

# Post Harvest Testing Survey

*Prepared by the PAA Certification Section  
Accepted January, 2004*

## 1. Which seed lots require a post harvest test?

Agency	Generation	To Recertify	To certify	Exceptions
AK	NA			Alaska does not perform winter testing. Only incidence of PLRV in a seed lot was in an imported lot. PVY not detected in any seed lot since 1984. Visual inspections have produced plants w/ symptoms of PVY but no positive ELISA for confirmation.
CA	FY3-FY5	Yes	--	FY1, FY2, FY7 not required in CA. FY6 not required in CA, just one time
Canada	All gen	No	No	No seed lot requires a PHT. The Canadian system is driven by market demand of its customers, and thus voluntary participation by seed growers. Many lots of G2, G3, & G4 are tested as a result of a sales or market requirement. Generally G1, and PE are not tested as these generations are usually maintained for as seed grower's own seed, but it can voluntarily be tested for sale purposes
CO	All gen	Yes	--	FY6 not eligible for recert; NA to FY7
ID	All gen	Yes	Yes	
ME	All gen	Yes	Yes	
MI	All gen	Yes	Yes	
MN	All gen	Yes	Yes	NA to FY7
MT	All gen (FY1-FY4)	Yes	Yes	
ND	All gen	Yes	--	
NE/WY	All gen (FY1-FY5)	Yes	--	
NY	All gen except Nuclear.	Yes	Yes	Nuclear Lots from Uihlein Farm winter tested prior to distribution to seed growers. Generally occurs after 2 <sup>nd</sup> field year.
OR	All gen	Yes	No	Lots less then 750 lbs exempt, FY6 not eligible for recert
WA	--	--	--	PHT optional except for following cases; 1. Recert. Of seed lots w/ > trace of virus 2. Lots in which chemical damage is detected 3. Field conditions no conducive to a field inspection
WI	All gen	Yes	Yes	FY1 & FY3 Lots <0.25 acres staying on farm. FY2, FY4-7 & all gen - Lots not requiring tags* *all acres on a seed farm must be entered for cert., but lots are often sold as chipstock or tablestock if price is favorable

**2. How many samples for each lot?**

Agency	FY1	FY2	FY3	FY4	FY5 +
AK	NA				
CA	All gen. (1 sample = 220 tubers). 1-5 acres=220 tubers; 6-10 acres=440 tubers; 11-20 acres=660; 21-40 acres=880; 41-80 acres=1100 tubers				
Canada	Lab test: 200 tubers OR Field test: 400 tubers. One sample/lot regardless of size.				
CO	25 tubers up to 1% of plant pop. of lot	100 tubers or 1% of plant pop of lot up to 400 tubers	1 <sup>st</sup> 40 acres = 400 tubers; 2 <sup>nd</sup> 40 acres (up to 80 a/lot) – 400 more tubers (800 total) 3 <sup>rd</sup> 40 a (up to 120 a/lot) – 200 more tubers (1000 total) 4 <sup>th</sup> 40 a (up to 160 a/lot) – 200 more tubers (1200 total)		
ID	Contact office	400 tubers/10 acres	400 tubers/50 acres	400 tubers/100 acres	400 tubers/lot
ME	Testing optional if lot not sold that yr	400 tubers/8 acres	400 tubers/15 acres		Foundation Class: 400 tubers/15 acres Certified Class: 400 tubers/40 acres
MI	1-40 a= 400 tuber sample; 0.5-0.9 a=200 tuber sample; <0.5 a=100 tuber sample. Smaller samples < 100 tubers at agency discretion for small lots.				
MN	200	400 / lots of 45m acres max. for G1 to Certified (FY1-FY7)			
MT	Contact office	1 sample/1-10 acres	1 sample/#40 acres		
ND	<2 a=300 tubers; 2-80 a=600 tubers; >80 a=1200 tubers				
NE	< 2000 lbs, no sample, all other based on acreage				
NE/WY	0-1 a=125 tubers; 2-10 a=250 tubers; 11-70 a=500 tubers; 71+ a=1000 tubers				
NY	Uihlein Farm (Nuclear) 50-400 tubers/lot. Seed growers required to submit 1 sample/lot. Size is based on acreage: <1 a =105 tubers; 2-25 a=410 tubers; 26-40 a=610 tubers; >40 a=810 tubers				
OR	220 – 2,240+ tubers (dependant on field size) (table in Standards, 20 tubers/acre if over 100 acres)				
WA	400 tubers / lot. 4 tubers/ 100 cwt for lots < 1 acre				
WI	400 tuber sample/ 50 A: min 1 to max of 4 sample. G-series generation nomenclature begins when seed move off the State Farm.				

