

Section 10. Disease Tolerance for Certification

- A. Montana certified seed potatoes that test within the RECOMMENDED PVX or maximum PVY tolerance limits in Table 2 are designated as "PVX Generation" or "PVY Generation" seed potatoes, respectively. Testing for PVX and PVY will be done during the summer using ELISA methods.
1. "PVX tolerance limits" means the RECOMMENDED allowable percentage of detection of potato virus X *at the time and place of a virus test* to qualify a lot of seed potatoes for specific certification.
 2. PVY tolerance limits" means the maximum percentage of detection of potato virus Y at the time and place of a virus test. These limits do not affect the qualification of a lot of seed potatoes for certification. EXCEPTION: The PVY maximum tolerance limit for planting in Montana will be 0.5% based on summer testing.
 3. Disease tolerance limits means the maximum allowable observation of any overt symptoms for certain diseases at the time and place of the inspection.
 4. Seed lots that test within the RECOMMENDED PVX tolerance limits as specified in Table 2 are designated as "PVX Generation".
 5. Seed lots that test within the maximum PVY tolerance limits as presented in Table 2 are designated as "PVY Generation" seed potatoes.
 6. The recommended PVX and the maximum PVY tolerance limits set by MSU for each class of Montana certified seed potatoes are specified in Table 2.
 7. All seed classes must be summer tested for PVY, except Generation 3 and 4 seed that will not be planted back in Montana for recertification, and Generation 5 seed. If summer testing was not performed on Generation 3 or 4 seed to be planted back for recertification, PHT results may be substituted for summer test results at the discretion of the managing director. Seed exceeding the maximum PVY tolerance limits cannot be planted for certification purposes in Montana. Note: If Generation 3 seed is being sold out of state for recertification as seed, growers are advised to test for PVY during the summer growing season.
 8. If PVX is detected in the Winter Post Harvest Test, all generations of all seed lots from that farm will be tested for PVX the following summer.
- B. Montana certified seed potatoes that exceed the RECOMMENDED maximum of PVX or the maximum PVY tolerance limits in Table 2 by lab test will have no prefix before the given generation.
- C. In the case of a positive lab test for *Clavibacter michiganensis* subsp. *sependonicus*:
1. Traceback will be initiated on all sister lots and contact lots (storage or equipment).
 2. 100% laboratory testing of all seed lots on farm at 4600 tubers per lot.
 3. Seed from CMS positive farm can only be sold for commercial planting after testing clean.

4. Mandatory testing of 100% of G2-G5 for 5 years after last detection.

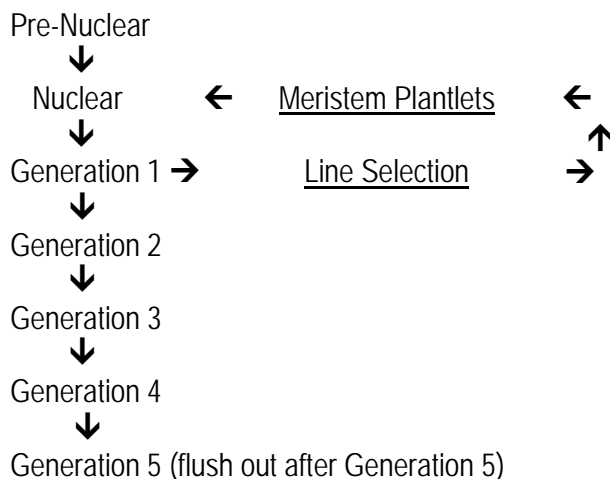
D. In the case of a visual bacterial ring rot diagnosis:

1. No seed from that farm can be certified for that crop year.
2. Traceback will be initiated on all sister lots and contact lots (storage or equipment).
3. Mandatory testing of 100% of G2-G5 for 5 years after detection.
See Section 8 D.2

E. An indication of zero tolerance means that a particular disease must not be observed during various field inspections, cellar visits or lab tests. Note: A "0" (zero) recorded for a disease does not mean that a lot of seed potatoes is free from a certain disease or cause of disease. It means only that a disease was not observed during regular certification procedures.

F. Certified Seed Production Field disease tolerances are listed in Tables 1 and 2.

1. Required steps for production of seed stocks. Each subsequent generation is the progeny of the previous generation.



2. Pre-Nuclear

Pre-Nuclear must be tissue culture plantlets cut from disease-free materials or greenhouse produced minitubers produced from disease-free plants.

3. Nuclear

- a. Seed source must be pre-nuclear and/or grower's selected lines grown in Montana.
- b. One hundred percent (100%) of the mother materials must be tested for all diseases of concern.
- c. Seed must be planted as tuber units and hill units if a selected line is used; or as family units if meristem plantlets are used.
- d. There must be two (2) feet between plants and three (3) feet between units.

