

## INFORMATION MEMO FOR THE RECORD

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### Issue:

The government of Mexico has requested expansion of the area of the conterminus United States to which Mexican Hass avocados may be distributed. Currently, Mexican Hass avocados are allowable only in Alaska, 19 northeastern U.S. States and the District of Columbia (Connecticut, District of Columbia, Delaware, Illinois, Indiana, Kentucky, Maine, Maryland, Maine, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, Vermont, West Virginia and Wisconsin.) Furthermore, the Government of Mexico is requesting that the shipping season, currently restricted to the months of November, December, January and February, be expanded. PPQ is proposing the expansion of the allowable distribution area to include 12 additional States (Colorado, Idaho, Iowa, Kansas, Missouri, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Utah and Wyoming) and the extension of the shipping season to include the months of March and April. This memo evaluates the risk of introduction of exotic pests of avocado if these requested changes are adopted. This evaluation is based on the risk analyses completed in 1995-1996 and additional information developed during the course of the current importation program that has been in place since 1997.

### Background:

Avocado fruit from Mexico and Central America had been prohibited from entering the United States since 1914, initially because of the presence of a seed weevil, *Heilipus lauri*. In 1973, the specific avocado quarantine was incorporated into the general nursery stock (7CFR§319.37) and fruit and vegetable (7CFR§319.56) quarantines. In 1993, the regulations were amended to allow importation of Mexican Hass avocados into the State of Alaska.

In July, 1994, the Government of Mexico presented APHIS with a proposal for the export of Hass avocados from Michoacan, Mexico to the District of Columbia and 19 northeastern U.S. States in addition to Alaska. APHIS reviewed the plan and provided comments to Mexican officials who drafted a revised plan in September, 1994. On November 15, 1994, APHIS published an advance notice of proposed rulemaking (ANPR) in the *Federal Register*. The ANPR announced that APHIS had received a request from the Government of Mexico to allow, under certain conditions, the importation of fresh Hass avocado fruit grown in approved orchards in approved municipalities in Michoacan, Mexico into certain areas in the United States. APHIS solicited comments and convened two public hearings in November, 1994.

In responding to the Mexican proposal, APHIS scientists conducted an analysis of the risks associated with the importation of Mexican Hass avocados. APHIS officials prepared two documents as part of this risk analysis. The first document, dated March, 1995 and entitled “Risk Management Analysis: A Systems Approach for Mexican Avocado,” (Miller,*et al.*, 1995) is an analysis of the procedures employed to reduce pest risks associated with the importation of Mexican Hass avocado fruit. The second document, dated May, 1995 and entitled “Importation of Avocado Fruit (*Persea americana*) from Mexico: Supplemental Pest Risk Assessment” (USDA, 1995) includes a quantitative assessment of the likelihood of introducing certain pests with such importations as well as a qualitative assessment of the consequences of such introductions. These documents were an important part of the knowledge base that informed the APHIS decision to proceed with a proposed rule.

On July 3, 1995, APHIS published a proposed rule to allow fresh Hass avocado fruit grown in approved orchards in approved municipalities in Michoacan, Mexico to be imported into certain areas of the United States, subject to certain conditions. APHIS solicited comments on the proposed rule and held a total of five public hearings to provide opportunity for comment. After reviewing more than 2000 public comments on the proposed rule, APHIS published a final rule amending the regulations governing the importation of fruits and vegetables to allow fresh Hass avocado fruit grown in approved orchards in approved municipalities in Michoacan, Mexico to be imported into certain areas of the United States, subject to certain conditions. The conditions include pest surveys, pest-risk reducing cultural practices, packinghouse procedures, inspection and shipping procedures, restrictions on the time of year shipments may enter and restrictions on the destinations of imported fruit. The final rule was published on February 5, 1997 with an effective date of March 7, 1997.

Beginning about a year after publication of the final rule, the Government of Mexico initiated requests to expand both the distribution area and the shipping season for Hass avocado fruit from Michoacan. In the final rule published February 5, 1997, APHIS states “The placement of additional States on the list of approved States would have to be a part of a subsequent rulemaking...importations into nonapproved States were not considered in the supplemental pest risk assessment and risk management analysis prepared for the July 1995 proposed rule, so we do not have sufficient information regarding potential plant pest risk associated with importing Mexican avocados into other States. New States may be added in the future if APHIS receives a request to do so and the agency determines that avocados can be imported into that State without presenting a significant pest risk...”

