Risk Management Document

Importation of Fresh Lemon (*Citrus limon* (L.) Burm. f.) from Northwest Argentina into the Continental United States

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Plant Health Programs (PHP)
Regulations, Permits and Manuals (RPM)
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Introduction

Currently importation of fresh Lemons from Argentina into the United States is not authorized by 7 CFR§319.56. The Plant Epidemiology and Risk Analysis Laboratory (PERAL) of the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Center for Plant Health Science and Technology (CPHST) prepared a pest risk assessment for the importation of commercially produced fresh Lemon fruit from Northwest Argentina into the continental United States (USDA, 2015).

Based on the pest risk assessment (USDA, 2015), 9 pests that could be associated with Citrus spp. in Argentina were determined to be of quarantine significance for the United States:

Acari (mites)
- *Brevipalpus californicus* (Banks) (vector of citrus leprosis virus CiLV)
- *Brevipalpus chilensis* Baker
- *Brevipalpus obovatus* Donnadieu (vector of citrus leprosis virus CiLV)
- *Brevipalpus phoenicus* (Geijskes) (vector of citrus leprosis virus CiLV)

Tephritidae (fruit flies)
- *Ceratitis capitata* (Wiedemann), Mediterranean fruit fly (Medfly)

Lepidoptera
- *Cryptoblabes gnidiella* (Millière), Honeydew moth
- *Gymnandrosoma aurantiunum* (Lima), Citrus borer

Fungi
- *Elsinoë australis* Bitanc. & Jenkins 1936, causal agent of sweet orange scab disease (SOS)

Bacteria

The pest risk potentials for the *Brevipalpus chilensis* mite and the three insects (*Ceratitis capitata*, *Cryptoblabes gnidiella*, and *Gymnandrosoma aurantiunum*) are high. The pest risk potentials for the other three mites (*Brevipalpus californicus*, *Brevipalpus obovatus*, and *Brevipalpus phoenicus*), the fungus (*Elsinoë australis*) and the bacterium (Xcc) are medium. Although a very low incidence of one of the plant pathogens may enter on an occasional symptomatic fruit, the evidence indicates that it is highly unlikely that any of these plant pathogens could become established via the pathway of commercial lemons (USDA, 2015).
In a previous revision of the PRA two plant pathogens, *Guignardia citricarpa* Kiely and *Xylella fastidiosa* (Wells, *et al.*)- Citrus variegated chlorosis strain, were included as a quarantine pathogens likely to follow the pathway. However new information relating to these pathogens lead to the removal of the analyses for these pathogens. For *Guignardia citricarpa* a pest risk assessment (PRA) conducted in 2010 concluded that fresh or dried citrus fruit is not epidemiologically significant as a pathway for the introduction of CBS because the combination of conditions required for disease transmission from harvested fruit are highly unlikely (USDA/APHIS, 2010). We therefore consider that fruit which is commercially harvested and surface treated with fungicides prior to shipment poses a negligible risk.

New research finalized in 2014 (Cordeiro *et al*., 2014; Coletta-Filho *et al*., 2014; Hartung *et al*., 2014), in conjunction with surveys conducted by SENASA (SENASA, 2011) demonstrates that lemon trees are a doubtful field host of *Xylella fastidiosa* (Wells, *et al.*)- Citrus variegated chlorosis strain (CVC). This research along with unpublished USDA-ARS research, also demonstrates that this bacteria is not seed transmitted in citrus (Cordeiro *et al*., 2014; Coletta-Filho *et al*., 2014; Brlansky, 2014), therefore, fruit is not a pathway for the spread of CVC.

**Standard Industry Practices**

The standard industry practices are listed in the PRA (USDA, 2015). Some of these practices will be required as part of the systems approach proposed for exportation of lemon fruits from Northwest Argentina to the continental United States.

**Pest Risk Management Measures**

1. Only commercially grown fruit from approved places of production that are registered with SENASA, the Argentinean National Plant Protection Organization (NPPO), will be exported to the United States. SENASA will ensure that growers are participating in the program and following the guidelines. Packinghouses must also be registered and approved by SENASA and meet the requirements of the systems approach.