- e. One hundred percent (100%) of the plants must be tested for PVA and PVY by ELISA during summer disease testing. PVA testing will be conducted for research purposes. (PVX testing optional unless found in the Winter Test)
Exception: if source of nuclear is tissue culture plantlets grown in an insect-proof greenhouse, one and one-half percent (1.5%) of the plants must be tested for PVA and PVY.
 - f. Nuclear plants must be free from all diseases of concern (Table 1 and Table 2).
 - g. Post-harvest testing is optional for seed not to be sold. Post-harvest testing at the Montana winter test plot is required for all seed to be sold.
Note: Nuclear seed is not to be sold out-of-state.
4. Generation 1
 - a. Source of Generation 1 must be nuclear seed.
 - b. Seed must be planted as hill units.
Exception: Seed generated from insect-proof greenhouses may be exempt from this rule.
 - c. 100 hundred percent (100%) of plants or hill units will be tested for PVA and PVY by ELISA in the summer testing. PVA testing will be conducted for research purposes. (PVX testing optional unless found in the Winter Test)
 - d. There is 0% tolerance for all diseases of concern (Tables 1 & 2).
 - e. Post-harvest testing is required.
 5. Generation 2
 - a. Seed source must be Generation 1.
 - b. Two hundred (200) plants per acre shall be tested for PVA, PVX and PVY by ELISA in the summer testing.
 - c. 10 tubers/acre or a minimum of 400 tubers/seed lot will be tested for BRR (*Clavibacter michiganensis* subsp. *sepedonicus*) by PCR on tuber cores collected after harvest.
 - d. Post-harvest testing is required
 6. Generation 3
 - a. Seed source must be Generation 2.
 - b. Testing plants (100 plants per acre) for PVA, PVX and PVY during the regular growing season is optional for seed that will not be planted back in Montana for recertification.
 - c. 10 tubers/acre or a minimum of 400 tubers/seed lot will be tested for BRR (*Clavibacter michiganensis* subsp. *sepedonicus*) by PCR on tuber cores collected after harvest.
 - d. Post-harvest testing is required.
 7. Generation 4
 - a. Seed source must be Generation 3.
 - b. Testing plants (50 plants per acre) for PVA, PVX and PVY during the regular growing season is optional.
 - c. 10 tubers/acre or a minimum of 400 tubers/seed lot will be tested for BRR (*Clavibacter michiganensis* subsp. *sepedonicus*) by PCR on tuber cores collected after harvest.
 - d. Post-harvest testing is required.

8. Generation 5

- a. Seed source must be Generation 4
- b. Testing plants (50 plants per acre) for PVA, PVX and PVY during the regular growing season is optional.
- c. 10 tubers/acre or a minimum of 400 tubers/seed lot will be tested for BRR (*Clavibacter michiganensis* subsp. *sepedonicus*) by PCR on tuber cores collected after harvest.
- d. Progeny of Generation 5 cannot be planted for recertification purposes in Montana.
- e. Post-harvest testing is required.

G. Identities

1. Line-selection (LS)

Seed potatoes produced through the process of line selection will be given LS as identity. To qualify for line selection, selected units must be planted in the field for comparison of plant performance and yields for at least two years. The best line can be used as a source of nuclear plants. **LS identity can only be carried to Nuclear and Generation 1.**

2. Meristem (M)

Seed potatoes generated through meristem methods and propagated in vitro will be given M as identity. Meristem- and propagation work must be done in a laboratory approved or recognized by Montana State University (Appendix B). **M identity can only be carried to Nuclear and Generation 1.**

3. Stem cutting (SC)

Seed potatoes increased using the stem cutting method will be given SC as identity. **SC can only be carried in Nuclear and Generation 1.**

**TABLE 1
VISUAL INSPECTION TOLERANCES FOR CERTIFICATION**

Disease	Nuclear & Gen 1 All Inspections	Gen 2 All Inspections	Gen 3 All Inspections	Gen 4 All Inspections	Gen 5 All Inspections
Leafroll	0.0	0.05	0.1	0.2	0.2
Mosaic	0.0	0.1	0.2	0.5	0.5
Spindle Tuber	0.0	0.0	0.0	0.0	0.0
Calico	0.0	0.15	0.3	1.0	1.0
TOTAL All Non-latent Viruses	0.0	0.2	0.4	1.0	1.0
Phytoplasma Diseases*	0.0	0.1	0.2	0.5	0.5
Giant Hill	0.0	0.05	0.1	0.5	0.5
Varietal Mix	0.0	0.05	0.1	0.5	0.5
Volunteer Potatoes (same variety)	0.0	0.05	0.1	0.5	0.5
Bacterial Ring Rot	0.0	0.0	0.0	0.0	0.0
Columbia Root Knot Nematode (visible symptoms)	0.0	0.0	0.0	0.0	0.0

* Diseases caused by Phytoplasmas including Haywire, Witches Broom, Purple Top and Zebra Chip (*Candidatus liberobacter solanacearum*).

IMPORTANT NOTE: The 0.0% tolerance is not intended, nor may it be construed, to mean that the lot inspected is free from the disease. In cases of bacterial ring rot and Columbia root knot nematode, it means only that said disease was not identified during the inspection process. In cases of other disease, it means only that the disease infection should be rogued to zero.

**TABLE 2
SUMMER RANDOM LEAF TESTING
PVX & PVY SEED CLASSES AND
REQUIREMENTS ****

SEED CLASS	PLANTS SERO-TESTED	RECOMMENDED PVY TOLERANCE	PVY TOLERANCE	RECOMMENDED PLANTING METHOD	OTHER DISEASE TOLERANCES
Nuclear	100%	0%	0%	Tuber Unit	See Table 1
Generation 1	100%	0%	0%	Hill Unit	"
Generation 2	200 leaves per acre	1%***	1%***	regular planting	"
Generation 3 (optional)	100 leaves per acre	N/A	N/A	regular planting	"
Generation 4 (optional)	50 leaves per acre	N/A	N/A	regular planting	"
Generation 5 (optional)	50 leaves per acre	N/A	N/A	regular planting	"

** NOTE: Percentage of infection is based on ELISA test

***EXCEPTION: Seed to be replanted in Montana may not exceed .5% PVX or PVY based on summer lab testing. See Section 10.A.2.

NOTES:

1. Enzyme-linked Immunosorbent Assay (ELISA) for all virus disease(s) of concern shall be required each year for Nuclear and G1.
2. G5 seed shall not be used for the purpose of recertification in Montana.
3. The 0.0 tolerance means that all infected plants must be rogued out.