Based on the information collected in support of the final rule published on February 5, 1997 and additional information collected since, APHIS does now have sufficient information to consider the Mexican Government’s request to expand the list of approved States and the season during which shipments can be made. This information is primarily derived from:

- < a supplemental pest risk assessment (USDA, 1995) (**Attachment 2**) and an addendum to it (USDA, 1996; **Attachment 3**); a risk management analysis (Miller, *et al.*, 1995) (**Attachment 1**) prepared for the July 1995 proposed rule;
- < four shipping seasons' (1997-2001) worth of shipping and inspection data collected either by APHIS or jointly by APHIS and it's Mexican counterpart, SAGARPA (**Attachment 5**); and,
- < a draft document, entitled "Identification of Susceptible Areas for the Establishment of *Anastrepha* spp. Fruit Flies in the United States and Analysis of Selected Pathways" (Sequeira, *et al.*, 2001) (**Attachment 4**) completed in 2001 as the U.S. portion of a project by a subcommittee of the Pest Risk Assessment Panel of the North American Plant Protection Organization (NAPPO).

### 1995 Risk Management Analysis (Miller, *et al.*, 1995)

The Risk Management Analysis document described the degree to which the various elements of the systems approach employed for the importation of Mexican Hass avocados were expected to mitigate the pest risk associated with such importations. Nine pests or classes of pests were evaluated:

- Small avocado seed weevils (*Conotrachelus perseae* and *C. aguacatae*);
- Large avocado seed weevil (*Heilipus lauri*);
- Avocado stem weevil (*Copturus aguacatae*);
- Avocado seed moth (*Stenoma catenifer*);
- Fruit flies (*Anastrepha ludens*, *A. striata* and *A. serpentina*); and,
- Hitchhikers and miscellaneous other pests.

The risk mitigation elements of the systems approach evaluated in the document included the following measures:

- Field surveys;
- Trapping and field treatments;
- Field sanitation;
- Host resistance;
- Post harvest safeguards;
- Winter shipping only;
- Packinghouse inspection and fruit cutting;
- Port-of-arrival inspection; and,
- Limited U.S. distribution.

The conclusion of the risk management analysis was that “...the cumulative effects of the systems approach lowers the risk of all target pests to an insignificant level. In addition, even if one of the mitigating elements would completely fail, the risk reduction effect of the other elements would maintain the risk to a low level. The risk from...’hitchhikers and other pests’ would be lower than hundreds of other products that are imported to and exported from the United States with port-of-entry inspection as the primary clearance requirement.”

#### 1995 Supplemental Pest Risk Assessment (USDA, 1995) and Addendum (USDA, 1996)

The primary components of the supplemental risk assessment are:

- < A listing of avocado pests known to occur in Mexico;
- < A qualitative assessment of the consequences of introducing selected quarantine pests expected to follow the pathway of avocado fruit imported for consumption;
- < Biological information on those selected quarantine pests;
- < A scenario analysis considering the likelihood that infested fruit transported to suitable habitat would result in the establishment of those selected quarantine pests in the United States;
- < Quantitative estimates of the likelihood that infested fruit transported to suitable habitat would result in the establishment of those selected quarantine pests in the United States; and,
- < Brief recommendations regarding measures to manage plant pest risk.

Estimates for pest establishment were made both assuming no specific risk mitigation measures were in place and assuming that the systems approach described in the July 3, 1995 proposed rule were in place. Those specific mitigation measures included:

- < Only the Hass variety of avocado fruit would be imported.
- < Hass avocado fruit would be imported from a single State in Mexico, Michoacan.
- < Hass avocado fruit would be imported only from November through February.
- < Hass avocado fruit would be imported only to 19 Northeastern States (Connecticut, Delaware, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, and Wisconsin) and the District of Columbia.
- < Hass avocado fruit could be transported to these locations only under certain conditions designed to minimize plant pest risk.

- < The United States would establish a program, and monitor compliance of the program to minimize the likelihood that plant pests would be introduced to the United States.
- < The entire export program would be monitored by officials of the Mexican Government.
- < The entire export program would be monitored by officials of the United States Government.
- < Regulatory controls to prevent movement of uncertified avocado fruit and plants into areas certified for production and processing.
- < Field sanitation of Mexican avocado groves.
- < Field trapping for specific avocado pests.
- < Field surveys for specific avocado pests at the State, Municipality, and grove levels.
- < Safeguarding of harvested avocado fruits to prevent post-harvest infestation.
- < Certification of Municipalities and groves with respect to specific avocado pests.
- < Certification of packing houses.
- < Control of shipments.
- < Inspection of imported fruits by U.S. officials in Mexico and again at the port of entry.