2. SENASA must provide an operational workplan to APHIS that details the activities and responsibilities that SENASA will, subject to APHIS’ approval of the workplan, carry out to meet the requirements of the systems approach. APHIS will be directly involved with SENASA in monitoring and auditing implementation of the systems approach.

3. If SENASA finds that a place of production or packinghouse is not complying with the requirements of the systems approach, no lemon fruit from the place of production or packinghouse will be eligible for export into the continental United
States until APHIS and SENASA conduct an investigation and appropriate remedial actions have been implemented.

4. Plant litter and fallen fruit must be removed from the place of production to remove potential fruit fly and Lepidoptera host material. Fallen fruit must not be included in field containers of fruit brought to the packing house to be packed for export.

5. Fruit must be imported in commercial consignments only and the fruit must be practically free of leaves, twigs and other plant parts, except for stems that are less than one inch long and attached to the fruit.

6. The identity and origin of the fruit must be maintained throughout the process—from the grove, through the packing house, and through the exporting process to the United States—for traceability back to the place of production.

7. SENASA will regularly visit and inspect places of production through the exporting season, starting thirty days before harvest and continuing until the end of the shipping season, to ensure that the growers are following the export protocols.

8. SENASA will provide oversight for all program activities including monitoring phytosanitary control programs, reviewing them at least once a year, and maintaining all forms and documents related to activities in groves and packing houses in the export program. APHIS may monitor places of production, packinghouses and records if necessary.

9. All fruit imported into the United States must be accompanied by a phytosanitary certificate (PC) with an additional declaration (AD) issued by SENASA stating that the fruit in the consignment are free of all mites including *Brevipalpus chilensis*, all quarantine insects (Medfly, Honeydew moth and Citrus borer) and have been produced in accordance with the requirements of the systems approach.

10. APHIS will inspect fruit consignments at the port of entry to the United States.

11. SENASA must monitor and audit the harvesting system and ensure that during the time the packinghouse is in use for exporting fruit to the United States, the packinghouse may only accept fruit from registered, approved places of production.

12. Fruit must be washed, brushed, surface disinfected in accordance with 7 CFR part 305 and according to treatment schedules listed in the PPQ Treatment Manual,
treated with fungicide (e.g. imazalil and/or thiabendazole) at labeled rates, and waxed at packinghouses.

13. Determination of pest free places of production for *Brevipalpus chilensis* mites. Between 1 and 30 days prior to harvest, 100 random samples of fruit must be collected from each registered production site under the direction of Argentina's NPPO. These samples must undergo a pest detection and evaluation method as follows: The fruit and pedicels must be washed using a flushing method, placed in a 20 mesh sieve on top of a 200 mesh sieve, sprinkled with a liquid soap and water solution, washed with water at high pressure, and washed with water at low pressure. The process must then be repeated. The contents of the sieves must then be placed on a petri dish and analyzed for the presence of live *B. chilensis* mites. If a single live *B. chilensis* mite is found, the production site will not qualify for certification as a pest free production site. Each production site may have only one opportunity per harvest season to qualify as a pest free production site, and certification of pest freedom will be valid for one harvest season only. The NPPO of Argentina will present a list of certified production sites to APHIS. If consignments are found with *B. chilensis* mites, the production sites will be disqualified for export for the remainder of the harvest season and must requalify for pest freedom in subsequent seasons.

14. SENASA will certify that places of production from exporting orchards have effective fruit fly trapping programs, and follow pest control guidelines, when necessary, to reduce regulated pest populations. The personnel conducting the trapping and pest surveys must be hired, trained, and supervised by SENASA or personnel authorized by SENASA.

15. Beginning at least 1 year before harvest and continuing throughout the year, trapping in the orchards for fruit fly monitoring must be at a density of at least 2 traps per km² in commercial production areas, with at least 2 traps placed in each place of production. Traps should be baited with APHIS-approved baits and serviced at least once every two weeks.