### 3. What diseases are checked for in winter test?

Agency	PLRV	PVY	PVA	PVX	Other
AK	NA				
CA	Visual/ELISA	Visual/ELISA	--	--	\$
Canada	<p><b>Field testing:</b> All visible diseases are rated for a field grown PHT. PVY, PVA, and PVX are categorized as visible MOSAIC virus. PLRV is rated separately. Other diseases may be noted but are not rated. When there is no collaborative agreement by inspectors, a lab test is used to verify findings.</p> <p><b>Lab testing: ELISA is the standard protocol, and PVY and PLRV are tested routinely, other viruses such as PVA and PVX may be requested. Both systems are equally recognized. Laboratory testing is more routinely performed in Eastern Canada and Field testing is more routinely performed in Western Canada.</b></p>				+
CO	Visual	Visual/ELISA	Visual/ELISA	Visual/ELISA	#
ID	Visual	Visual	Visual	Visual	
ME	Visual	Visual	Visual		
MI	Visual	Visual	Visual	Visual	
MN	Visual	Visual	Visual		%
MT	Visual	ELISA	Visual/ELISA	--	##
ND	Visual	Visual	Visual	--	
NE/WY	Visual/ELISA	Visual/ELISA	--	--	@@
NY	Visual	Visual	Visual	Visual	@ Calico ^
OR	Visual	Visual	Visual	Visual	Any *
WA					&
WI	Visual	Visual	Visual	Visual	@

@ - WI. Rules don't require distinguishing between visual mosaic causing viruses. Inspectors have been able to identify mosaics that are not due to PVY and have them diagnosed by ELISA (e.g., PVA, PVM)

# - CO. Visual-haywire, calico, blackleg. ELISA – certain varieties are screened w/ ELISA.

& - WA. PHT based on visual inspection. ELISA may be used for confirmation

^ - NY. Samples are scored for Leafroll and mosaic. Other diseases/problems reported as appropriate

\*- OR. ELISA used to reaffirm +/- visual symptoms

%- MN. Visual readings are for MO and LR. If a MO is neg. for PVY, we'll test it for PVA

+ - Canada. As required by markets, lab testing may be requested in addition to a field test for specific varieties exhibiting poor symptom expression, e.g., Russet Norkotah and Shepody

\$ - CA. Cal White, FL varieties screened w/ ELISA

@@- NE. GMO for Atlantic, Burbank, Norkotah, Shepody, Superior. Except for Nuclear. Lots for replanting in NE, all Norkotah & Shepody are ELISA screened for PVY.

##-MT. All varieties screened for PVY, PVYn w/ ELISA

**4. Do you confirm visual readings with ELISA? Do you test all plants with a symptom?**

<b>Agency</b>	<b>Response</b>	<b>Comments</b>	<b>Test all symptom plants</b>
AK	NA		
CA	Yes	Most of the time	No – eventually to have proof
Canada	No	Only when inspectors do not agree, or a specific market requests an ELISA lab test	No – see comments
CO	Yes	Test all mosaic plants	Yes
ID	Yes	All plants w/ symptoms are checked w/ ELISA	Yes
ME	No	Set of Shepody's are ELISA tested to correlate inspector eyes with visual symptoms	No
MI	Yes	For rejections or downgrades	No
MN	No	Occasionally	No
MT	Yes		Yes
ND	No	Only as needed	No
NE/WY	Yes	Only if unsure of visual symptoms	No
NY	Yes	Confirm visual w/ ELISA when necessary. Final disposition of a lot based on visual assessment	No
OR	Yes when needed	Lab used to test for questionable symptoms and generally at least one conformation sample per lot tested.	No – see comments
WA	No	Lab confirmation is used for plant w/ atypical symptom of when results are disputed	No – see comments
WI	--	Correlation between visual & ELISA is frequently checked. Confident in the ability of inspectors to correctly visually diagnose virus infections.	No

