



Introduction

The aims of the *first* edition of the **Regulatory Response Manual** were:

- To collect and organize the wealth of day-to-day experience, expertise and information compiled in 1996 by staff members who enforced California's Mediterranean fruit fly quarantines in the Los Angeles Basin and Ventura County.
- To provide a “nuts and bolts,” real world approach to the initial implementation and maintenance of regulatory guidelines and restrictions during a quarantine, to assist those federal, state and county officers whose future assignments might include one.

Taking this approach enhanced the utility of the manual in several different settings, from predominantly urban, to agricultural, to mixed-use areas of the State.

Although there are action plans and procedural manuals for invasive fruit fly quarantines, as well as archival information files available from previous quarantines, there is no handbook, *per se*, on the daily regulatory priorities that need to be addressed in actual practice during the *first two weeks* of a declared quarantine. This manual seeks to correct that deficit.

The first edition was a “snapshot” of regulatory priorities between the years 1994-96. Assembling it involved reaching consensus among the contributors regarding topics, choosing the format for each section, and organizing sections based on regulatory priorities.

The first edition had an appendix for each section that contained standard regulatory documents. Although its focus was on the first two weeks of a quarantine, it did attempt to address maintenance aspects of both longer-term area-wide, as well as smaller short-term, quarantines.

This *second* edition was prepared to widen the scope of the manual and bring it up to date. The new version now addresses those procedural elements common to conducting quarantines for all types of invasive fruit flies, including the Medfly. Reflecting the wider scope of this edition, it has been renamed the **Invasive Fruit Fly Regulatory Response Manual**.

This manual will continue to evolve over time as new crop trends develop, additional agricultural pest control techniques are adopted, and regulatory priorities change. Periodic updates of each section will be issued as revisions are made.

The editors continue to encourage the submission of helpful comments and suggestions from manual users and reviewers. We are solely responsible for any errors of omission or commission that resulted from its production.

We acknowledge our profound indebtedness to all those regulatory officers in federal, state, and county agencies, who have provided documentation of all their field and office activities involving invasive fruit fly quarantine compliance and enforcement. This manual would not have been possible without their continuing contributions.

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National Plant Board Principles Of Plant Quarantine

(Adopted by the National Plant Board, 1931,
Amended 1936)

1. **Definition.** A quarantine is a restriction imposed by duly constituted authorities, whereby production, movement, or existence of plants, plant products, animals, animal products, or any other article or material, or the normal activity of persons, is brought under regulation, in order that the introduction or spread of a pest may be prevented or limited, or in order that a pest already introduced may be controlled or eradicated, thereby reducing or avoiding losses that would otherwise occur through damage done by the pest or through a continuing of control measures.
 2. **Basis In Logic.** Since the ends to be attained by a quarantine and the measures required by it could not be undertaken by private individuals or groups, involving as they do restrictions on areas, persons, or activities for the benefit of wider interests or the public at large, resort to regulation imposed by public authority is logical.
 3. **Necessity.** Establishment of a quarantine should rest on fundamental prerequisites, as follows: (1) the pest concerned must be of such nature as to offer actual or expected threat to substantial interests; (2) the proposed quarantine must represent a necessary or desirable measure for which no other substitute involving less interference with normal activities, is available; (3) the objective of the quarantine, either for preventing introduction or for limiting spread, must be reasonable of expectation; and (4) the economic gains expected must outweigh the cost of administration and the interference with normal activities.
 4. **Legal Sanction.** A quarantine must derive from adequate law and authority and must operate within the provisions of such law.
 5. **Validity.** A quarantine established for the purpose of attaining an objective other than that which it indicates or defines is open to serious criticism, even though the actual objective is itself desirable.
 6. **Public Notice.** If the circumstances will permit, public notice of a proposed quarantine should be given and those interested should be invited to contribute facts in their possession, but if the object would be defeated by the delay required for such notice and discussion, duly constituted authorities should assume responsibility for the decision to impose or withhold quarantine action.
 7. **Scope.** The extent of restrictions imposed by a quarantine should be only such as are believed necessary to accomplish the desired end but on the other hand, the objective of a quarantine should not be jeopardized by omission of any necessary restrictions.
 8. **Relation To Eradication.** If a quarantine is imposed in order that eradication of a pest from a given area may be undertaken, the restrictions involved may properly be relatively extensive, because of the importance of the objective sought, and because the time through which the quarantine will operate may be expected to be relatively limited.
 9. **Relation To Retarding Spread.** If a quarantine is imposed for the purpose of limiting or retarding the spread of a pest, but without expectation of eradication, the restrictions should be such as are in line with the objective of the quarantine and should recognize the fact that continuance of the pest in the area where it is established, or possibly its spread in time to new areas, is accepted. *[Both the United States Department of Agriculture and the California Department of Food and Agriculture now give consideration to revoking a quarantine if eradication or intensive control is not possible]*
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10. Cooperating Authorities. Since quarantines usually involve relations between public authorities, such as those of the government of one country with that of another, or of federal and state governments, or of state government and local authorities, the cooperative relationship that is necessary to adequate enforcement should be clearly recognized and duly provided for.

11. Cooperation Of The Public. Because of the fact that the success of a quarantine requires that its restrictions be fully maintained, it is essential that all persons who are affected by it adhere to its requirements. In order that this end may be attained, the administration of a quarantine should seek the intelligent cooperation of the public affected, rather than depend exclusively on police powers, the imposition of penalties, or resort to court action.