16. If more than 0.7 FTD (number of fruit flies per trap per day) of Medfly is trapped, pesticide bait treatments must be applied in the affected place of production in order for the place of production to remain eligible to export fruit.

17. SENASA must keep records of fruit fly detections for each trap and make the records available to APHIS upon request. The records must be maintained for at least 1 year.

18. Lemon fruit may be shipped without a quarantine treatment for fruit flies if they are harvested green between April 1 and August 31. The lemons must be shipped with an Additional Declaration: “The lemons have been harvested green between April 1 and August 31”. If the lemons are harvested outside of this window, or harvested yellow, they must be treated with an approved quarantine treatment in
accordance with 7 CFR part 305 for *Ceratitis capitata* (as listed in the PPQ Treatment Manual) and monitored by an official authorized by APHIS per APHIS policy.

19. Fruit must be packed within 24 hours of harvest in a pest-exclusionary packinghouse or stored in a degreening chamber in a pest-exclusionary packinghouse. Fruit must be safeguarded by a pest-proof screen or plastic tarpaulin while in transit to the packinghouse and while awaiting packing. All openings to the outside of the packinghouse must be covered by screening with openings of not more than 1.6 mm or by some other barrier that prevents pests from entering. The packinghouse must have double doors at the entrance to the facility and at the interior entrance to the area where lemon fruits are packed. Fruit must be packed in insect-proof cartons or containers, or covered with insect-proof mesh or a plastic tarpaulin for transport to the United States. These safeguards must remain intact until the fruit arrive in the United States.

20. Fruit must be inspected by SENASA, or personnel authorized by SENASA, following post-harvest processing. A biometric sample, to be jointly determined by APHIS and SENASA, will be visually inspected for pests, washed and the filtrate inspected for *Brevipalpus chilensis* mites (as in #13). A portion of the fruit will be cut open to detect internal pests, such as fruit flies and Lepidoptera larvae.

21. If a single *Cryptoblabes gnidiella* or *Gymnandrosoma aurantianum* in any stage of development is found on the lemons, the entire consignment is prohibited from export to the United States, and the registered place of production that produced the lemons is suspended from the export program until APHIS and the NPPO of Argentina jointly agree that the place of production has taken appropriate remedial measures to address plant pest risk. If a single *B. chilensis* or *Brevipalpus* spp. mite in any stage of development is found on the lemons, the entire consignment is prohibited from export, and the registered place of production that produced the lemons may be suspended from the export program, pending an investigation. If a single immature Medfly is found in or with the lemons, the lemons must be treated in accordance with 7 CFR part 305 and the operational workplan, and the registered place of production that produced the lemons in the consignment may be suspended from the export program.

**Evidence of Effective Removal of Pests of Concern from the Pathway**

Orchard registration with SENASA allows trace-back to place of production and correction of phytosanitary issues or removal of places of production from the fruit exportation program. Orchard registration ensures that SENASA will provide oversight and that registered places of production follow the export program. Since the fruit never loses its identity (all fruit remain traceable back to the farm that originated them; the place of production), origin can be determined even after the fruit has reached the
consumer distribution outlets and other points of sale. Trace-back and registered places of production allow backtracking of pest problems and remedial mitigation or removal of places of production or areas from the program. Requiring packing in pest exclusionary packing houses prevents infestation of fruit by pests after harvest and also prevents hitchhiking pests (pests not normally associated with citrus fruit) from following the pathway of packed citrus.

Sanitation measures, such as removing and discarding fallen fruit, are essential components of good agricultural practices and are mainstays of commercial fruit production (Kirk et al., 2001; USDA, 2007a). Removal of fallen fruit eliminates insect host material, which helps to maintain low pest populations (Verghese et al., 2004; Judd & Gardiner, 2005). Removal of inoculum, such as litter and fallen fruit, is also an effective way to reduce disease occurrence (Van der Plank, 1963; 1975). This procedure targets SOS, but also will reduce Xcc inoculum (Gómez et al., 2006; Gottwald et al., 2002; USDA, 2009).