**5. Which varieties do you screen with ELISA for latent viruses? How many plants do you include in the screen? Do you apply ELISA or visual readings to the tolerance?**

Agency	Varieties	# of plants screened	ELISA or visual applied to tolerance
AK	NA		
CA	Cal White	100 / acre	
Canada	None, except if market required or a grower chooses a lab test	Based on market requirement	There is no tolerance standard established in the Canadian program. Both readings are included but when ELISA is used to resolve an inspection discrepancy, the ELISA result will be the final.
CO	Norkotah, Gem, Shepody, Silverton, CO80011-5 & other known latent PVY expressers	400 tuber sample – 50 plants 200 tuber sample – 25 plants 100 tuber sample – 15 plants <100 tuber sample – 15 plants	No leaves of visually + plants are picked in the screening. These plants are marked so they are not duplicated in the readings. Both tests applied to tolerances (summed – 1%ELISA+1%visual=2%). Rarely done, normally visual reading is accurate
ID	Norkotah, Shepody, Gem, Cal White & some numbered lines	100 / 400 tuber sample	ELISA
ME	Norkotah	100/400 tuber sample	ELISA for PVY; visual for PLRV- sum of both = total virus
MI	Norkotah, Shepody	100	Inspectors discretion. If disease symptoms are good then visual readings are used
MN	Norkotah, Shepody	100 / lot	ELISA
MT	All varieties	100% that were germinated	ELISA
ND	Norkotah, Shepody, Gem	300 or more (depends on sample size)	Both
NE/WY	Norkotah, Shepody	Same scale as summer tests unless grower requests more	ELISA
NY	Green Mountain, Norkotah	All plants in small samples & 50% of plants in larger samples	Do not “screen” specific varieties for latent viruses. Samples of problematic var. tested. Winter test is scored on visual basis
OR	Shepody, Norkotah., Winema, Cal White, Gem, Shasta, A9014-2. Required only at FY1 & FY2 for PVY (above var.) & PVX (all var.)	Testing done in summer and involves 25% at FY1, 500 plants/a at FY2	They have specified tolerances
WA	n/a	N/a	n/a
WI	Norkotah, Shepody	200 / lot	Visual

**6. Do you have a tolerance for variety mix?**

Agency	Response	Comments
AK	NA	
CA	Yes	G2(FY3) 0.25%; G3(FY4) 0.5%; G4(FY5) 1%; G5(FY6) buyer/seller agreement
Canada	No	Simply noted when observed
CO	No	Grower is notified & remedies are discussed
ID	No	
ME	No	VM is scored and reported, but do not reject for VM (may use results to follow-up in storage and if necessary, reject there)
MI	No	Varietal mix tolerance is applied in summer readings
MN	No	
MT	No	
ND	No	
NE/WY	Yes	Same as field tolerances, but grower has right to rogue prior to 1 <sup>st</sup> inspection in summer
NY	Yes	0.25% for all generations
OR	Yes	0 – 1.5% depending on class
WA	No	
WI	Yes	0% for recert.; 2% for cert. Class

**7. Are your tolerances applied to recertification? (i.e., does it have to meet these tolerances in order to recertify the following year).**