The risk assessment identified 91 pests of avocado in Mexico, 26 pathogens and 65 arthropods. Of the 91 pests identified, 32 (two pathogens and thirty arthropods) satisfied the geographic and regulatory requirements of a quarantine pest. Of these 32 quarantine pests, only nine arthropods were expected, based on their biology, to possibly follow the pathway of imported avocado fruit for consumption. These nine arthropods were then selected for further analysis:

- < *Anastrepha fraterculus* - fruit fly
- < *Anastrepha ludens* - fruit fly
- < *Anastrepha serpentina* - fruit fly
- < *Anastrepha striata* - fruit fly
- < *Conotrachelus aguacatae* - seed weevil
- < *Conotrachelus perseae* - seed weevil
- < *Heilipus lauri* - seed weevil
- < *Copturus aguacatae* - stem weevil
- < *Stenoma catenifer* - seed moth

The nine pests were categorized for the purposes of the extended assessment as follows:

- < **fruit flies:** *Anastrepha fraterculus*, *A. ludens*, *A. serpentina*, *A. striata*;
- < **seed weevils:** *Conotrachelus aguacatae*, *C. perseae*, *Heilipus lauri*;
- < **stem weevil:** *Copturus aguacatae*; and,
- < **seed moth:** *Stenoma catenifer*.

The pest groups were rated qualitatively for their “Pest Risk Potential” (PRP). The ratings are based on a series of risk elements that estimate the consequences of a pest’s introduction (USDA, 2000). The PRP is considered to be a biological indicator of the potential destructiveness of the pest. The seed weevils, stem weevil and seed moth had PRP values considered to be medium risk. The risk assessment reached this conclusion on the basis that although these pests could potentially have a significant economic impact on domestic avocado production, their host range is extremely narrow (the weevils are only known to attack avocado and the seed moth attacks one plant species other than avocado), they have a narrow climatic tolerance and their dispersal potential is limited. The fruit flies’ PRP was considered high. The difference in the ratings for the fruit flies as compared to the weevils and the seed moth can be attributed to the broader range of hosts attacked by the fruit flies, their greater motility and higher potential economic impact.

The risk assessment document estimated the likelihood that particular pests would be introduced as a result of importation of Mexican avocado fruit in two steps. First, the events that would have to occur before pest outbreaks could occur were conceptualized using the method of Scenario Analysis. The results of the scenario analysis were then used to run a series of Monte Carlo simulations to estimate the frequency of pest outbreaks. The chosen endpoint for the simulations was the frequency of pest outbreaks. Two scenarios (i.e., program alternatives) were considered:

- Importation of Mexican avocado fruit with no specific measures to mitigate plant pest risks; and,
- Importation of only Hass avocado fruit and only under a Systems Approach for mitigating plant pest.

A single risk model was employed for both the unmitigated (baseline) scenario and the mitigated (program) scenario. It is a linear, multiplicative model comprised of seven “nodes” with the endpoint of frequency of outbreaks (establishment) per year based on an estimated number of shipments. It was assumed that all of the events (nodes) in the model are independent and all must occur before a pest establishment can take place. The risk model is as follows:

**F1:** Frequency of shipments (number of boxes imported per year)

**X**

**P1:** Probability pest infests fruit: pre- or postharvest

**X**

**P2:** Probability pest **not** detected during harvest or packing

**X**

**P3:** Probability pest survives shipment

**X**

**P4:** Probability pest **not** detected at port of entry inspection

**X**

**P5:** Probability fruit is transported to area with suitable hosts and climate

**X**

**P6:** Probability infested fruit in suitable habitat leads to outbreak

**=**

**F2:** Frequency of pest outbreaks in the United States

Because the actual probabilities of the independent events comprising the risk model were not known, they were estimated. Although the probabilities were estimated, pertinent data were available for each independent event. The estimates were based to a large extent on expert judgment. A core team of four entomologists estimated probabilities. Additionally, numerous technical specialists (e.g., scientists specializing on particular taxonomic groups, port inspectors, specialists in international trade, etc.) were consulted throughout the process regarding various details. The estimates were specified as probability distribution functions that described a range of values between specified maxima and minima. The frequency of pest outbreaks was calculated using Monte Carlo simulation.

