

Colorado State University
Colorado Potato Certification Service



RULES AND REGULATIONS
FOR
CERTIFICATION OF SEED POTATOES
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COLORADO RULES AND REGULATIONS FOR CERTIFICATION OF SEED POTATOES

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Definition of Terms:

1. Colorado Potato Certification Service (PCS), - Colorado State University, Center, CO. A program of seed improvement and inspection carried out by Colorado State University in cooperation with the PCS Advisory Council.
2. Certified Seed – means that the potatoes were inspected while growing in the field and again after being harvested and were thereafter duly certified by PCS as provided in the Rules and Regulations approved by the Board of Governors of the CSU System. Certified seed is eligible to be sold as certified.
3. Qualified Seed – means potatoes derived from certified potatoes which have been inspected by Colorado Potato Certification Service. Qualified seed has met all applicable rules and regulations for certification and is eligible to be recertified and must meet all official disease control standards. Qualified seed is not eligible for sale as certified seed and no tags or bulk certificates will be issued.
4. Seed - refers to the vegetatively propagated tuber used for reproduction of the potato rather than true seed that is sexually produced from the potato flowers.
5. Limited Generation Seed – refers to seed potatoes produced to meet the respective special requirements outlined in the Limited Generation System requirements.
6. Experimental Seed – refers to those seed potatoes produced to meet the respective special requirements outlined in the Experimental Seed requirements.
7. Non- Generation Certified – This refers to a seed lot that has met all disease tolerances but does not meet the special requirements outlined for limited generation or experimental seed. PCS personnel will determine if the seed meets the criteria for “NGC” and exercise discretionary power. See the Non-Generational Seed Potatoes requirements section.
8. Lot – refers to a field of potatoes that has the same seed source(s) which is assigned an individual lot # designation or the potatoes harvested therefrom.
9. Official State Tag – means the tag carrying the official seal of the Board of Governors of the CSU System, cultivar, grower and address, generation level, lot number and year of production, which must be attached to seed represented to be “Colorado Certified Seed”.
10. Bulk Certificate – is an official document issued by PCS to verify the certified status of a specified quantity of Colorado Certified Seed potatoes which are shipped bulk.
11. Waiver of Grade Inspection – a statement which may be part of a sales contract or on a separate form wherein the buyer agrees to accept grade without official inspection. The Waiver of Grade Inspection may only be used if the Federal/State Inspection Service is unable to inspect a lot sold within the Marketing Order.
12. Disease Tolerance – Certification rules make provisions to allow the presence of certain diseases at levels sufficiently low as to preclude significant effect on seed value. In case of bacterial ring rot, there is zero tolerance, and the discovery of a single ring rot infected plant in the field or tuber in the bin, brings about rejection of the lot from certification. Conversely, the lack of discovery of bacterial ring rot in any given seed lot does not necessarily mean the seed is free from the disease.
13. U.S. Standard for Seed Potatoes – is understood to be grades of potatoes as defined and issued by the U.S. Department of Agriculture.
14. Inspector – is a qualified person, approved by the Colorado Potato Certification Service as being capable of conducting field, cellar, grade, greenhouse, and pots-harvest test plot inspections.

15. Rejected – when applied to a field or lot of potatoes means that the potatoes fail to meet the standards covering Generation, Non-Generation Certified or Experimental seed potatoes, and cannot be sold as such without being guilty of violation of the Seed Certification Law.
16. Withdrawn – when applied to a field or lot of potatoes means that a grower has voluntarily remove this seed from certification. The field or lot is no longer eligible or qualifies as certified seed. The reason for withdrawing the field or lot will be noted on the official PCS field inspection report.
17. Roguing – means the removal of all diseased or undesirable plants or tuber-units, and potatoes produced thereon.
18. Tuber-Unit Planting – is a method of dropping two or more seed pieces from one tuber consecutively in a row. Tuber-Unit Field is a field: a) that is planted by tuber-unit method, and b) from which entire units are rogued if any plant in a unit is found to have virus disease.
19. Mass or Straight Planting – as opposed to tuber to tuber-unit planting. May refer to whole or cut seed planted in a conventional manner.
20. Field Isolation – is the physical separation between field plantings to minimize accidental mixing of tubers, transmission of virus disease and contamination by certain bacterial diseases.
21. Storage Isolation – is physical separation between seed lots in storage to prevent the accidental mixing of different lots or cultivars and minimize the tuber-to-tuber spread of disease.
22. Soft Rot or Wet Breakdown – means any soft, mushy, or leaky condition of the potato tissue.
23. Internal Discoloration – means any type of necrosis, stem-end browning, internal brown spot or other similar types of discoloration not visible externally, except blackheart.
24. Farming Operation – a seed potato enterprise that includes all land, equipment, storage facilities, and labor that are utilized in a common effort to produce certified seed potatoes. This includes all potato fields in the enterprise whether actually grown by the applicant or under growing agreements with common equipment and storages.
25. U.S. Plant Variety Protection Act – refers to the federal law administered by the USDA which outlines the regulations and rules of practice for protecting sexually reproduced or tuber propagated plant varieties.
26. Zero Tolerance – means none found during visual inspection. Certification of a lot, however, is not a guarantee that the lot inspected is free from any “zero tolerance” disease or pest. When a “zero tolerance” disease or pest is confirmed, the lot will be rejected from certification.
27. Seed Grower (Grower) – Any party and/or parties that submit a seed application and that pays the fees for certification of seed potatoes on a given farming operation.
28. Seed Grower in Good Standing – any seed grower (who raises certified or qualified seed) that is current on payment of fees and royalties, has submitted all required paperwork in the appropriate time frame, works with PCS to have inspections conducted when necessary and when conditions are optimal, and provides requested information in a timely manner. A member that does not meet these standards is at risk of falling out of “good standing”. This will be evaluated by PCS and the PCS Advisory Council on a case-by-case basis and will be decided by the Department Head of Horticulture and Landscape Architecture.

Fee Structure:

- A. **Acreage Fees for Certified and Qualified Seed:** \$30.00 per acre (Generations 1 & 2), \$25.00 per acre (Generation 3-5), \$20.00 per acre (Generation 6).
1. Minimum charge to any grower, \$150.00 for 6 acres or less. Future Farmers of America and 4-H member, minimum charge of \$3.00 for 3 acres or less.
 2. To certify seed potatoes in Colorado, a grower must be a Seed Grower in “Good Standing” with the Colorado Potato Certification Service.
 3. Acreage entered may be voluntarily withdrawn at any time.
 4. **For Payment: Checks payable to Colorado State University: (PCS in memo line). Acreage fees must accompany the application for certification.**
 5. Application plus payment of acreage fees for certification must be made on or before June 1st. Applications received after June 1st will be accepted at the discretion of PCS. All growers will be assigned a permanent grower identification number upon submitting an application for Certification. Deadline for all applications is June 1st or 10 days after planting. Late applications will be accepted June 2nd through June 25th and will be assessed a \$500/day for every day application is late.
- B. **Post-Harvest Test Fee:** Samples submitted for field grow-out will be charged on a project cost basis once the PHT costs are known.
- C. **Tag and Bulk Certificate Fees:**
1. Bulk Certificates: \$0.12 per hundred weight (cwt).
 2. Tag Fees: \$0.12 per tag. This is in addition to the \$0.12/cwt fee for shipping certified seed. A tag is required on each sack of certified seed. All unused tags must be destroyed by the grower at the end of each shipping season.
 3. Bulk certificates are due 30 days after shipping date. Bulk certificates that are submitted after the due date will cost \$0.30 per hundred weight (cwt). All bulk certificates need to be entered into Seed Hub. New bulk certificates will not be issued to any grower who is not current on his/her bulk certificate submittals (growers who generate their own bulk certificates will need to stay current on their submittals, or risk losing this privilege).
- D. **Billing Policy:**
1. All charges for tags, bulk certificates, laboratory services, and greenhouse inspections will be billed on a monthly basis.
 2. All checks or money orders must be made payable to **the Colorado State University; (PCS in memo line)** and mailed to 0249 E. Rd. 9 N., Center, CO 81125, in care of Potato Certification Service.

E. Disease Testing Fees & Testing Requirements:

See pages 9-11 for details involving required laboratory testing for nuclear and G1 seed lots. All the expenses for virus testing will be paid by the individual grower. Standard disease testing fees are listed below.