Agency	Response	Tolerances for recert.
AK	NA	
CA	Yes	If field exceeds tolerances, downgraded until level permissible for recert. If above max., then out of system . Table of tolerances – see Appendix 2
Canada	No	None – Not mandatory requirement in Canada
CO	Yes	LR 1%; Total MO 3%; Severe MO 1% (visual PVY, PVA combined); Mild MO 3% (visual PVX, PVS, etc); Other virus 0.5%.
ID	Yes	In summer if a lot has >0.1% LR, it can't be recert. In winter test; 0.8% LR; 2.0% Mosaic
ME	Yes	Tolerances the same for cert. and recert. Foundation Class must meet 0.5% total virus w/ no PSTV or BRR. Cert. Class must meet 5.0% w/ no PSTV or BRR
MI	Yes	We have 0.5% winter test tolerance for foundation. 0.25% for summer
MN	Yes/No	Virus tolerance in the winter test is 0.5%. Field tolerances depend on the class.
MT	Yes	0.5%
ND	Yes	Established by Seed Commissioner
NE/WY	Yes	Visual – lots w/ any virus not recommended for recert. Lots double the field tolerance, not eligible for recert. Lots in excess of 8% rejected from cert. ELISA – lots w/ any virus not recommended for recert. Lots from 4-8% not eligible for recert. Lots in excess of 8% rejected from cert.
NY	Yes	Tolerances are the same for recertification and certification. Foundation = 0.5% total virus, Certified class = 5.0%.
OR	Yes	There is a specific set of tolerances (by class) for the winter growout. Lots not meeting the tolerances can be downgraded but not totally rejected (i.e. max. downgrade is to G5 class (FY6). Table of tolerances – see Appendix 1.
WA	Yes	All percents: LR - N 0; G1 0.25; G2 0.5; G3 0.75; G4 1.0; G5 2.0 MO (well defined) – N 0; G1 0.25; G2 0.5; G3 1.0; G4 1.5; G5 2.0 Total Virus – N 0; G1 0.5; G2 0.75; G3 1.0; G4 1.5; G5 3.0
WI	Yes	0.5% PLRV or 0.5% Mosaics; 0.5% total virus if both present

**8. Are your tolerances applied to certification (whether it gets a tag or not)?**

Agency	Response	Tolerance for cert.
AK	NA	
CA	Yes	See Appendix 2
Canada	No	None
CO	No	
ID	No	
ME	Yes	See #7
MI	Yes	1.0% summer; 5.0% winter
MN	No	
MT	Yes	
ND	Yes	Established by Seed Commissioner
NE/WY	Yes	8% maximum for visual or ELISA
NY	Yes	--
OR	No	Downgrading possible, but not rejection. Table of tolerances – see Appendix 1.
WA	No	Acceptance of lots that don't meet the PH tolerances must be based on buyer/seller agreement
WI	Yes	5% PLRV; 5% mosaic; 5% total virus.

**9. Are your % disease readings based on the number of plants that emerge?**

Agency	Response	Comments
AK	NA	
CA	Yes	
Canada	Yes	Disease readings percentage calculations are based on the number of plants positive per number emerged at a growth stage where symptoms are anticipated to be visually expressed
CO	No	
ID	No	
ME	Yes	Less than 50% emergence of sample – revert back to summer field readings
MI	Yes	
MN	Yes	
MT	Yes	
ND	Yes	When significant number do not emerge
NE/WY	No	
NY	Yes	Shown on PHC as # emerged / # planted (e.g. 350/410)
OR	Yes	
WA	Yes	
WI	Yes	

**10. Are your % disease readings based on the number of tubers planted?**

<b>Agency</b>	<b>Response</b>	<b>Comments</b>
AK	NA	
CA	No	
Canada	No	400 tubers are the standard planted, but not used in calculation
CO	Yes	
ID	Yes	If number emerged is lower than overall emergence, additional sample is tested from storage
ME	No	See # 9
MI	No	
MN	No	
MT	No	
ND	Yes	
NE/WY	Yes	
NY	No	Would prefer to base on # of tubers. Based on # of emerged plants may artificially inflate readings and unfairly penalize a grower.
OR	No	
WA	No	
WI	No	

**11. What dormancy breaking treatment to you use? What you also use a heat treatment? How long (days)? What is your average emergence per lot or sample?**