The results of quantitative estimates of the likelihood of introduction section of the 1995 risk assessment are summarized in the following table:

| <b>Table 1. Pest Outbreak Frequency: Mexican Avocado Pests, By Program As Calculated in the 1995 Risk Assessment</b> |             |                                       |                                  |
|--|-------------|---------------------------------------|----------------------------------|
| <b>Program Alternative</b>   | <b>Pest</b> | <b>Outbreaks Frequency (per year)</b> |                                  |
|  |             | <b>Mode</b>                           | <b>Mean</b>                      |
| <b>A</b><br><b>No specific mitigation program</b>  | Fruit flies | 0.0139<br>or<br>one chance in 72      | 0.0518<br>or<br>one chance in 19 |
|  | Seed Weevil | 0.0105<br>or<br>one chance in 95      | 0.0419<br>or<br>one chance in 24 |
|  | Stem Weevil | 1.389<br>or<br>one chance in 0.7      | 5.183<br>or<br>one chance in 0.2 |
|  | Seed Moth   | 0.00282<br>or<br>one chance in 355    | 0.0120<br>or<br>one chance in 83 |



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|--|-------------|--|--|
| <b>Program Alternative</b>   | <b>Pest</b> | <b>Outbreaks Frequency (per year)</b>                      |  |
|  |             | <b>Mode</b>  | <b>Mean</b>  |
| <b>B</b><br><br><b>Systems approach for risk mitigation</b>  | Fruit flies | 8.64 X 10 <sup>-8</sup><br>or<br>one chance in 12 million  | 3.57 X 10 <sup>-7</sup><br>or<br>one chance in 3 million   |
|  | Seed Weevil | 6.66 X 10 <sup>-7</sup><br>or<br>one chance in 1.5 million | 3.13 X 10 <sup>-6</sup><br>or<br>one chance in 320,000     |
|  | Stem Weevil | 8.77 X 10 <sup>-5</sup><br>or<br>one chance in 11,042      | 0.000387<br>or<br>one chance in 2600                       |
|  | Seed Moth   | 1.87 X 10 <sup>-7</sup><br>or<br>one chance in 5 million   | 8.98 X 10 <sup>-7</sup><br>or<br>one chance in 1.1 million |

Following comments received from the public regarding the July 3, 1995 proposed rule, APHIS made modifications to the systems approach that had not been considered in the 1995 risk assessment document. The changes that appeared in the February 5, 1997 final rule are:

- < Fallen fruit must be removed from the orchard no less frequently than every seven days during harvest.  
  
This requirement affected the estimates for node **P1** (Probability pest infests fruit: pre- or postharvest.)
- < The final rule requires that number of fruit inspected from each lot be increased from 250 to 300.  
  
This change affected estimates for node **P2** ( Probability pest **not** detected during harvest or packing.)
- < The final rule specified that a sticker identifying the export grove must be placed on each individual fruit imported under the program.  
  
This requirement affected both the probability that the pests would evade detection at the ports of entry (**P4**) and the probability that fruit will be transported to a habitat with suitable hosts and climate (**P5**.)

As a consequence of these changes APHIS revised the calculations presented in the 1995 risk assessment document for the likelihood of introduction under the mitigation program. The revised calculations were compiled in a 1996 document entitled “Importation of Avocado Fruit (*Persea americana*) from Mexico: Supplemental Pest Risk Assessment- Addendum I: Estimates for the Likelihood of Pest Outbreaks Based on the Draft Final Rule” (USDA, 1996; **Attachment 3.**) The revised calculations were made to estimate how much further risk reduction would be achieved by the additional measures. Since the risk, prior to these modifications, was already deemed insignificant, the revised calculations of the addendum were not considered necessary for publication of the final rule. They are provided in the table below as additional information for the record.

| <b>Table 2. Pest Outbreak Frequency: Mexican Avocado Pests, By Program - Input Values Based on Draft Final Rule</b> |             |  |  |
|---|-------------|--|--|
| <b>Program Alternative</b>  | <b>Pest</b> | <b>Outbreaks Frequency (per year)</b>                      |  |
|   |             | <b>Mode</b>  | <b>Mean</b>  |
| <b>B</b><br><br><b>Systems approach for risk mitigation</b>   | Fruit flies | 8.89 X 10 <sup>-11</sup><br>or<br>one chance in 11 billion | 4.85 X 10 <sup>-8</sup><br>or<br>one chance in 21 million  |
|   | Seed Weevil | 5.76 X 10 <sup>-9</sup><br>or<br>one chance in 173 million | 4.01 X 10 <sup>-7</sup><br>or<br>one chance in 2.5 million |
|   | Stem Weevil | 3.08 X 10 <sup>-6</sup><br>or<br>one chance in 325,000     | 1.03 X 10 <sup>-4</sup><br>or<br>one chance in 9708        |
|   | Seed Moth   | 3.60 X 10 <sup>-9</sup><br>or<br>one chance in 278,000     | 1.19 X 10 <sup>-7</sup><br>or<br>one chance in 8 million   |