Description	Test	# Samples	Cost \$
Mother Plants [^] and Clonebanks [^]	¹ PVX, S,Y,A,M, M-ID PMTV,PLRV, Potato Latent, PSTV,Cms & Pec	Individual	52.00/test + PSTV \$4.00/test
Nuclear [^] (PCS Maintenance)	PVX,S,Y,M,Cms & Pec	Individual - Combined 5/test	\$52.00/test
Greenhouse foliage [^]	PVX, S,Y or any other virus tested by using ELISA	Individual - Combined 5/test - 10 min. to 1% of plant pop.	\$3.00/test
Greenhouse tubers [^]	Pec (lenticel) Cms (IFAS and/or ELISA)	Individual with 10 min. to 0.5% of plant pop. Up to 100 per group with 10 min. to 1% of plant pop.	Pec \$0.75/test Cms \$16.00/test
Greenhouse Inspections [^] - for CCPGA members entering less than 50 acres seed	Within the Area II Marketing Order Region Outside of the Area II Marketing Order Region		\$300/visit \$400/visit
Field foliage [^]	G1 - PVX, PVY	G1- Individual - 25 min. to 1% of plant pop. G1 combined 5/test	\$3.00/test \$315.00/ELISA plate
Cms tuber test (post harvest)	Cms (IFAS and/or ELISA) PCR	Individual - Combined 100 tuber cores/test up to 400 tubers min. per lot	\$16.00/test max of 100 cores/test \$320/400 tubers
Pec tuber test	Pec (lenticel)	Individual with 25 min.	\$0.75/test
Late blight tuber screening	Tuber incubation, high humidity, 68-72 ^o F, 21 days, visual examination.	See late blight test requirements for the San Luis Valley	\$12.50/50 tubers \$.25/tuber

¹Potato viruses X, S, Y, A and M, Potato Latent, PLRV (potato leafroll virus), PSTV (potato spindle tuber viroid), Cms (*Clavibater michiganensis*, subsp. *sepedonicus*), Pec (*Pectobacterium* spp.) [^]Required testing to qualify for certification.

These are base prices. Costs may increase if partial plates are utilized. The prices listed above are on an “at cost basis” for Colorado Certified Seed growers only. Services provided to outside PCS customers will be billed on a retail cost basis.

General Requirements for Producing Certified Seed Potatoes:

- A. *Seed Designation:* Each lot of seed potatoes entered for certification shall be identified as Limited Generation, Non-Generation Certified, Experimental, or qualified. Experimental seed must be accompanied by written authorization from the potato breeding program from which the numbered potato selections originate (germplasm release notice). Each seed lot must meet all General Requirements and applicable Special Requirements mentioned herein. **ANY SEED LOT BROUGHT INTO THE COLORADO LIMITED GENERATION SYSTEM FROM OUT-OF STATE WILL HAVE ITS ENTRY LEVEL DETERMINED BY THE COLORADO POTATO CERTIFICATION SERVICE.**
- B. *Protected Cultivars:* Any grower wishing to certify privately owned cultivars or cultivars under PVP status, must provide to PCS written documentation, stating that the grower has permission to grow that cultivar. In addition, greenhouses or labs must provide evidence that privately owned or PVP status cultivars have undergone all appropriate testing from an accepted lab. It is the responsibility of the grower to provide PCS with information on sources with documentation as well as descriptions and uses of cultivars that are not currently found in the PCS database.
- C. *Line Selection Characteristics:* The Potato Certification Service verifies that each cultivar accepted into certification as certified seed has been correctly identified by phenotype, genetic fingerprinting, or appropriate documentation. Some individual seed growers, however, may have developed or obtained from another source, line selections that possess characteristics such as yield potential, maturity, vine and or tuber type that could be different from any given cultivar as originally described and named. Since such characteristics for line selections cannot usually be verified on a reliable basis by conventional certification methods, the responsibility for informing the seed buyer about line selection characteristics rest with the seed grower.
- D. *Rejections based on Quality Concerns:* **Any disease or other condition seriously affecting seed quality, and its ability to sprout and grow normally that is not mentioned herein, may be cause for rejecting a lot entered for certification.**
- E. *Rejections based on Certification Standards:* **Any lot of seed may be rejected at any time such lot is found not to meet the Certification standards.** When non-PCS personnel or the seed potato grower discover a zero-tolerance disease or pest during any phase of certified seed potato production, PCS will be notified by the seed potato grower so that follow-up inspections and final diagnosis can be made in a timely fashion. Roguing or disposing of infected plants and or tubers prior to PCS notification and examination will not be allowed under any circumstance and may be cause for rejection for the lot for certification.
- F. *Farming Operation Requirement:* All potato fields on a farming operation must be eligible, that is, have met the minimum standards for certification either in Colorado's program or

another official certification program, and be entered for certification. See definition of a Farming Operation.

- G. *Early Vine Kill*: Any certified seed or qualified seed grower intentionally removing or killing the vines of a seed field or lot prematurely (prior to final inspection) and without PCS approval will be subject to a hearing by the PCS Advisory Council and PCS. The judgement on how to handle the field or lot in question will be rendered by PCS on a case-by-case basis and may include adjusting the status of the farming operation to grower entry for the current year.
- H. *Grower Misconduct*: If a certified seed or qualified seed grower violates the Rules and Regulations for Certification of Seed Potatoes in Colorado or engages or persists in practices which in the judgement of PCS are likely to injure or discredit the Colorado Seed Potato Industry or PCS, the grower may be suspended or expelled from the Potato Certification Program by action of the PCS Manager. Judgement will be based on input from the PCS Advisory Council at any regularly scheduled or special council meeting.
- I. *Directory Publication*: All certified seed successfully passing field inspection and eligible for sale will be listed in an annual directory published by PCS. Owners or representatives of private cultivars will be given the option to un-list their seed stocks but must notify PCS prior to publication of the directory each year.
- J. *Seed Production Guidelines*: Refer to the recommendations and guidelines of Colorado State University for appropriate and accepted seed potato production (Appendix II).
- K. *Isolation*:
 - 1. All potato fields entered for certification must be isolated from adjacent fields not entered for certification or lots rejected for serious seed-borne diseases during the current season. Potato fields entered for certification not meeting isolation requirements will be reduced in acreage accordingly. Grower entry Tier I and II producers shall be exempt from the field isolation requirements.
 - 2. Each lot of seed potatoes in storage must be physically separated from other potatoes to prevent mixture or contamination. Mixing of lots from different farming operations within a storage unit will not be allowed unless previously approved by PCS and appropriate separation is maintained.
 - 3. Each lot of certified seed potatoes must be kept in a storage building that contains only potatoes approved by PCS. Potatoes from seed lots rejected for certification due to bacterial ring rot will not be allowed under any circumstances. For qualified seed potatoes please see storage isolation; page 13, letter G.
- L. *Other Disease Requirements*:
 - 1. The tolerance for late blight in Colorado certified seed for replant in the San Luis Valley (SLV) shall be zero as stated in the 'Requirements for Importing Seed Potatoes in the San Luis Valley of Colorado' (<http://potatoes.colostate.edu/wp->

<content/uploads/2014/02/Late-Blight-Quar-2014.pdf>) for certified seed potatoes which are imported into the SLV.

2. Bacterial ring rot and spindle tuber viroid – all generations have a zero tolerance.
3. The Colorado Seed Act requirements shall be followed which state that Colorado certified seed for replant in the state of Colorado shall have a zero tolerance in seed lots for potato mop top virus, tobacco rattle virus, and PHT result of less than 1% of PVY^N strains testing positive on ELISA N serotype antisera, all of which have been confirmed by an accepted laboratory test.

M. *Special Requirements for Non-Generation Seed Potatoes:* Seed identified as Non-Generation Certified is intended to provide limited opportunity for a grower to produce certified stocks of cultivars for which tissue culture derived, laboratory-tested seed sources are temporarily not available. Growers who intend to produce Non-Generation Certified seed must verify to PCS prior to April 1st of any given growing season that the cultivar in question is not available from a Limited Generation seed program and each request must be reviewed and approved by PCS. The PCS manager may request that the PCS Advisory Council review the situation and provide feedback before a final decision is made. However, any prospective seed lots must have been post-harvest tested and meet qualifications for re-certification. Non-Generation Certified seed lots will be inspected and classified according to the disease tolerances and all the applicable Rules and regulations established for Generation 6. These stocks will be identified in the Seed Directory and when sold will be inspected for grade and properly identified with tags or bulk certificates. The symbols “NGC” shall be printed in the Seed Directory and on the tags and bulk certificates to denote their status.

N. *Colorado Certifying Authority:* All seed potatoes certified in the state of Colorado shall be certified by the Colorado Potato Certification Service (Colorado State University). Any grower that certifies their potatoes through another state or state agency, without written permission from the Colorado Potato Certification Service, shall be in violation of the Certification Rules and Regulations and will be guilty of Grower Misconduct (see item H, under General Requirements for Producing Seed Potatoes for the definition of Grower Misconduct).

