroll. Most of the time, the current-season infection does not produce foliar symptoms, but the virus will move to the tubers and set the crop up for a new round of seed-borne virus. To combat this, seed growers have a rigid spray program to control GPA, and they routinely rogue their seed crops. That is, they remove any seed-borne leafroll plants during the summer.

To help monitor aphid activity in the traditional seed areas of Idaho, an aphid trapping network is set up using a series of yellow pan traps. These traps are checked twice a week for GPA. The seed areas don't have overwintering populations of GPA and the aphids come into the areas later in the summer. When the first aphids are detected an alert goes out to all the growers in the area so that they can make sure their spray programs are in place or if late enough in the season, they can kill the vines to avoid exposure to aphids.

MOSAIC VIRUS

Mosaic virus can also be seed borne or current season. Again, when the seed tuber is infected, the plant has a chronic infection and whole plant is involved. Symptoms can include a mottled (or mosaic) pattern of green and yellow, rougher deeper veined leaflets, and overall stunting of the plant. These symptoms vary from variety to variety and in some are latent (i.e. not visible to the eye or at least not until a certain time in the season). A good example of a latent PVY-mosaic variety is Russet Norkotah. If you refer to the previous table you can see

that the yield impact of PVY-mosaic is less on Norkotah. This is most likely due to the fact that Norkotahs do not have the stronger type symptoms that are related to Russet Burbank.

Just about any aphid that feeds on a potato plant can transmit mosaic virus. Mosaic virus is evenly distributed through out the cellular tissue of a plant whereas leafroll is confined to the phloem tissues. When an aphid probes an infected plant, the mosaic virus particles adhere to the aphid's stylet. That aphid is now infective and can transmit the virus to the next plant that it probes with its stylet. This process of acquisition and transmission of the virus just takes a few seconds and spraying with insecticides will not stop the feeding quickly enough to prevent the transmission of virus. The best method that seed growers have for keeping mosaic virus levels low on their farms is to not replant lots above a certain percentage and to remove (rogue) diseased plants to reduce the level of virus inoculum available to the aphids. Mosaic virus can also be transmitted mechanically, but the biggest spread comes from aphid transmission.

SEED PROBLEM CHECKLIST

Even with the most careful grower and best certification programs, disease problems with seed lots occur from time to time. Have some sort of checklist when there is a problem to help you sort out if the problem is seed related. Your first step in solving a problem is to contact the seed grower, an Extension Specialist, or the seed agency. Some of the things you might include on your checklist could be the following:

- Are all of the seed pieces having germination problems (or just the cut ones?)
- Did the seed pass through many hands or come direct from the grower?
- Are there 'sister' lots in your area from the same seed source? If they do not have the same type of problem, the cause may not be the seed.
- Check random areas of your field to see if the problem is widespread or isolated to certain areas. If it is only in certain areas, are there cultural or environmental conditions that might have caused or contributed to the problem?
- What condition was the seed held in before planting (e.g. Was the lot pre-cut? Did the lot sit on a truck for an extended period of time, especially without air movement?)
- What were the growing conditions immediately after planting (wet, cold, waterlogged soil can set a field up for soft rot)
- Did the lot have a certified tag on it?
- What were the results recorded on the Plant Health Certificate?

SUMMARY - SEED BUYING TOOLS

Remember that the purpose of a certification program is to check all seed lots for disease and apply those results against a certain set of tolerances. The other purpose is to track seed and keep a paper trail or history of that seed. As a buyer you need to know what documents exist and that they are available to you to help you make a good seed buying decision. The one document that summarizes all the inspections and history of a seed lot is the Plant Health Certificate. It is available at all seed agencies. Keep track of the seed lot certification numbers that you plant - that is the start of your paper trail. Get to know your seed grower, visit their farm, look at the fields, storages, and general attention to cleanliness. If there is a

problem, talk to your seed grower - a good seed grower will respond to legitimate complaints and problems.

Nolte, P., M.D. Larkin, S.L. Love, P.H. Berger, J.L. Whitworth and M.K. Thornton. 1998. The effect of different percentages of seed borne PVY on yield in three potato varieties. *Amer. J. Potato Research.* 75: 291 (Abstr.).

NORTH AMERICAN CERTIFIED SEED POTATO HEALTH CERTIFICATE - CROP YEAR 2000

Grower
 Name Joe Idaho
 City, State/Prov. Seed Area, Idaho

Importer

Variety Russet Burbank **Acres** 50.00

Quantity shipped 300 cwt
Size _____

Lot certification
 Certification # 50995562
 Seed class / gen. G3
 Certifying state Idaho

Lot origination from tissue culture No Yes
 Year micropropagated for planting 1997
 by Jim's Clean Seed Greenhouse, Inc.

Production environment pedigree Fill 1 column per production year; use different initials in Greenhouse or Field boxes for different farms (e.g. JSF for John Smith Farms); indicate a tuber-united lot with a '+' after the farm initials; describe other footnotes in 'Notes' below.

1992	1993	1994	1995	1996	1997	1998	1999
				X			
					X	X	X
				9604820	57996231	58995623	59995874
				ID	ID	ID	ID

Year of production _____
Greenhouse (insect excluding) & sterile soil _____
Field (note special measures [e.g. row covers] below) _____
Certification no. _____ **Number of years produced in** _____
Certifying state _____ **field soil:** 3

Summer field readings
 Field inspection

1st	2nd	3d	FINAL
0.00	0.00		
0.00	0.00		
0.00	0.00		

Post-harvest test readings
 Visual Location Oceanside, CA
 _____ _____
 _____ _____
 _____ _____
 Sample no. 400
 Plant count 389

Less than _____
 Less than _____

%LEAFROLL 0.00
 %MOSAIC 0.00
 %VARIETAL MIXTURE 0.00

ELISA TEST RESULTS FOR LATENT VIRUSES
 %PVY N/A
 %PVX 0
 %PVA N/A

Other diseases

	Not known to occur in grower's area	No. of years since last found on this grower's farm, or NONE ON RECORD if free > 10 years	This year apparently free by inspection	Status unknown
Golden nematode	X			
Root-knot nematode	X			
Potato rot nematode	X			
Bacterial ring rot		NONE ON RECORD		
PSTV	X			
Powdery scab	X			
Potato wart	X			
Late blight			X	

Notes

The above information is accurate to the best of our knowledge.

Program official/title _____ Date _____
 Agency _____ Telephone _____
 _____ FAX _____

Approved for use by the Certification Section of the Potato Association of America - December 1999

Figure 1. Sample Plant Health Certificate
 125