Admittedly the 1995 risk assessment is not without criticism. Commenters on the July 3, 1995 disputed some of the probability estimates made by the risk analysts. As explained in the risk assessment document, these were subjective probability estimates made by a core group of experts. It is to be expected that a different group of experts would arrive at a different set of estimates. APHIS stands by its estimates and cites the success of the program and the lack of pest detections (**Attachment 5**; see discussion below) as evidence that those estimates were accurate. Other commenters suggested that evidence and conclusions in the risk assessment were insufficiently documented. APHIS believes that sufficient documentation was provided.

Finally, some commenters argued that the APHIS risk assessment methods themselves were invalid. To that end the Harvard Center for Risk Analysis organized a workshop in January of 1997 to examine the methods employed by APHIS in conducting probabilistic commodity plant pest risk assessments. The workshop was sponsored, in part, by the California Avocado Commission. The outcome of the workshop was that the expert panel assembled for the workshop “...strongly endorsed the use of risk assessment approaches by the USDA...” and “...in general were happy with USDA and APHIS analyses...” (EPA, 1997.)

Identification of Susceptible Areas for the Establishment of *Anastrepha* spp. Fruit Flies in the United States and Analysis of Selected Pathways (Sequeira, *et al.*, 2001)

This document reviews the risk associated with *Anastrepha* spp., especially in relation to these pests as they occur in United States fruit imports from Mexico. It focuses on the likelihood that *Anastrepha ludens* (“Mexfly”), *A. serpentina*, *A. striata* and *A. fraterculus* become established in the United States due to the avocado pathway. The study is motivated by U. S. grower concerns that existing and proposed changes in avocado import patterns will pose increased risks to American productivity and profitability.

This document is part of a broader effort to assess the establishment likelihood of *Anastrepha* spp in all of North America. That document “Identification of Susceptible Areas for the Establishment of *Anastrepha* spp. Fruit Flies in North America” is part of an ongoing NAPPO initiative and is being submitted and will appear as NAPPO publication.

Paraphrasing from the document, the approach used was to first examine the resource at risk (commercial fruit production) then characterize host susceptibility (timing and location of susceptible fruit) and characterize climatology so as to study pest reproduction potential as a function of the previous factors. This approach can be characterized as an epidemiological analysis. The avocado pathway was used as a case study for the risks associated with fruit imports. The study used evidence from ongoing observations (sampling) and those that have been recorded since the initiation of the avocado export program (**Attachment 5**) to determine the probability that fruit flies are getting through undetected along this pathway.

Epidemiologically, the study concludes that a combination of Hass avocado’s status as a poor to inadequate host and marginal developmental conditions leads to low production field fruit fly densities. They note that *Anastrepha* spp favors peaches, citrus, and other species. Statistically, the study demonstrates that the probability that fruit fly infestations (even very low level infestations) are going undetected in inspections under the current export program is close to nil. That is, the statistical evidence suggests that if infestations were even as low as one *Anastrepha* spp. larva per one hundred thousand fruit, they would be detected with likelihood greater than 95 percent.

The study concludes that the existing populations in Mexico and under the cropping and pest management practices currently in place are too low to be a threat to agriculture in States receiving Mexican avocado exports.

In summary, the study concludes that the highest likelihood for the potential spread of Mexfly in the United States is concentrated in portions of the southern States of Texas, California, Florida,

Georgia, South Carolina, Arizona and Louisiana. The State of Hawaii showed the highest risk for the establishment of *Anastrepha* spp. A combination of limited host availability, a short period of climate conducive to *Anastrepha* spp. development and lethal low temperatures for prolonged periods makes most of the continental United States outside of the Southern States be at low risk from these species.

#### Shipping and inspection data

The final rule, published February 5, 1997, requires that Mexican avocado municipalities and orchards that wish to participate in the U.S. export program must fulfill certain obligations regarding pest surveys. The municipality must be surveyed at least annually and found to be free of the large avocado seed weevil (*Heilipus lauri*), avocado seed moth (*Stenoma catenifer*) and the small avocado seed weevils (*Conotrachelus aguacatae*, *C. perseae*). The orchard and all contiguous orchards and properties must be surveyed annually and found to be free from the avocado stem weevil (*Copturus aguacatae*). Trapping must be conducted in the orchard for the fruit flies *Anastrepha ludens*, *A. serpentina* and *A. striata*.