Limited Generation Seed Potato Requirements (Nuclear – Generation 6):

A. *Limited Generation System for Colorado Certified Seed Potatoes:* The major goal of all seed potato improvement is to maximize the productivity of marketable potatoes through: a) elimination of disease organisms and pests, and b) selection of superior clones within any cultivar. The Nuclear phase of seed improvement will be the focal point of insuring that the best seed stocks are introduced into the Colorado seed potato program. The methods of disease elimination and cultivar improvement may vary somewhat since new laboratory and greenhouse techniques to control diseases are constantly being developed. Colorado State University, the Potato Certification Service, and research personnel will cooperate with producers of Nuclear seed stocks to maintain the highest level of technology available.

Listed below are the various steps that any given seed stock will pass through in the Limited Generation System:

Nuclear	(Lab and/or greenhouse produced)
Generation 1	(1st year in field)
Generation 2	(2nd year in field)
Generation 3	(3rd year in field)
Generation 4	(4th year in field)
Generation 5	(5th year in field)
Generation 6	(6th year in field)

B. Seed Sources and Disease Standards:

1. Nuclear Production:
 - i. Seed source for nuclear production must be from the Colorado certification system from single hill field selections obtained from certified seed of Generation 5 or earlier generations or from a source with prior approval by PCS. Approved sources include other state or provincial labs, private labs, PVP owners, etc.
 - ii. Must be free of all visible disease symptoms. Testing for *Clavibacter michiganensis* subsp. *sepedonicus* will be handled as outlined in the "Protocol for Indexing and Confirmation of Diagnosis of Bacterial Ring Rot of Potato" (accepted 12/01 by the NPC U.S. Seed Potato Certification Subcommittee).
 - iii. Mother plants: Those units (plantlets) initiated from field selected plants or tubers. All mother plants to be used for subsequent propagation must be tested and proven negative for the disease organisms. (See pg. 5 for testing requirements).
 - iv. All clone bank in-vitro stocks are to be disease tested annually. (See pg. 5 for testing requirements).
 - v. Nuclear stocks: Those stocks derived from mother plants. These include material used in maintaining a clone bank, plantlets increased for use in production of in-vitro microtubers, plantlets increased for use in field production of tubers, and minitubers produced in a greenhouse. (See pg. 5 for testing requirements).
2. Plantlet/Greenhouse Production: representative samples of micro propagated materials for use in field or greenhouse plantings, of not less than 10 units and not to exceed 1.0% of the planting stock, must be tested for PVX, PVS, and PVY to verify that such material still tests negative for these pathogens. In the case of greenhouse production, the testing will take place between the time of first and second visual inspections. In the event that trace amounts of virus are detected, the grower will be informed of the results and have the seed lot in question classified accordingly upon completion of the Generation 1 field testing. Greenhouse stocks will have an additional test for the presence of *Pectobacterium* spp. and *Clavibacter*

michiganensis subsp. *sepedonicus* (Cms) completed at the same rate as above on the minitubers. A positive test for presence of *Pectobacterium* spp. will result in downgrading of the stocks to Generation 2 for sale outside the originating grower's program. However, the contaminated stocks may be replanted for certification and entered as Generation 1 on the original grower's farm. Under certain circumstances an additional test for *Phytophthora infestans* will be performed on the minitubers brought in for testing. A positive result for either *P. infestans* or Cms will result in rejection of the lot(s) brought in for testing. A positive result for either *P. infestans* or Cms will result in rejection of the lot(s) from certification.

C. *Field Production:*

1. Generation 1¹
 - i. Seed source must be Nuclear stocks approved by PCS. All Nuclear seed stocks must have a Certificate of Origin, North American Plant Health Certificate, tag, or similar document available for inspection by PCS prior to being accepted into the certification program.
 - ii. A representative sample of each lot will be lab tested for PVX and PVY and, at the grower's option, for potato leafroll virus and/or PVY. At least 1.0% of the plants must be sampled. If there are indications that viral infection has taken place, then, at the grower's option, at least one leaflet from each plant in the infected lot will be sampled to identify and aid in removal of the infected plants or blocks of samples will be tested to determine the extent of the infection. If the grower refuses additional testing or the level of virus found in the stocks is too high for removal of infected plants, the lot will be downgraded to the next appropriate generation level. Trace PVX or PVY infections, as determined by PCS, will not result in downgrading of the lot if replanted for certification on the original grower's farm the following year.
 - iii. Must meet G1 requirements or will be downgraded to next appropriate generation level.
2. Generation 2¹
 - i. Seed source must be Nuclear or Generation 1.
 - ii. Must meet G2 requirements or will be downgraded to G3.
3. Generation 3^{1,2,3}
 - i. Seed source must be Generation 2 or earlier generations.
4. Generation 4^{1, 2, 3}
 - i. Seed source must be Generation 3 or earlier generations.
5. Generation 5^{1, 2, 3}
 - i. Seed source must be Generation 4 or earlier generations.
6. Generation 6^{1, 2, 3}
 - i. Seed source must be Generation 5 or earlier generations.
 - ii. May be tagged and sold as Generation 6 but is not eligible for certification the following year.

¹See tables 1 and 1A on page 14 for disease tolerances.

²At the grower's option, Generations 2-6 seed lots may be tested for PVY, PVX and or PVS. PCS will be notified no later than July 15th. Options are for 20, 100, or 200 leaflets per acre at grower's discretion. Results will not be published in the Seed Directory, however, PVX content of the tested lots may be listed on the tag or bulk certificate at the grower's option. Tolerances do not apply.

³All G3-G6 lots exceeding the 2nd inspection mosaic tolerances and within the 1.51-2.0% range for mosaic will be provisionally certified and can be sold as certified seed if they pass the post-harvest test tagging tolerance of 8%. Seed from these lots cannot be recertified the following year.

Summer Field and Storage Inspections:

- A. *Field Inspection Requirements:* Each field entered for certification shall receive at least two inspections. A third inspection may be made if growing conditions permit. Three or more inspections may be made on any field at the discretion of the inspector. PCS shall be responsible for determining when the final field inspection shall be conducted based upon experience, cultivar characteristics, and annual disease plot information. Each inspection shall consist of a visual examination of the growing plants in each field. At least 100 plants per acre shall be counted on the first and second inspections to determine disease percentages. When individual seed lots consist of less than 10 acres, at least 1000 plants or 100% of the lot shall be counted. A third inspection shall consist of a visual survey of plants that normally does not include a plant count unless a disease condition or other problem is discovered that requires a numerical estimate of affected plants. All disease diagnoses or problem identifications shall consist of visual examination of the plants in question, which may include utilizing a serological test such as ELISA to supplement the visual inspection to determine disease levels.
- B. *Marking of Lots:* Seed fields must be marked so that the inspector can tell, at all times, where the different seed lots are located. For example, blank rows separating the lots or brightly colored stakes at least 4 feet tall spaced about 600 feet apart with three to four across the field.
- C. *Reasons for Denying Inspections:* All lots must have at least one field inspection to be eligible for certification. Field inspection may be refused and seed lots rejected for certification if the inspector believes the field cannot be properly inspected due to: 1) excess weeds, 2) hail or frost damage, 3) damage caused by insects or disease, 4) chemical injury, or 5) any other condition that prevents visual identification of diseases or other factors affecting seed quality and performance. However, after first inspection, any lot rejected due to hail, frost or excess weeds may be certified provided the post-harvest test requirements are met and 400 tubers are tested for bacterial ring rot, at the grower's expense. Tubers must be selected in a manner similar to the post-harvest sampling and found to be negative for ring rot. Lots rejected due to other circumstances which prevent foliar inspections are not eligible for sale as certified seed but may be retained by the original grower for re-certification on his farm the following year provided post-harvest test requirements are met

and 400 tubers are tested for bacterial ring rot, at the grower's expense. Tubers must be selected in a manner similar to post-harvest sampling and found to be negative for ring rot.