SENASA already has an adequate monitoring program in effect that is used for citrus export to the European Union (USDA, 2015). A similar systems approach including recording and trace-back will be required. SENASA will certify that exporting orchards have effective fruit fly trapping programs, and follow control guidelines, when necessary, to reduce regulated pest populations. APHIS may monitor the production areas and packing houses if necessary.

The phytosanitary certificate with additional declaration requires SENASA to conduct an inspection and certify that the lemon fruit are free of quarantine insects (medfly, honeydew moth, and citrus borer). This raises the awareness of those requirements for our port of entry inspection. Many of these pests have stages that are visible upon inspection, or cause visible damage (USDA, 2007b; Parra et al., 2001; 2004; Silva & Mexia, 1999).

U.S. Customs and Border Protection agricultural inspectors receive specific instruction for detecting quarantine pests and are instructed to inspect for insects, mites, insect/mites damage, and disease blemishes (USDA, 2012b).

Pre-harvest grove inspections reduce the likelihood that infested/infected fruit is harvested and transported to the packinghouse (USDA, 2006; Kinney, 2007).

Washing and brushing removes insects from fruit (Vincent et al., 2003). Culling citrus fruit removes fruit with visible signs of insect damage. Removal of any damaged or blemished fruit reduces the risk that pests will be exported to the continental United States. Three surface disinfectants are currently approved by USDA for Xcc and SOS decontamination of regulated citrus fruit moved within the United States: sodium hypochlorite, SOPP (sodium orthophenyl phenate) and peroxyacetic acid (CFR, 2006; USDA, 2012a). Various studies demonstrated the effectiveness of these disinfectants in reducing numbers of Xanthomonas citri subsp. citri cells or similar bacteria to low or undetectable levels (Obata et al., 1969; Brown & Schubert, 1987; Canteros et al., 2000;
The same surface disinfectants were approved by USDA for SOS (USDA, 2010). Packing house treatments such as waxing, surface disinfection and fungicide dip (USDA, 2010), should be effective in reducing the viability of any *Elsinoë australis* propagules.

The regulations governing the interstate movement of citrus fruit from Florida with respect to citrus canker (7 CFR 301.75-7) require that the fruit be packed in a commercial packinghouse operating under a compliance agreement, treated with a surface disinfectant in accordance with 7 CFR part 305, and be free of leaves, twigs, and other debris. In October 2009, APHIS amended these regulations to remove some previous restrictions based on a pest risk analysis that concluded that "commercially packed and disinfected fresh citrus fruit is not an epidemiologically significant pathway for the introduction and spread of Xcc," the causal agent of citrus canker.

Domestically, interstate movement of citrus fruit from SOS infested areas requires that fruit must be washed, brushed, surface disinfected (with at least one approved treatment), fungicide treated with labeled rates of imazalil and/or thiabendazole and waxed at packinghouses (USDA, 2010). Equivalent measures are required for importation of lemon fruit from Uruguay.

Lemons may be shipped without quarantine treatment for Medfly if they have been harvested green between April 1 and August 31. Lemons are considered to be a poor host for Medfly (USDA, 2008), and research has shown that if lemons are harvested green within this time period, when fruit fly populations are low, they are not hosts to Medfly (Willink *et al.*, 2007). If the lemons are harvested outside of this window, or harvested yellow, they must be treated with an approved quarantine treatment. Cold treatment (Schedule T107-a) is approved for disinfesting citrus of *Ceratitis capitata* (USDA, 2012b). Mandatory trapping will identify high populations and require bait treatments to lower populations. For lemons harvested yellow or outside of the harvest window, quarantine treatments are effective in eliminating *Ceratitis capitata* from lemons (USDA, 2012a, Willink *et al.*, 2007). Quarantine treatments have been used successfully to mitigate pest risk for importing different types of fruits from many countries and are used on lemons from Uruguay.