Data from these various trapping and surveys programs as well data on the number of fruit shipped and the number of fruit intercepted outside of the approved States are now available for the four shipping seasons that the export program has been in place (1997 / 1998 through 2000 / 2001). These data are summarized below and shown in **Attachment 5**.

Table 3. Number of Mexican Hass avocado fruit entering the United States

| <b>Season</b> | <b>Shipments</b> | <b>Boxes</b> | <b>Fruit</b> |
|---------------|------------------|--------------|--------------|
| 1997-1998     | 347              | 537,850      | 25,816,800   |
| 1998-1999     | 560              | 868,000      | 41,664,000   |
| 1999-2000     | 669              | 1,036,950    | 49,773,600   |
| 2000-2001     | 576              | 895,900      | 42,854,400   |
| Total         | 2152             | 3,338,700    | 160,108,800  |
| Average       | 538              | 834,675      | 40,027,200   |

Table 4. Number of Mexican Hass avocado fruit intercepted outside approved States

| <b>Season</b> | <b>Boxes</b> | <b>Fruit</b> |
|---------------|--------------|--------------|
| 1997-1998     | 668          | 32,064       |
| 1998-1999     | 3,114        | 149,472      |
| 1999-2000     | 45           | 2160         |
| 2000-2001     | 54           | 2592         |
| Total         | 3881         | 186,288      |
| Average       | 970          | 46,572       |

Table 5. Number of Mexican Hass avocado fruit cut and inspected

All fruit cut and inspected were negative for target pests. Orchard and packinghouse inspections were joint Mexican (SAGARPA) / United States (APHIS) inspections. Border inspections were conducted by U.S. inspectors.

| Season    | Orchard<br>(SAGARPA/<br>APHIS) | Packinghouse<br>(SAGARPA /<br>APHIS) | At Border<br>(APHIS) | Total     |
|-----------|--------------------------------|--------------------------------------|----------------------|-----------|
| 1997-1998 | 1,155,305                      | 417,900                              | 10,410               | 1,583,615 |
| 1998-1999 | 1,121,471                      | 203,250                              | 16,800               | 1,341,521 |
| 1999-2000 | 952,423                        | 166,650                              | 20,070               | 1,139,143 |
| 2000-2001 | 1,209,814                      | 172,800                              | 17,280               | 1,399,894 |
| Total     | 4,439,013                      | 960,600                              | 64,560               | 5,464,173 |
| Average   | 1,109,753                      | 240,150                              | 16,140               | 1,366,043 |

Table 6. Mexican fruit fly trapping data

Complete trapping data for Mexican fruit flies (*Anastrepha ludens*, *A. serpentina* and *A. striata*) are presented in **Attachment 5**.

| Year<br>Municip. | Number of Fruit Flies Trapped During Current and Proposed Shipping Seasons by Municipality |  |           |         |
|------------------|--|--|-----------|---------|
|                  | Periban  | Salvador Escalante                       | Tancitaro | Uruapan |
| 1997             | 0  | 0  | 0         | 0       |
| 1998             | 0  | 0  | 3 (Nov)   | 0       |
| 1999             | 0  | 0  | 0         | 0       |
| 2000             | 0  | 4 (Jan)<br>4 (Feb)<br>3 (Mar)<br>2 (Apr) | 0         | 0       |

## Evaluation of the Applicability of Existing Risk Analyses to Proposed Changes to the Mexican Hass Avocado Import Program

The 1995 risk management analysis (Miller, *et al.*, 1995) identified two elements of the systems approach, “winter shipping only” and “limited U.S. distribution,” that are directly impacted by the proposal to expand the shipping season and the distribution area in the United States.

The risk management analysis concluded that “winter shipping only” reduces the pest risk of fruit flies. The analysis estimated a risk reduction between 60 and 90 percent for fruit flies, given the winter shipping only restriction. According to the 1995 risk management analysis, “The majority of reduction in pest risk from this element would be from limited adult fruit fly activities under colder temperatures in the growing areas in Mexico.” Given this assumption, the question arises: Would extending the shipping season for two additional months to include March and April result in fruit being shipped from orchards with high rates of adult fruit fly activity? Trapping data collected as required by the current program (**Attachment 5**; see above) would indicate this is not the case. In four years of trapping, only five fruit flies have been captured during the months of March and April. All five of those captures (three in March and two in April) occurred in a single season (2000) and in a single municipality (Salvador Escalante.) Climatological data presented in the Sequeira, *et al.*(2001) study indicate that even in the very unlikely event fruit flies were shipped with Mexican Hass avocados, escaped detection and arrived during the months of March or April, temperatures in the approved and proposed States would still fall below the optima for fruit fly activity.