- D. *Appeals:* Any grower of Certified Seed may appeal the decision of an inspector by making such appeal in writing to the Potato Certification Service, San Luis Valley Research Center, 0249 East Rd. 9 North, Center, CO 81125. Such appeal must be received within one week following the inspection and must clearly state the reason for the appeal and show cause why a re-inspection should be given. Roguing or sorting will not be permitted between the time of inspection and examination following appeal.
- E. *Bacterial Ring Rot:*
1. In the case of bacterial ring rot caused by *Clavibacter michiganensis* subsp. *Sepedonicus* (Cms), the visual diagnosis shall be supplemented with the gram stain procedure as described by Glick, Ark, and Racicot in the American Potato Journal, Vol 21:311-14, 1944 and an appropriate laboratory serological test as outlined in the "Protocol for Indexing and Confirmation of Diagnosis of Bacterial Ring Rot of Potato" (accepted 12/01 by the NPC U.S. Seed Potato Certification Subcommittee) or a PCR test outlined in Gudmestad et.al. (A real-time PCR assay for the detection of *Clavibacter michiganensis* subsp. *sepedonicus* based on the cellulase A gene sequence (Plant Dis. 2009; 93:649–659). Field inspectors shall observe at least 4600 plants or 100% of the lot during the time that bacterial ring rot symptoms, if expressed, should be visible. Seed lots which are withdrawn or rejected during the season for reasons other than bacterial ring rot shall have a final field inspection. If the grower is requesting a final field inspection before bacterial ring rot expression typically occurs, with PCS approval, the grower will be required to submit a tuber sample at harvest to the PCS disease lab for bacterial ring rot testing using both PCR and ELISA as described above. The tuber sample size will be based on PHT sample sizes (pg.15, C., 1 and 2). If Cms is identified with a lab test, PCS staff will confirm the find by collecting additional samples from the seed lot in question and will also send an additional sample to a 3rd party lab to verify. In the case of an early vine kill, the final field inspection will occur 1 or 2 days prior to vine kill.
 2. Any lot of seed potatoes proven to be infected with bacterial ring rot will be rejected for certification regardless of the time or place of inspection. A farming operation which has grown any lot of potatoes rejected because of bacterial ring rot will have an * printed in front of the seed lot number(s) which were approved for certification and grown on that farming operation in the annual Seed Directory; also, on certified tags and bulk certificates. Any seed lot with an * in its designation cannot be sold for re-certification. However, any seed lot identified by an * may be replanted for certification the following year by the grower of the seed or on the farming operation where bacterial ring rot was found.
 3. In the event a farming operation has more than one field planted from the same seed lot source and bacterial ring rot is discovered in at least one of the fields, the

remaining fields (planted with the same seed source) will be automatically rejected unless the pattern of infected plants observed by the inspector provides clear evidence that the cause of contamination was equipment used exclusively in connection with seed cutting, handling and/or planting the seed lot in question.

- F. *Storage Inspections:* Each storage building shall be inspected following completion of harvest and prior to removal of the certified seed potatoes to determine the suitability of the structure and bins to provide reasonable security against contamination and/or cultivar mixing. The grower shall be responsible for proper disinfection of the storage building, bins and equipment utilized. Also, the grower shall identify the location of each seed lot by means of a label attached to the storage bin. The label information shall include the grower's name, seed lot number, cultivar, and number of hundredweight stored. In the event two or more seed lots are combined, the status of the entire bin shall be downgraded to the oldest generation and highest disease readings concerned, and if a varietal mix has occurred, all seed lots which have been mixed shall be denied certification unless the varieties are capable of being visually separated and sorted, and such separation and sorting has in fact taken place to the satisfaction of PCS officials.
- G. *Isolation for Limited Generation Seed:*
1. Storage Isolation - Full certification or grower entry to obtain full certification.
 - i. Generation 1 potatoes must be isolated from all other certified potatoes in the same storage. Emphasis should be directed toward intensive sanitation and physical separation by solid wall partitions.
 - ii. All certified seed lots must be kept in a storage building which contains only seed entered for certification. Non-certified stocks and potatoes rejected due to blackleg or zero tolerance diseases such as bacterial ring rot will not be allowed in the storage building; the presence of such potatoes will result in rejection of the certified seed lots present.
 - iii. Grower Entry or Qualified seed lots should be isolated and if possible stored separately from non-certified stocks for official control status.
- H. *Blackleg Downgrades:* Generation 1 and 2 seed lots exceeding specified blackleg tolerances will be downgraded to the next appropriate generation level. Roguing of these lots to restore them to blackleg tolerance will not be allowed.
- I. *Summer Reinspection Policy:* Growers of Generations 1 through 4 seed lots may be given one additional opportunity to restore the seed lot to tolerance following the first and second scheduled inspections providing the following conditions are met: 1) The grower agrees to complete roguing of the field as soon as possible and 2) Field conditions, plant development and other factors such as presence of insect vectors would not, in the judgment of the inspector, limit the accuracy and effectiveness of the roguing effort.

J. *Summer Field Inspection Tolerances:*

Field Inspection Tolerances for Limited Generation Seed¹

Table 1. Percentages Allowed by Generation - First Inspection

Item	G1	G2	G3-G6
Potato Leafroll Virus	0	0.1	0.8
Mosaic Viruses	0	0.2	3.0
Other Virus	0	0.1	1.0
Total Virus Allowed			3.5
Haywire	0	0.5	1.0
Giant Hill	0	0.5	0.5
Variety Mix	0	0.1	0.5
Blackleg ¹	0	0.1	4.0

Bacterial ring rot and spindle tuber viroid - all generations have a zero tolerance

Table 1-A. Percentages Allowed by Generation - Second Inspection

Item	G1	G2	G3-G6
Potato Leafroll Virus	0	0.05	0.4
Mosaic Viruses ²	0	0.1	1.5
Other Virus	0	0.05	0.5
Total Virus Allowed			2.4
Haywire	0.1	0.5	1.0
Giant Hill	0	0.5	0.5
Variety Mix	0	0.07	0.25
Blackleg ¹	0	0.1	4.0

PVX & PVY (Lab Test): Will be performed on G1 seed lots with tolerances for G1=0. G1 lots exceeding the virus tolerances will be downgraded to the next appropriate generation level.

Post-Harvest Test Requirements:

All Colorado certified or qualified seed potatoes must be subjected to a post-harvest test and meet prescribed standards to be eligible for re-certification or sale.

- A. *Purpose:* Because of the inability to detect certain virus diseases at all times under Colorado field conditions, samples from seed lots eligible for re-certification and/or sale are planted where these diseases can be observed in the greenhouse or in the field in a region appropriate for potato growth during the winter.
- B. *Method:* Samples are to be selected so as to represent all field areas of any given seed lot. Tubers must be in the 2-3 ounces size range. Actual sub-samples should be derived from a sample representing the entire number of tubers required per lot (i.e., 800 tubers sampled from lot; sample mixed thoroughly; two sub-samples of 400 tubers each taken).
- C. *Post-Harvest Test Sample Requirements:*
1. Generation 1 - Not less than 25 tubers, not to exceed 200 tubers in a given seed lot, shall be sampled. Tubers shall be laboratory tested for potato leafroll virus and PVY and PVX or grown at the post-harvest test plots at the grower's request.
 2. For Generations 2-6, the number of tubers sampled for the postharvest test will follow these guidelines: Lot size of 0.1-0.2 acres = 100 tuber sample; >0.2-1.0 acres = 200 tuber sample; >1.0 – 1.5 acres = 300 tuber sample; >1.5 acres – 40.0 acres = 400 tuber sample; >40 acres – 80 acres = 800 tuber sample; >80 acres = 1,200 tuber sample.
 3. In the case of experimental line selections and extremely small lot size (less than 0.1 acres), where a very limited number of tubers is available, not less than 25 tubers will be selected. The actual number selected for the post-harvest test sample will be established by PCS personnel.
 4. Post-Harvest test samples of suitable size and which are representative of each given lot will be collected by the grower. Sample collection will be audited on a periodic basis by PCS. All samples must be delivered to a designated assembly point by the grower. The samples of seed tubers from all lots eligible for re-certification are grown in a post-harvest test either in the greenhouse or in field test plots during the winter months to observe the plants for evidence of disease spread or chemical damage that may have occurred the previous growing season. Each plant in each seed lot sample is visually observed for disease symptoms. The stand count in each lot is recorded and disease content is calculated by dividing the number of diseased plants observed by the stand count. Seed lots found to contain tuber-borne diseases in excess of prescribed tolerances will be ineligible for certification the following season.
- D. *Post- Harvest Test Backup (B) Sample Testing:*
1. An additional sub-sample of up to 400 tubers from all lots to be sold as certified seed will be gathered during the post-harvest test sample collection. These additional samples may be tested and/or examined as appropriate for various

diseases and pests including, but not limited to, bacterial ring rot and root knot nematode.

2. Seed lots will be evaluated by PCS personnel for certification eligibility when the following conditions apply: 1) if tuber samples do not produce plants of adequate size due to dormancy problems or plants are destroyed due to weather, pests, or other unforeseen problems at the test site. This will be accomplished based on a laboratory test for potato leafroll and PVY on the additional tubers collected (B sample) or appropriate field inspection data. 2) if a lot is rejected for recertification because of excess mosaic and falls between 3-8%. In the case of a lot rejected for recertification at post-harvest test for mosaic, and at the grower's request and expense, the PCS laboratory will test the tubers for PVY and PVX if necessary. If the mosaic level is >8%, a lab test may be conducted at the grower's request and expense, only if the B sample was submitted to PCS prior to the reading of the PHT plots. If virus content is lower, the field reading will be replaced by the lab results.

E. *Special Requirements for Post-Harvest Test (Disease Tolerances):* Special requirements for PHT must be met for the following: generations 1-5, seed to be re-certified or sold, G6 seed for sale, and qualified seed.