Agency	Dormancy break	Heat trt	Duration	Avg. emergence	Comments
AK	NA				
CA	GA <sub>3</sub>	Yes – 70-75 F	10-14 days	Ranges from 75/220 to 175/220	
Canada	Bromo ethane (west) Rindite (east)	Yes – 74 F	Min. 3 days, but generally shipped and held to planting at approx. same temp.	Tends to be varietal and area grown dependent, but an anticipated average is 320/400. Previous to 2002, used GAA with poor to medium success (variable results) Average was 200/400. GAA is much more temperature dependent.	
CO	Rindite + GA <sub>3</sub>	Yes – 75 F prior to trt	14 days minimum	315-340 out of 400	Rindite + GA <sub>3</sub> – used on hard to bread varieties
ID	GA <sub>3</sub>	Yes – 75 F	1 week	270/400 Burbank other varieties ~300-340/400 tubers	Switching to Rindite trt for 2002 crop
ME	Rindite	Yes – 65 F prior to trt  75 F during trt	1 week prior to Rindite  3-4 days during Rindite	360-375 out of 400 on many varieties	
MI	Rindite	Yes – trt done by WI			
MN	Bromo ethane	Yes – 65 F			Depends on variety, we keep ½ of some varieties such as Sangre in EGF to cut and trt w/ GA and ELISA test the grow-out under lights
MT	Rindite	Yes – 72 F	10 –14 days	~90% in Hawaii	
ND	Bromo ethane	Yes – 75 F	2 days	NA	
NE/WY	Rindite & GA <sub>3</sub>	Yes – 75 F	1 week minimum, more if time allows	--	
NY	Rindite	Yes – 75 F prior to trt  78 F during trt	3-7 days  3 days	80-100% stand, depending upon variety	Extra GA <sub>3</sub> trt is done in FL prior to planting for some cultivars
OR	GA <sub>3</sub>	Yes – 80-85 F	2-3 weeks	95%	Testing in greenhouse
WA	--	Yes – 75 F	30 days	395 out of 400	Testing in greenhouse
WI	Rindite	Yes – 70-75 F prior to trt  75-78 F during trt	4-6 days prior to Rindite  3 days during Rindite	95+%	

**12. Using your dormancy breaking treatment, which varieties are difficult to break dormancy?**

<b>Agency</b>	<b>Dormancy trt</b>	<b>Varieties which prove difficult to dormancy break</b>
AK	NA	
CA	--	--
Canada	Bromoethane (west) Rindite (east)	Sangre, Nooksack, Penta, Pike
CO	Rindite	Sangre, Russet Nugget, Alpha & some numbered lines
ID	GA <sub>3</sub>	Russet Burbank, Norkotah
ME	Rindite	Kennebec, Amey, Andover, Eva, FL 1625, 1833, 1867, Kanona, Norwis, Onaway, Pike, Red Cloud, Superior
MI	--	--
MN	Bromo Ethane	Sangre, impossible, inconsistent: Penta, Kanona, Pike, Dakota Pearl
MT	Rindite	Gem, Sangre
ND	Bromoethane	Sangre, Durango, Pike, FL varieties
NE/WY	Rindite & GA <sub>3</sub>	Most FL varieties, Pike, and some reds. Those w/ dormancy problems are dipped in GA <sub>3</sub> , then warmed a few days before gas treatment
NY	Rindite	Allegany, Amey, Elba, Eramosa, Eva, Hampton, Norwis, NY 118, NY 121, NY E11-45, Pike all do better with GA after Rindite. Even w/ GA, Allegany emerge is ~30%.
OR	GA <sub>3</sub>	Gem
WA	--	Pike, All Blue, Cal Red
WI	Rindite	Pike, all FL varieties, Kennebec

**13. Standardizing generations. Last vote was in favor, but not a consensus. What are your agency's plans to add field generation to the tag? What are your concerns if you are not adding this to the tag?**

Agency	Current actions	Comments
AK	Uses gen. # on tags & other lot identification	G1-G8 matches FY and is part of the lot number
CA	--	Issue will be discussed with growers
Canada	It currently is a provided for as a regulatory option	It currently is a provided for as a regulatory option, but <u>not as listed</u> in your Table: Pre-Elite = G1, Elite 1 = G2, etc. Our understanding of the resolution was the first generation in the field is G1, etc. The first generation planted in the field is: Nuclear/PE for most state and Canadian systems.
CO	Plan to adopt for 2003 season	
ID	Not listed on tag yet	Further action to be decided when consensus is reached
ME	Started using it Jan. 2002	Will not add this to rules until rules are revised for some other reason
MI	1 <sup>st</sup> field yr is Field Year 1 or FY1	FY is used for FY1 to FY6. Very few tags are used. Bulk loads have a bulk certificate issued at inspection which identifies field generation
MN	Not part of the rules	Seed growers know what they are planting and other never asked for it.
MT	--	No, we will not add field gen. to the tag. We feel field gen. is not relevant to actual disease infection. We would like to see that disease reading and field gen. be defined.
ND	--	Hopefully next season
NE/WY	Put field gen on tag in N, GI-GIV	Don't know if we will switch to FGI - FGIV
NY	--	--
OR	--	Will likely follow lead of neighboring states, but must be approved by Advisory Committee of Certification Board. Adding <u>actual</u> field year could become difficult for down graded lots (i.e. a "FY2" lot that was downgraded to G5 due to virus). If added would most likely list <u>maximum</u> number of field years possible.
WA	Rules require tag to list gen.	Could change our gen. Scheme to reflect field gen. & growers probably willing as long as neighboring states did the same
WI	Not decided yet. Printing equip. not easily modified.	Would it be too difficult to require PHC to accompany every load coming into state? Possibility to reject lots entered w/o adequate documentation (i.e. PHC). Make buyer and seller responsible for acquiring documentation.