Furthermore, Sequeira, *et al.* (2001) concluded that sampling evidence and statistical analysis showed that the likelihood of introducing a mating pair in shipments of up to a million avocados is low.

The risk management analysis estimated that limiting U.S. distribution would significantly reduce the risk of all nine analyzed pests. The reduction was estimated to range from 95 to 99 percent for all of the pests except the avocado stem weevil, *Copturus aguacatae* (90 to 99 percent) and hitchhikers (75 to 95 percent.) The authors attributed this reduction to the low prevalence of host material and the reduced likelihood of survival of these generally tropical or subtropical pests in northern U.S. States. The same is true for the twelve States proposed for addition to the list of approved States. None of the additional States supports the growth of avocado (Sequeira, *et al.*, 2001), the sole host of avocado seed and stem weevils and the preferred host of the seed moth. Although the weather conditions appropriate for *Anastrepha* spp. include a wide range of temperatures, prolonged low winter temperatures inhibit fruit fly establishment. According to Sequeira, *et al.*, 2001, winter temperatures are low enough to prevent establishment in all of the States proposed for addition to the list of approved States.

The 1995 risk assessment document qualitatively estimated the Pest Risk Potential (PRP) for the avocado seed weevils, stem weevil, seed moth and fruit flies based on the pests' climatic needs, host range, dispersal potential, economic impact and environmental impact. The addition of the 12 proposed States to the list of approved States and/or the extension of the shipping season do not alter host availability. Nor would they be expected to appreciably impact the other risk elements that comprise the PRP. Consequently, the PRP ratings would be expected to remain at medium for seed weevils, stem weevil and seed moth and high for fruit flies.

The 1995 risk assessment document used scenario analysis and Monte Carlo simulation to probabilistically estimate the likelihood of introducing the above named pests into the United States via imports of Mexican Hass avocados. The risk model for the analysis was comprised of seven nodes corresponding to specific independent events that must occur in order for a pest to be introduced. The impact of the proposed changes in the avocado program and the body of data collected under the current program are summarized below:

**F1: Frequency of shipments (number of boxes imported per year)**

The 1995 risk assessment (as well as the 1996 addendum) estimated that between one and two million boxes of fruit would be imported under the systems approach program. The actual number of boxes imported fell short of the minimum in all but one of the four years the program has been in place. As indicated in Table 3 above, the program averaged only 834,675 boxes per year. Because of this, we believe that the 1995/1996 assessments actually overestimated the risk. It also means that even if the addition of 12 States to the program doubled the number of imported Hass avocados, the actual number of imported boxes would still fall within the range of values in the 1995/1996 estimate and the existing results would remain valid. Given that, as a whole, the population of the 12 additional States is less than the 19 States currently approved, it seems likely that the number of imported boxes would less than double, and fall within the range predicted by the existing estimate for F1.

**P1: Probability pest infests fruit: pre- or postharvest**

The 1996 risk assessment addendum estimated that the value for P1 would range between  $5 \times 10^{-8}$  and  $5 \times 10^{-6}$  for the fruit flies, between  $5 \times 10^{-6}$  and  $5 \times 10^{-5}$  for the seed weevils, between  $1 \times 10^{-3}$  and  $1 \times 10^{-2}$  for the stem weevil and between  $5 \times 10^{-6}$  and  $5 \times 10^{-5}$  for the seed moth. One might suspect that the risk of Mexican Hass avocados being infested with fruit flies (if one accepts that Hass avocado is a host for fruit flies) would increase as the shipping season was extended into March and April based on the assumption that as temperatures warmed fruit flies would become more active. However, as described above, fruit fly trapping data do not support the assumption that there is significant adult fruit fly activity in Michoacan avocado orchards in March and April. Likewise, fruit cutting data in the orchard has produced no finds of any of the pests of concern even after sampling nearly four and a half million fruit during the growing season. Similarly, no pest detections have been made after cutting nearly one million fruit in packinghouse inspections. To date, nearly 3.4 million boxes of Mexican Hass avocados have been shipped to United States under the export program with no target pest finds.



These data suggest that even with an increase in the volume of exports the original risk assessment numbers still represent a reasonable estimate and may even overestimate the likelihood that stem weevils will infest program fruit.

**P2: Probability pest not detected during harvest or packing**

The proposed changes to the export program would not impact the estimates for this node. It is worth noting, however, that in four seasons under the current program, no target pests have been detected after nearly one million fruit have been inspected by cutting at the packinghouse (Table 5.)