1. Special Requirements:
 - i. Certified and Qualified seed exceeding the 5% total virus level will be ineligible for replant to meet official disease control standards in Colorado.
 - ii. Seed lots of generation 1 and 2, for re-certification on the grower's own farm only, will be handled in the following manner. There will be no PHT tolerances enforced, except for a 5% tolerance for mosaic and a 1% tolerance for PVY(N/NTN).
 - iii. Re-certification Tolerances

Re-certification Tolerances
All Generations

<u>Disease</u>	<u>%</u>
Leafroll	1.5
Total Mosaic Allowed	3.0
PVY(N/NTN)	1.0
Other Virus	0.5
Haywire	2.0
Spindle Tuber	0.0
Bacterial Ring Rot	0.0

Requirements to Sell Certified Seed:

A. Sale of Nuclear Material from Private or Grower Operated Laboratories:

1. Rules governing the seed sources and disease tolerance standards (as outlined on pages 9-10) for Nuclear stocks must be followed. All stocks must have an annual testing for the presence of disease organisms and a grow-out or other test approved by PCS to verify trueness to type and varietal identification.
2. Accurate and complete accession records must be kept on all nuclear stocks and be available for review if requested by PCS. Information should include year received as tissue culture material, source of the line, and disease testing history. A form for this information will be provided by PCS.
3. All greenhouse produced stocks (minitubers) shall have at least two inspections during their growth. At the time of the second inspection, prior to vine death, plants will be examined to verify trueness to type and varietal identification. Minitubers may be examined in storage for any apparent problems prior to shipment or subsequent field growth.
4. All nuclear stocks must be kept in a clone bank with accurate identification, specifically the variety name and date received, on each tube or vessel.
5. At the time an increase is started for a greenhouse crop, the nuclear material must have had an annual disease test. The greenhouse crop should be labeled with the date the nuclear material was received.
6. Nuclear stock production in Colorado can be contracted for out-of-state growers providing that the arrangements made fall within the capacity of PCS to carry out. If requested, a copy of the contract shall be made available to PCS prior to actual tissue culture increase and sale. Nuclear stocks under contract must meet minimum Colorado standards as described within this document.
7. Nuclear stocks sold will not be tagged with an official tag or bulk certificate used on other certified seed stocks. Instead, there will be an affidavit included with the nuclear material which carries information relating to its accession, disease testing records, varietal identification, numbers sold, and product identity (i.e., minitubers, tissue culture plantlets, microtubers, etc.). The stocks will be recorded as eligible for certification as Generation 1 under the Colorado Rules and Regulations.

B. Use of Sacks to Sell Certified Seed:

1. New sacks must be used if seed potatoes are harvested and/or stored in sacks.
2. New sacks must be used for the marketing of seed potatoes unless they are shipped in bulk.
3. Mini-bulk bags (20-25 cwt/bag) are considered a bulk conveyance.

C. *Tags, Bulk Certificates, Seals:*

1. No potatoes are recognized as officially certified unless properly tagged or identified with a bulk certificate. Illegal use of tags or bulk certificates will be prosecuted.
2. Bags or bulk certificates will be issued only to the applicant or his agent. NO MUTILATION OF TAGS OR BULK CERTIFICATES, BY WRITING OR MARKING OVER, OR OTHERWISE ALTERING ORIGINAL INFORMATION PRINTED THEREON, WILL BE PERMITTED. The responsibility of proper use of tags and bulk certificates is placed on the person to whom such articles have been issued.
3. A metal seal shall be placed on the conveyance doors of bulk shipment containers identified by a bulk certificate.
4. Special permission may be granted by PCS to imprint a duplicate image of an official Colorado Certified Tag on a small plastic bag (3 lbs. to 10 lbs.) to be used for marketing small quantities of certified seed potatoes.
5. The artwork layout must be approved by PCS prior to printing. Information normally printed on the Colorado seed tag (i.e., seed grower's name, cultivar, crop year, field generation, lot number, and maximum tuber size) will be printed on the bag in order that the reader can readily identify the seed source. One completed copy of a bag bearing all of the above-mentioned information related to a given shipment must be filed with PCS. All such shipments must comply with designated grade inspection requirements. A bulk certificate will accompany each load.

D. *Grades and Grade Inspection:*

1. All Certified Seed Potatoes must be graded to conform with the Colorado standard grades and sizes for seed potatoes unless a signed waiver of grade inspection has been obtained from the purchaser as outlined in Section 14-d or an inspection exemption has been obtained from the CO PCS as outlined in Section 14h.
2. All seed potatoes must be shipped under tags or bulk certificates that represent the grade to which they have been sorted. Potatoes failing to meet the grade specified on the tag or bulk certificate will be (1) resorted to meet the grade requirements, (2) re-tagged with new tags or re-issued a new bulk certificate representative of the grade of the potatoes, or (3) the tags must be removed.
3. All shipments must be inspected by a Federal/State Inspector at the time of shipment. The Federal/State Inspection Service is responsible for inspecting seed shipments to verify that proper grade standards have been met. If a "zero tolerance" disease such as bacterial ring rot or root knot nematode is suspected or any other condition which may disqualify a seed lot from certification is discovered during the inspection, PCS will be notified by the seed grower and suspect tubers submitted to PCS so additional procedures can be implemented to identify and confirm the true nature of the problem. Upon confirmation of a "zero tolerance" disease or pest, the remaining portion of the affected lot will be rejected from certification, and it will be the responsibility of the seed grower to notify all recipients of the previous shipments of the lot of the finding of a "zero tolerance" disease or pest.

4. Seed cut prior to shipment must be accompanied by a signed cut seed disclaimer and waiver, and an official tag or bulk certificate indicating that the seed potatoes are "CUT SEED".
5. Each lot sold within the Marketing Order Area shall be inspected by a Federal/State inspector.
6. All Certified Seed Potatoes marketed in bags and carrying a tag must meet the highest-grade requirements indicated by either the bag or the colored tag. U.S. No. 1 Seed Grade is not strictly a U.S. No. 1 grade and may not be marketed in bags branded as U.S. No. 1.
7. All Certified Seed Potatoes exported outside of the U.S. shall meet the U.S. EXPORT "SEED POTATOES" standards for the given generation being shipped.
8. Certified Seed Potatoes marketed and shipped in quantities less than 24 cwt per cultivar or clone within the same load shall be exempt from Federal/State grade inspection. However, an 'inspection exemption for certified seed potatoes' shall be obtained from the CO PCS verifying the load as containing less than 24 cwt per cultivar, and a waiver of grade inspection must be secured from the purchaser at the time of delivery or acceptance.

E. *Colorado Grade Standards for Certified Seed Potatoes:*

1. The following grade standards apply to all certified seed potatoes.

<u>Grade Defect for Tubers</u>	<u>All Certified Seed %</u>
Stem end discoloration	5.0
Net Necrosis (Leafroll, after laboratory identification)	0.5
Net Necrosis (aster yellows)	2.0
Bacterial Ring Rot	0
Root Knot Nematode (visible tuber symptoms) Corky Ring Spot (visible tuber symptoms coupled with confirmation of Tobacco Rattle Virus presence by accepted laboratory test)	0

2. Disease caused by Phytoplasma (i.e., Purple Top, Aster Yellow, etc.) or *Candidatus liberibacter* (Zebra Chip) are reported but are not counted against certification eligibility unless severe enough to mask scoring of other diseases.
3. Exotic Diseases: Lots showing a disease new or uncommon to Colorado may have certification withheld pending further investigation (i.e., Corky Ringspot, Zebra Chip, Potato Yellow Vein Virus, etc.).
4. Colorado Blue Tag Grade shall consist of potatoes which meet the requirements of the disease tolerances and grade standards previously listed for CERTIFIED SEED POTATOES. In addition, they shall be graded to conform with the U.S. No. 1 Seed Potatoes Grade as defined under U.S. Standards for Grades of Seed Potatoes (see Appendix I) with the following exceptions:
 - i. Not more than 1% of the potatoes shall be damaged by dry rot.