*Cryptoblabes gnidiella* primarily attacks fruit that have infestations of Homoptera species producing honey dew (Silva & Mexia, 1999). Small *Cryptoblabes gnidiella* larvae feed on the honey dew and do not attack the fruit until they have grown to a larger stage. Small larvae will be removed from the pathway by packing house washing and brushing. *Cryptoblabes gnidiella* has never been intercepted by APHIS in permitted cargo of citrus fruit (AQAS-PestID, 2015). *Cryptoblabes gnidiella* is not a pest in well maintained commercial lemon places of production free of Homoptera (Silva & Mexia, 1999). Based on the pest damage symptoms, inspection and culling will remove Lepidoptera pests, including *Cryptoblabes gnidiella* and *Gymnandrosoma aurantianum*, from the pathway (Parra *et al.*, 2001; 2004; Silva & Mexia, 1999).
Inspection is adequate for the three species of mites; *B. californicus*, *B. obovatus* and *B. phoenicus* rated medium in the PRA. In general, infestations of mites cause bronzing of fruits that can be detected upon visual inspection. A systems approach will be used to remove *B. chilensis* from the pathway. The systems approach to for *B. chilensis* defines pest free places of production based on field and packing house sampling for *B. chilensis* mites. This systems approach has been used for Chilean citrus, including grapefruit, oranges and tangerines, and kiwi fruit, baby kiwi fruit and has been tested on grapes in a pilot project. In these programs it has been successful in excluding fruit infested with mites from the export pathway. The success of this systems approach derives from the resolving power of the sampling technique. Washing of the fruit samples with pressurized soapy water loosens and removes most pests from the fruit and the sieve collects and concentrates all pests from many samples into one spot so they are easily seen.

**Summary**

APHIS believes that the risk management measures discussed in this document will provide an appropriate level of phytosanitary protection against the pests of quarantine concern associated with the importation of fresh lemons from Argentina into the continental United States.

The measures that are proposed for importation of lemons from Argentina are equivalent to those in the regulations for interstate movement of citrus from Xcc and SOS quarantine areas in the United States. Sweet orange scab disease is easily controlled with field treatments and is further inhibited with post-harvest treatments (EPPO-CABI, 1997; USDA, 2010).

Trapping and bait spraying will further ensure that fruit fly populations will be low. Packinghouse culling and fruit removal from orchards will remove any senescent fruit, which are more likely to be hosts to fruit flies.

*Gymnandrosoma auranianum* is rare in commercial citrus in South America (USDA, 2007b). *G. auranianum* has never been intercepted by APHIS in commercial citrus fruit from any country and only once in passenger baggage from Ecuador (AQAS-PestID, 2015). *Cryptoblakes gnidiella* primarily attacks fruit that has infestations of Homoptera species producing honey dew (Silva & Mexia, 1999). Small larvae feed on the honey dew and do not attack the fruit until they have grown to a larger stage. Small larvae will be removed from the pathway by packing house washing and brushing. *Cryptoblakes gnidiella* has never been intercepted by APHIS in commercial citrus fruit and only once from South America in maritime stores (on a ship from Venezuela in 1992 on citrus fruit not intended for entry to the United States) (AQAS-PestID, 2015). Based on the pest damage symptoms, inspection and culling will remove Lepidoptera pests from the pathway (Parra _et al._, 2001; 2004; Silva & Mexia, 1999).

Argentina has exported citrus fruits to the European Union for many years. The phytosanitary measures currently in place in Argentina (USDA, 2015) for export to the
European Union have been proposed by Argentina to be the basis for a systems approach for the importation of lemon fruit to the continental United States. APHIS agrees with some of the proposed measures and proposes additional measures, which are included in the system approach described in this document.

In addition to the systems approach in Argentina, U.S. Customs and Border Protection officials will inspect lemon fruit from Argentina at ports of entry to prevent symptomatic or infested fruit from entering the United States.

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References


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