**P3: Probability pest survives shipment**

The proposed changes to the export program would not impact the estimates for this node.

**P4: Probability pest not detected at port of entry inspection**

The proposed changes to the export program would not impact the estimates for this node. It is worth noting, however, that in four seasons under the current program, no target pests have been detected after nearly 65,000 fruit have been inspected by cutting at the port of entry (Table 5.)

**P5: Probability fruit is transported to area with suitable hosts and climate**

As stated above, none of the States proposed for addition to the list of approved States supports the growth of avocado (Sequeira, *et al.*, 2001), the sole host of avocado seed and stem weevils and the preferred host of the seed moth. Likewise, all of the additional States pose a low risk for the establishment of *Anastrepha* fruit flies even in the very unlikely event any would be imported on Mexican Hass avocados (Sequeira, *et al.*, 2001). The 1995 risk assessment estimated that between 0.5 percent and 5.0 percent of the imported Hass avocado would be transported to an area with suitable hosts and habitat. This was assumed to be the result of either inadvertent or intentional (smuggling) movement to non-approved avocado growing or fruit fly supporting States. The 1996 addendum reduced these estimates to between 0.05 percent and 2.0 percent as a consequence of the requirement for stickering that was included in the final rule published February 5, 1997.

Actual data for seizures of fruit outside the approved States (Table 4) indicate that in the 1997-1998 and 1998-1999 shipping seasons, 0.12 percent and 0.36 percent of boxes of imported Mexican Hass avocados were intercepted outside of the approved States. Assuming, for the sake of argument, that all of these intercepted boxes ended up in areas with suitable hosts and climates, that places the actual values well within the range of predicted values. Beginning midway through the third year of the program (1999-2000) a more stringent compliance requirement became effective. Consequently in the 1999-2000 and 2000-2001 shipping seasons 0.004 and 0.006 percent of the imported boxes of Mexican Hass avocados were intercepted outside of approved States (Table 4.)

Given the reduced levels of fruit leaving the approved States under the stronger compliance requirement, even if one assumes not all diverted fruit is intercepted, the estimates in the 1995 and 1996 risk assessments are, at the very least, accurate and more likely overestimate the likelihood that fruit will be transported to an area with suitable hosts and climate.

**P6: Probability infested fruit in suitable habitat leads to outbreak**

The proposed changes to the export program would not impact the estimates for this node.

Conclusion

We have reviewed the 1995 risk management analysis (Miller, *et al.*, 1995; **Attachment 1**), the 1995 risk assessment and its 1996 addendum (USDA, 1995; **Attachment 2**; USDA, 1996; **Attachment 3**), the draft document, entitled “Identification of Susceptible Areas for the Establishment of *Anastrepha* spp. Fruit Flies in the United States and Analysis of Selected Pathways” (Sequeira, *et al.*, 2001) (**Attachment 4**), shipping and inspection data from the current program (Tables 3-6; **Attachment 5**) and other relevant information. We find that the evidence, assumptions and conclusions of the 1995 risk management analysis and the 1995 risk assessment and its 1996 addendum remain valid even if the proposed changes are made to the Mexican Hass avocado program.

This memo has been reviewed by Edwin Imai and Gary Cave of the Plant Protection and Quarantine, Permits and Risk Assessment Staff, Wayne Burnett of the Plant Protection and Quarantine, Phytosanitary Issues Management Team and Charles Miller of the Policy and Program Development Risk Analysis Staff and they are in agreement with the conclusions herein.

## References

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Sequeira, R., Millar, L. and Bartels, D. 2001. Identification of Susceptible Areas for the Establishment of *Anastrepha* spp. Fruit Flies in the United States and Analysis of Selected Pathways. North American Plant Protection Agency, Ottawa, Canada. (In Press) (**Attachment 4**)

USDA. 1995. Importation of Avocado Fruit (*Persea americana*) from Mexico: Supplemental Pest Risk Assessment. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Riverdale, MD. (**Attachment 2**)

USDA. 1996. Importation of Avocado Fruit (*Persea americana*) from Mexico: Supplemental Pest Risk Assessment- Addendum I: Estimates for the Likelihood of Pest Outbreaks Based on the Draft Final Rule. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Riverdale, MD. (**Attachment 3**)

USDA. 2000. Guidelines for Pathway-Initiated Pest Risk Assessments. Version 5. <http://www.aphis.usda.gov/ppq/pracommodity/cpraguide.pdf>.