- ii. Size shall be 1-1/2" to 12 oz., size is not required on the tag, a smaller maximum however, will be specified on the tag or bulk certificate.
 - iii. Not more than 3% of the potatoes in any lot may be below the specified size and, in addition, not more than 8% may be above the specified size.
 - iv. Physiological internal pigmentation shall not be considered a grade factor.
- 5. Colorado Yellow Tag Grade shall consist of potatoes which meet the requirements of the disease tolerances and grade standards previously listed for CERTIFIED SEED POTATOES. This grade is intended to provide the buyer and seller an opportunity to establish certain mutually agreed upon specifications not allowed in the Colorado Blue Tag Grade. The potatoes must be graded to conform with the U.S. No. 1 Seed Potatoes Grade as defined under U.S. Standards for Grades of Seed Potatoes (see pages 19-20) with the following exceptions:
 - i. Soft rot shall not exceed 1%.
 - ii. Tuber size shall be specified on the tag or bulk certificate. Tolerances for specified size limits: Not more than 3% of the potatoes in any lot may be below the stated minimum and, in addition, not more than 10% may be above the stated maximum.
 - iii. Tubers shall not be seriously damaged by external defects, or seriously misshapen unless otherwise specified, and shall not be more restrictive than the U.S. No 1 Seed Potato Grade.
 - iv. Physiological internal pigmentation shall not be considered a grade factor.
- 6. *Applications of Tolerances:* The application of grade and size tolerances shall be as outlined in the United States Standards for Potatoes, Section 51.3003 (Appendix I).
- 7. *U.S. Export:* "Seed Potatoes" shall consist of potatoes which meet the requirements, disease tolerances, and grade standards for international export as listed under the USDA Export Program Manual U.S. EXPORT STANDARDS FOR SEED POTATOES (4-5-7)
https://www.aphis.usda.gov/import_export/plants/manuals/domestic/downloads/xpm.pdf

Requirements for Grower Entry Program

- A. *Grower Entry program:* The grower entry program is designed for growers who wish to enter the certification program but are unable to fulfill all the requirements during the first year of production, or for growers who wish to meet official disease control standards within their farming operation. To be certified or qualified, seed in this program must meet the disease tolerances and all pertinent rules and regulations for the generation grown. There are two tiers to this program.

- B. *Grower Entry Tier I:* This tier is for grower's intent on becoming full certified seed growers. It should be valuable for an inexperienced seed grower who would get the benefit of PCS inspections and training before assuming full responsibility for selling certified seed. A prospective grower must contact the PCS office prior to May 1st and outline how he expects to eventually meet all requirements for certification. A review of progress will be made at the end of each growing season to determine the feasibility of continuing in the grower entry program or proceeding to full participation as a certified producer the next season. Normal fees will be assessed for certified acreage entered into the grower entry program. In addition, a \$6.00/acre fee will be assessed on all acreage within the farming operation not entered as certified in the grower entry program for a one-time bacterial ring rot inspection. Seed produced under this tier is not eligible for sale as seed, either certified or common, no tags or bulk certificates will be issued, nor will seed lots be included in the Seed Directory until the grower has qualified for full certification as per the rules and regulations.
- C. *Grower Entry Tier II: "Qualified Seed Potatoes"* - This tier is for grower's intent on meeting official disease control standards within their operation. A prospective grower must contact the PCS office prior to May 1st and outline how he plans to use the seed inspected to meet disease control standards within his operation. A review of progress will be made at the end of each growing season to determine the feasibility of continuing in the grower entry program. Normal fees will be assessed for acreage entered into the grower entry program. Seed produced under this tier is not "certified seed" and may not be sold to any other grower. It may be used only within the growers' operation and is intended only to meet disease control standards within that operation. The Colorado Seed Act allows planting of 'year-out from certified sources' seed in any Colorado farming operation. Nothing in the Grower Entry program precludes this possibility but, if a lot is rejected for certification, certification officials will discuss with the grower any disease issues found in the seed and the ramifications for the following year's crop.

Requirements for Experimental and New Cultivars

- A. *Description:* The Memorandum of Understanding between the Colorado Certified Potato Growers' Association and the Board of Governors of the CSU System authorizes the Potato Certification Service to "cooperate with the Experiment Station in increasing and releasing new varieties of potatoes developed by the Experiment Station," thus it becomes necessary to develop acceptable guidelines for conducting the testing and seed increase program. In this respect, it is important to acknowledge the unavoidable limitations to the visual inspection process encountered when the disease symptom expression of any potato clone is unknown at the time a seed grower would like to enter it for certification. Therefore, the Experimental Seed category was established to expedite and facilitate field testing of numbered potato clones being considered for naming and official release.
- B. *Two categories of Experimental Seed were established:*
1. Category 1 (labeled EXP1) will include only unnamed "Seedling" potato clones involved in the field testing phase of a potato cultivar development program on

which bacterial ring rot symptom expression is unknown. Seed stocks of such clones will not be eligible for certified tags or bulk certificates, nor will they be listed in the Seed Directory. Field plantings of such clones will be inspected, and a written report submitted to the Leader of the Cultivar Development Program. When adequate field test data on disease expression and other performance characteristics has been collected to justify further evaluation on seed growers' farms, any given clone may be transferred to Category 2 of the Experimental Seed category. This decision will be made jointly by the Leader of the Cultivar Development Program, the Potato Certification Service, and the Seed Improvement Committee of the Colorado Certified Potato Growers' Association.

2. Category 2 (labeled EXP2) seed lots will include only unnamed "Seedling" clones whose symptom expression of bacterial ring rot is known to be adequate under Colorado field conditions. In the case where bacterial ring rot expression is unknown, a tuber sample is required to be tested for bacterial ring rot using both ELISA and PCR (testing protocol described on pg. 8, 15.a.) and is to be submitted to the PCS Disease Testing Lab. Sample size will be based on PHT sample size (pg 9, 16.c.). Such seed lots will be eligible for entry into the certification program on the following basis: There will be three years production allowed for Experimental Seed - Non-Generation Category 2 stocks. At the end of three years, the status of these stocks will be reviewed and, where possible, these stocks will be phased out and replaced with Limited Generation seed sources. If this is not possible, an annual review will be conducted to verify the status of the stocks. This decision will be made jointly by the Leader of the Cultivar Development Program, the Potato Certification Service, and the Potato Cultivar Management Committee (as outlined in the "Potato Cultivar Research and Improvement Agreement" between CSU, CCPGA, & CSURF). Non-Generation Category 2 seed lots will be inspected and classified according to the disease tolerances and all of the applicable Rules and Regulations established for Generation 6. All stocks which meet the criteria for certification will be listed in the Seed Directory. The symbols "Exp 2-" followed by a number designating the years in the field after initial release (i.e., Exp 2-1, Exp 2-2, etc.) will be printed both in the Seed Directory and on tags and bulk certificates.
3. Limited Generation sources of these stocks will carry the same designations with the exception that the symbols after "Exp 2-" will reflect their status from the Limited Generation program, (i.e., Exp 2-G1, Exp 2-G2, etc.). Limited Generation stocks will be inspected and classified according to the disease tolerances and all of the applicable Rules and Regulations established for Limited Generation Seed. Because of the limited knowledge concerning potential disease reactions, and/or other problems in these seed stocks, the seed seller must obtain and submit to the Potato Certification Service an affidavit signed by the seed buyer prior to seed shipment which states that the buyer is willing to accept the risks involved with purchasing experimental seed. This affidavit or its equivalent will be kept with the tag or bulk certificate order in the grower's Potato Certification Service file. Also, it is understood that experimental seed stocks may be rejected at any time due to uncommon disease reactions.

- C. Any seed grower/organization entering numbered potato selections for seed increase and evaluation in the potato certification program also agrees to abide by an agreement with the Colorado State University Agricultural Experiment Station, or to obtain written authorization from the potato breeding program from which the numbered potato selections originate. The CSU agreement “Notice to Receivers of Experimental Potato Selections” consists in part of the following:
1. *Colorado State University Agrees to:*
 - i. Supply seed stocks or grant permission to utilize these stocks for further propagation and evaluation to the grower applicant.
 - ii. The term of this agreement will be for a one-year period beginning upon seed grower/organization receipt of the numbered stocks.

 2. *By Acceptance of Such Potatoes, The Seed Grower/Organization Agrees to:*
 - i. Enter crop for certification. These stocks will be grown in accordance with the Rules and Regulations of the seed potato certification program for the appropriate seed level using generally accepted cultural practices.
 - ii. Furnish land and labor, and meet all expenses involved in production and certification of the crop.
 - iii. Permit representatives of the University to make observations and to obtain samples if desired.
 - iv. Not to further propagate or distribute seed stocks of this (these) selections for propagation beyond the terms of this agreement unless authorized by the University.
 - v. Dispose of any numbered selection discarded from the Potato Cultivar Development Program. These stocks will not be eligible for entrance in any seed potato certification program unless authorized by the University.
 - vi. Special disposition instructions: As directed by Cultivar Development Program Leader.
 - vii. A meeting between the Seed Grower(s)/Organization Representative(s), the Potato Cultivar Management Committee, the Potato Certification Service, and the Project Leader of the Potato Cultivar Development Program prior to January 1st to establish guidelines on price and method of distribution of seed.
 - viii. Not hold the University or its representatives financially liable for losses incurred as a result of production and/or disposition of this seed.