## Appendix 1

### *From the Oregon Seed Potato Standards*

C. Minimum sample size {for winter growouts} will be:

1. Winter test samples must be submitted in bags weighing no more than approximately 50 pounds.
2. Small seed lots: 4 tubers per hundred weight, with a minimum of 50 tubers.
3. Larger lots:

<u>Acres</u>	<u>Tubers</u>	<u>Acres</u>	<u>Tubers</u>
0.5-1 at least	220	41-50 at least	1,420
2-5 at least	320	51-60 at least	1,620
6-10 at least	420	61-70 at least	1,820
11-20 at least	620	71-80 at least	2,020
21-30 at least	1,020	81-90 at least	2,220
31-40 at least	1,220	91-100 at least	2,420

For lots over 100 acres, submit at least 2,420 tubers, plus 20 tubers for each additional acre over 100.

### WINTER TEST TOLERANCES

Factor	<u>Nuclear</u>	<u>Gen 1</u>	<u>Gen 2</u>	<u>Gen 3</u>	<u>Gen 4</u>	<u>Gen 5</u>
Leafroll	0	0.25	0.30	0.75	1.0	BSA <sup>d</sup>
Mosaic						
- Other varieties	0	0.25	0.50	1.00	2.00	
- Latent PVY varieties	0	0.25	0.50	1.00	5.00	BSA <sup>d</sup>
Spindle tuber viroid	0	0	0	0	0	0
Other visible virus <sup>a</sup>	0	0.25	0.75	2.00	2.00	BSA <sup>d</sup>
Total visible viruses						
- Other varieties	0	0.50	0.75	2.00	2.00	BSA <sup>d</sup>
- Russet. Norkotah	0	0.50	0.75	2.00	5.00	BSA <sup>d</sup>
Bacterial Ring Rot <sup>b</sup>	0	0	0	0	0	0
Root-knot Nematode	0	0	0	0	0	0
Chemical injury: Severe <sup>c</sup>	0.25	0.50	0.50	1.00	BSA <sup>d</sup>	
Chemical injury: Mild <sup>c</sup>	0.50	1.00	3.00	3.00	BSA <sup>d</sup>	
Variety mixtures	0	0	0.25	0.50	1.00	BSA <sup>d</sup>

<sup>a</sup> Includes phytoplasma-like organism

<sup>b</sup> Protocol on file specifying what constitutes a confirmation of diagnosis for BRR.

<sup>c</sup> Does not apply.

<sup>d</sup> Acceptance of the seed lot will be based on buyer/seller agreement.

**Appendix 2**

California Post Season Test Disease Tolerance

<b>Factor</b>	<b>Nuclear</b>	<b>G1</b>	<b>G2</b>	<b>G3</b>	<b>G4</b>	<b>G5</b>
Leafroll	0	0.5	0.5	0.5	1.0	****
Mosaic – other var.	0	0.5	0.5	1.0	2.0	****
Mosaic – Russet Norkotah and Cal White	0	0.5	0.75	1.0	5.0	****
Spindle tuber viroid	0	0	0	0	0	0
Other visible virus	0	0.5	0.5	1.0	2.0	****
Total visible virus – other var.	0	0.5	0.5	1.0	2.0	****
Total visible virus – R-Norkotah and Cal White	0	0.5	0.75	2.0	5.0	****
Ring Rot and Root-Knot Nematodes	0	0	0	0	0	0
Chemical injury: Severe	***	0.5	0.5	0.5	1.0	****
Chemical injury: Mild	***	0.5	1.0	3.0	3.0	****
Varietal Mixtures	0	0	0.25	0.5	1.0	****
*** Does not apply						
**** Acceptance of the seed lot will be based on buyer/seller agreement						