 3. *It is Mutually Agreed:*

- i. The proceeds from the crop produced under this agreement shall be the property of the Seed Grower/Organization that submitted the stocks for certification.
 - ii. That information derived from these evaluations shall be jointly shared by the parties to this agreement.
 - iii. That the selections may be legally protected under the federal Plant Variety Protection Act or other mechanisms that may require royalty payments before being grown commercially.
4. Any potato cultivar or numbered clone introduced from another breeding program or a non-Colorado certified seed potato program whose disease symptom expression resulting from infection with the ring rot bacterium (*Clavibacter michiganensis* subsp. *sepedonicus*) is unknown under Colorado growing conditions shall be eligible for certification under the following conditions: a) If test results demonstrate adequate symptom intensity, that will normally permit inspectors to visually detect the presence of these diseases under field conditions, the seed lot will be allowed to proceed through the certification process and be approved provided other requirements are met. Testing to determine disease reaction will be concurrent with field production of the cultivars or numbered clones in question. Growers who intend to enter such stocks in the current year's certification program must provide a minimum of 75 tubers of each cultivar or numbered clone to PCS by May 1st of any given growing season. b) In the event disease expression is totally latent or mild to the degree which prevents detection during field inspection an affidavit must be signed by the buyer which acknowledges the limitations to disease detection or, if unable to meet a) then; c) A 400 tuber sample selected in a manner similar to post harvest sampling, will be tested for bacterial ring rot, at the grower's expense, and found to be negative for ring rot.

United States Standards for Grades of Seed Potatoes

51.3000 General.

51.3001 Grade.

51.3002 Tolerances.

51.3003 Application of tolerances.

51.3004 Samples for grade and size determination.

51.3005 Definitions.

51.3006 Classification of defects.

§51.3000 General.

Compliance with the provisions of these standards shall not excuse failure to comply with provisions of applicable Federal or State Laws.

§51.3001 Grade.

"U.S. No. 1 Seed Potatoes" consist of unwashed potatoes identified as certified seed by the state of origin by blue tags fixed to the containers or official State or Federal State certificates accompanying bulk loads, which identify the variety, size, class, crop year, and grower or shipper of the potatoes, and the State certification agency. These potatoes must meet the following requirements:

(a) Fairly well shaped.

(b) Free from:

(1) Freezing injury;

(2) Blackheart;

(3) Late Blight Tuber Rot;

(4) Nematode or Tuber Moth injury;

(5) Bacterial Ring Rot;

(6) Soft rot or wet breakdown; and,

(7) Fresh cuts or fresh broken-off second growth.

(c) Free from serious damage caused by:

(1) Hollow Heart; and,

(2) Vascular ring discoloration.

(d) Free from damage by soil and any other cause. (See §51.3005 - 06).

(e) Size:

(1) Minimum diameter, unless otherwise specified, shall not be less than 1-1/2 inches (38.1 mm) in diameter;

(2) Maximum size, unless otherwise specified, shall not exceed 3-1/4 inches (82.6 mm) in diameter or 12 ounces (340.20 g) in weight.

(f) Tolerances. (See §51.3002).

§51.3002 Tolerances.

In order to allow for variations incident to proper grading and handling in the foregoing grade, the following tolerances, by weight, are provided as specified.

(a) For defects:

2

- (1) 10 percent for potatoes in any lot which are seriously damaged by hollow heart;
- (2) 10 percent for potatoes in any lot which are damaged by soil;
- (3) 5 percent for potatoes in any lot which are seriously damaged by vascular ring discoloration;
- (4) 11 percent for potatoes which fail to meet the remaining requirements of the grade including therein not more than 6 percent for external defects and not more than 5 percent for internal defects: Provided, that included in these tolerances not more than the following percentages shall be allowed for the defects listed:

Percent

Bacterial Ring Rot	0.00
Serious damage by dry or moist type Fusarium Tuber Rot	2.00
Late Blight Tuber Rot	1.00
Nematode or Tuber Moth injury	0.00
Varietal mixture	0.25
Frozen, soft rot or wet breakdown	0.50

Provided, that en route or at destination, an additional 0.50 percent, or a total of 1 percent, shall be allowed for potatoes which are frozen or affected by soft rot or wet breakdown.

(b) For off-size:

- (1) For undersize: 5 percent for potatoes in any lot which fail to meet the required or specified minimum size.
- (2) For oversize: 10 percent for potatoes in any lot which fail to meet the required or specified maximum size.

§51.3003 Application of tolerances.

Individual samples (See §51.3004) shall not have more than double the tolerances specified, except that at least one defective and one off-size potato may be permitted in any sample; Provided, that en route or at destination, one-tenth of the samples may contain three times the tolerance permitted for potatoes which are frozen or affected by soft rot or wet breakdown; and provided further, that the averages for the entire lot are within the tolerances specified for the grade.

§51.3004 Samples for grade and size determination.

Individual samples shall consist of at least 20 pounds (9.06 kg). The number of such individual samples drawn for grade and size determination will vary with the size of the lot.

§51.3005 Definitions.

- (a) "Fairly well shaped" means that the potato is not materially pointed, dumbbell-shaped or otherwise materially deformed.
- (b) "Nematode or Tuber Moth injury" means the presence of, or any evidence of, Nematode or Tuber Moth.
- (c) Soil:
 - (1) "Fairly clean" means that at least 90 percent of the potatoes in the lot have no more than 10 percent of the surface covered with caked soil.
 - (2) "Damage by soil" means that caked soil covers more than 25 percent of a potato's surface.
 - (3) "Loose soil" -- A lot of seed potatoes is not considered damaged by the presence of loose soil, clods, rocks, vines, and foreign material, but such will be considered a tare factor if the following allowances are exceeded:
 - 8 ounces (226.80 g) in a 100 pound (45.3 kg) container.
 - 4 ounces (113.40 g) in a 50 pound (22.65 kg) container.

2 ounces (56.70 g) in a 25 pound (11.33 kg) container or less.

1 percent in a bulk load.

(d) "Shriveling" -- Damage by shriveling means that the individual potato is more than moderately shriveled, spongy or flabby.

(e) "Freezing injury" means that the potato is frozen or shows evidence of having been frozen.

(f) "Soft rot or wet breakdown" means any soft, mushy or leaky condition of the tissue.

(g) "Zero Tolerance" (0.00) means none found during the normal inspecting procedures.

Certification of a lot is not a guarantee that the lot inspected is free of a zero tolerance disease or injury.

(h) "Damage" means any defect or any combination of defects which materially detracts from the internal or external appearance of the potato, or any external or internal defect which cannot be removed without a loss of more than 5 percent of the total weight of the potato (See §51.3006).

(i) "Serious damage" means any defect or any combination of defects which seriously detracts from the internal or external appearance of the potato, or any internal or external defect which cannot be removed without a loss of more than 10 percent of the total weight of the potato (See §51.3006).

(j) "External defects" are defects which can be detected by examining the surface of the potato. Cutting may be required to determine the extent of the injury (See §51.3006, Table I).

(k) "Internal defects" are defects which cannot be detected without cutting the potato (See §51.3006, Table II).

(l) "Permanent defects" are defects which are not subject to change during storage or shipment.

(m) "Condition defects" are defects which may develop or change during storage or shipment.

§51.3006 Classification of defects.

(a) Brown discoloration following skinning, dried stems, flattened depressed areas (showing no underlying flesh discoloration), greening, skin checks and sunburn do not affect seed quality and shall not be scored against the grade.

(b) Table I -- External Defects.

x-indicates method of scoring unless otherwise noted.

Defect	Damage	
	When materially detracting from the appearance of the potato	or When removal causes a loss of more than 5 percent of the total weight of the potato.
Air cracks.....	.....	X
Bruises.....	.....	X
Cuts and broken-off second growth (healed).....	X.....	X
Elephant hide (scaling)	X.....	
Enlarged, discolored or sunken lenticels.....	X.....	
Folded ends.....	X.....	
Second growth.....	X.....	
Shriveling.....	When more than moderately shriveled, spongy, or flabby.	
Sprouts.....	When more than 20 percent of the potatoes in any lot have any sprout more than 1 inch (25.4 mm) in length.	
Surface cracking.....	X.....	X
Flea Beetle injury.....	X.....	X
Grub damage.....	X.....	X
Rodent and/or bird damage.....	X.....	X
Wireworm or grass damage.....	Any hole more than 3/4 inch (19.1 mm) long or when the aggregate length of all holes is more than 1-1/4 inches (31.mm) ¹ .	
Dry rots.....	.....	X
Rhizoctonia.....	X.....	
Scab, pitted.....	X.....	X
Scab, russet.....	When affecting more than 1/3 of the surface.....	

Scab, surface.....	When affecting more than 5 percent of the surface	
Silver Scurf.....	When affecting more than 25 percent of the surface.....	
Growth cracks.....	When seriously detracting from the appearance.....	
Pressure bruises and sunken areas with underlying flesh discolored.	.....	When removal causes a loss of more than 10 percent of the total weight.

¹Definitions of damage and serious damage are based on potatoes that are 2-1/2 inches (63.5 mm) in diameter or 6 ounces (170.10 g) in weight. Correspondingly lesser or greater areas are permitted on smaller or larger potatoes.

(c) **Table II- Internal Defects.**

Defect	Damage	
	When materially detracting from the appearance of the potato	or When removal causes a loss of more than 5 percent of the total weight of the potato
Ingrown sprouts.....	.....	X
Internal discoloration occurring interior to the vascular ring (such as, Internal Brown Spot, Mahogany Browning and Heat Necrosis.).	When more than the equivalent of three scattered light brown spots 1/8 inch (3.2 mm) in diameter ¹	
All other internal discoloration excluding discoloration confined to the vascular ring.	.....	X

¹Definitions of damage and serious damage are based on potatoes that are 2-1/2 inches (63.5 mm) in diameter or 6 ounces (170.10 g) in weight. Correspondingly lesser or greater areas are permitted on smaller or larger potatoes.

Defect	Serious damage	
	When seriously detracting from the appearance of the potato.	or When removal causes a loss of more than 10 percent of the total weight of the potato.
Internal Discoloration confined to the vascular ring.	.....	X
Hollow Heart or Hollow Heart with discoloration.	When affected area exceeds that of a circle 3/4 inch (19.1 mm) in diameter. ¹	

¹Definitions of damage and serious damage are based on potatoes that are 2-1/2 inches (63.5 mm) in diameter or 6 ounces (170.10 g) in weight. Correspondingly lesser or greater areas are permitted on smaller or larger potatoes.

APPENDIX II

GUIDELINES FOR THE PRODUCTION AND STORAGE OF LIMITED GENERATION SEED STOCKS

Field operations

1. If possible, use separate equipment for Generations 1-3 seed lots. Otherwise, be sure to follow a program of thorough cleaning and sanitation.
2. Maintain strict control over labor personnel and insist on use of clean outer garments and shoes when involved with handling plants or tubers.
3. Fields must be rogued early, starting when plants are 6-8 inches high. Rogue continuously until harvest. Remove all rogued plants from the field or bury same in adjacent rows. Recommendations concerning roguing will be made following field inspection.
4. Plant blank rows with a green non-potato crop to reduce potential increased aphid landing rates due to the edge effect.
5. Irrigate with well water instead of surface water whenever possible.

Storage operations

1. Have well water available at the storage cellar for use in sanitation procedures.
2. Make every attempt to minimize personnel and equipment contact between Generations 1-3 stocks and Generations 4-6 stocks in storage.
3. Maintain strict physical separation of Nuclear and Generation 1 stocks from all other seed lots.
4. Minimize handling and sorting of Nuclear and Generations 1-3 stocks to avoid bruising and potential disease spread.
5. Avoid using the same equipment in different storages. Also, thoroughly disinfect equipment between seed lots.
6. Sprouted seed potatoes pose a disease spread threat; therefore, manage storage conditions to minimize sprout growth prior to sorting. This does not include the use of sprout inhibitors.

General sanitation procedures

1. All storages used for storing seed potatoes must be cleaned and disinfected each year before storing.
2. Wash and steam clean equipment and storages prior to application of chemical disinfectants.

3. Select effective disinfectants; follow recommendations carefully and allow sufficient time for chemicals to kill disease organisms.
4. Pay special attention when attempting to clean and disinfect equipment such as seed cutters and planters.
5. Wash and thoroughly disinfect all conveyances used to handle or ship seed potatoes.

General protocols for collection of soil samples for nematode testing

1. Decide on best approach to mapping individual field and/or lot for sampling. Growers may elect to sample one section intensively (approximately 1/4 of the field - 100 cores/area sampled) in a grid pattern or sample the entire field in increments of 2-4 acres each (one core/increment), again in a grid pattern.
2. A general time frame for taking soil samples is between 2-3 weeks prior to vine kill until actual harvest (mid to late fall). Samples should be taken as deep as the plow layer (typically 12-16" deep), representative of the rhizosphere area of the root zone, and mixed prior to placing in a sample collection bag. Samples must be kept cool and moist, and sent immediately to the appropriate lab for analysis. Keep in mind that collection of soil samples to be used for phytosanitary purposes (shipments into nematode-free zones or restricted areas) must be supervised by an official state agent (i.e., PCS, Department of Ag, etc.) and sent to an official state or federal lab for analysis for the results to be valid.
3. Analysis should be conducted for the presence of injurious nematodes including *Meloidogyne* spp., *Trichodurus* spp., and others of importance to potato production.
4. Once a report is received, results should be communicated to PCS.

Some general procedures useful to reduce the spread of PVY and/or potato leafroll virus

1. Plant problematic cultivars as early as possible and kill the vines as early as possible after final field inspection has been completed. Use quick vine kill methods (i.e., sulfuric acid) where feasible and make sure the vines are completely dead within three to four days after initial application. Whenever possible, use isolated fields (1-2 miles from any commercial potatoes) to produce early generation material. Consider the use of row covers or stilet oils to reduce the potential for virus spread in the earliest generations of problematic cultivars.
2. Differentiate between replant seed stocks (stocks for your operation) and commercial, saleable seed. Isolate earliest generation or lowest disease level stocks within the interior of the field. Utilize information such as post-harvest test readings to avoid replanting the higher disease level stocks. Recognize that heavy disease loads are difficult to rogue and may be responsible for spread of virus to clean stocks nearby.

3. Rogue infected plants early in the season and rogue intensively until tubers start to bulk. Manage fertility to decrease the chance of early season masking of mosaic or leafroll symptoms. Be aware of cultivar differences in symptom expression and “windows” of opportunity to remove infected plants. This is especially critical when managing leafroll.
4. Use appropriate systemic insecticides to reduce or eliminate colonizing aphids from fields. Recognize that some insecticides will flare the population of certain aphid species like green peach aphid (GPA) and that certain systemic insecticides will decrease in their ability to provide control later in the season. Keep in mind that many insecticides are useful in controlling spread of leafroll both in-field and from outside sources, but no insecticides will really control the spread of stylet borne viruses such as PVY from outside sources. There are few aphids which effectively spread potato leafroll virus (GPA, potato aphid) while over 50 species of both colonizing and non-colonizing aphids will spread PVY to some degree.
5. Utilize field edge spraying when appropriate to reduce the use of insecticides and reduce the potential for GPA colonization within the field. GPA will typically colonize the first 12 meters of a field first prior to movement into the interior of the field.
6. Utilize border or trap crops to help in cleaning the stylets of PVY-infected aphids. Maintain fallow ground outside the crop border, but not between the crop border and the field or within the seed lot. Whenever possible, remove the edge of the field and/or lot (12 meters or 6 to 10 rows) and use as commercial potatoes rather than storing with the rest of the seed lot to reduce potential high virus levels due to aphid landing/edge effects.

APPENDIX III

Potato Certification Service
Colorado State University
Colorado Certified Seed Potatoes Bulk Certificate # 21044CAN21-101

Buyer

Seller

San Luis Valley Research Center
0249 East County Road 9 North
Center, CO 81125

Variety & Kind : Canela Russet Potato

Lot Number : 21044CAN21

Amount Sold : 1 CWT

Generation : G2

Tag Grade : Blue

Cut Seed : N

Experimental Seed? : N

Size Specification :

Re-Certification Eligibility : Eligible pending Winter Test

PVP Status : U.S. Plant Variety Protection Granted or Applied For - UNAUTHORIZED PROPAGATION PROHIBITED!

Owner of Conveyance :

Number of Car or Truck License : **Date Loaded** : 11/03/2021

Federal/State Inspection Certificate No. : xxx

Shipping Seal No. :

We, the undersigned, submit that the potatoes covered by this CERTIFICATE not to exceed the above stated amount sold, have been grown and handled according to the Rules and Regulations governing the production of certified seed potatoes as promulgated by the Board of Governors of the CSU System and administered by the Potato Certification Service.

Date: ____/____/____ Seller's Signature: _____

Since the use, crop, yields or quality of seed potatoes is beyond the control of the producer, the seller, the inspector, or the Board of Governors of the CSU System, no warranty of any kind, express or implied, including merchantability, which extends beyond the description on the face of this Certificate is made concerning the performance or quality of these seed potatoes. Also, there is no representation or warranty that licensed cultivars listed on this bulk certificate will not infringe any patent or other proprietary right. By acceptance of these seed potatoes, buyer expressly agrees that its exclusive remedy for breach of any warranty shall be limited in all events to a return of the purchase price of the seed.

THIS CERTIFICATE IDENTIFIES THE ABOVE DESCRIBED SEED POTATOES AS CERTIFIED ONLY WHILE THEY ARE ON BOARD THE CONVEYANCE DESCRIBED ABOVE AND THE SEAL REMAINS UNBROKEN. ONCE THEY ARE UNLOADED, NO FURTHER IDENTITY WITH THIS CERTIFICATE MAY BE CLAIMED!

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