12. Clarity. In order that a quarantine may be administered readily and consistently, it should be designed with care, should be phrased clearly, and should be made as simple as is consistent with legal requirements and the objectives to be attained.

13. Information Service. Since the persons affected by a quarantine may not reasonably be expected to possess full or accurate knowledge of the circumstances that make it necessary, or the nature and importance of the aim sought, and since compliance with quarantine restrictions will be more complete if the objective and plans are understood, measures should be taken to set forth the conditions existing, the means to be employed, and the end to be attained, and these measures should be continued from time to time as the undertaking proceeds toward accomplishment.

14. Research. If an emergency requires the establishment of a quarantine before satisfactory biological data are available, provisions should be made as soon as possible for extending the Fund of Biological Knowledge. The authority that exercises the right to establish the

quarantine should command or secure the means for biological research, both in order that the quarantine may be made more efficient, and in order that the restrictions may be lessened where possible. The need for research, however, should not be permitted to delay the establishment of a quarantine believed by authorities to be desirable, thereby jeopardizing the objective that might otherwise have been attained.

15. Modifications. As conditions change, or as further facts become available, a quarantine should promptly be modified, either by inclusion of restrictions necessary to its success or by removal of requirements found not to be necessary. The obligation to modify a quarantine as conditions develop is a continuing obligation and should have continuing attention.

16. Repeal. If a quarantine has attained its objective, or if the progress of events has clearly proved that the desired end is not possible of attainment by the restrictions adopted, the measure should be promptly reconsidered, either with a view to repeal or with intent of substituting other measures.

17. Notices To Parties At Interest. Upon establishment of a quarantine, and upon institution of modifications or repeal, notices should be sent to the principal parties at interest, especially to federal and state authorities and to organizations representing the public involved in the restrictive measures.

18. Use Of Natural Boundaries. In defining the boundaries of a quarantined area, it is usually desirable to utilize state, county, or township lines. However, if a substantial natural feature, such as a mountain range or a large river, more correctly defines the actual area, such natural features should be utilized in the description of a quarantined area. *[Added 1936]*



Selected California Food and Agricultural Code Sections that Address Quarantine and Invasive Fruit Flies Issues

5321. If the secretary receives information of the existence of any pest, which is not generally distributed within this state, he shall thoroughly investigate the existence and probability of its spread, and the feasibility of its control or eradication.

5322. The secretary may establish, maintain, and enforce quarantine, eradication, and such other regulations as are in his or her opinion necessary to circumscribe and exterminate or prevent the spread of any pest, which is described in Section 5321.

5323. This division and the regulations which are established pursuant to this division are of a statewide interest and concern and are intended to occupy the field. No local jurisdiction shall adopt ordinances, laws, or regulations, which prevent, hinder, or delay the effect or application of this division or regulations established pursuant to this division. Regulations established pursuant to this division are not valid unless they are clearly consistent with a strict interpretation of this division and are necessary to effectuate the purpose of this division. The adoption of the regulations does not create any presumption of their necessity or validity.

5701. (a) If any pest exists on any premises, the secretary or the commissioner may hold any plant or other host or possible carrier which is, or may be, capable of disseminating or carrying the pest. The secretary or the commissioner also may hold the plants, other hosts, or other possible carriers on any premises within five miles of the premises on which the pest was found to exist. The secretary or commissioner shall notify the owner of the plant or other host or possible carrier, or his or her agent, of this action, and the issuance of any shipping permit or nursery stock certificate with respect to the plant or other host or possible carrier shall be refused and any such permit or certificate which has been previously issued shall be revoked.

(b) The distance from the premises at which a pest is found that the secretary or commissioner may hold plants, other hosts, or other possible carriers shall be the maximum distance that the secretary or commissioner determines the pest is likely to travel, but not to exceed five miles.

5702. If, in the opinion of the secretary or commissioner, the plant or other host or possible carrier is not infested or infected with the pest, or has been disinfected or cleaned so as to eradicate or control the pest, the secretary or commissioner shall in writing release it or issue the shipping permit or nursery stock certificate as the case may be.

5703. This article does not affect any other authority which is granted to a commissioner by Chapter 3 (commencing with Section 6501), Part 2 of this division.

5704. It is unlawful for any person to move any plant or other host or possible carrier from the premises on which a hold notice has been issued, except under the written permission of the secretary or commissioner and in accordance with the conditions which are stated in the written permission.

5705. (a) The secretary or commissioner may enter into compliance agreements with any person which provide for the movement of hosts or other possible carriers of any pest from one area of the state to another. These agreements shall establish the treatment, harvesting, packing, and handling requirements that may be necessary to assure that the hosts or carriers are not infested.

(b) Violation of the treatment, harvesting, packing, or handling terms of a compliance agreement is unlawful.

(c) Any person who violates treatment, harvesting, packing, or handling terms in an agreement is also liable civilly in an amount not exceeding ten thousand dollars (\$10,000). This remedy is in addition to, and does not supersede or limit, any and all other remedies, civil or criminal, that otherwise are available to the state.

(d) Any funds recovered by the department pursuant to this section shall be deposited in the Department



of Food and Agriculture Fund for use, upon appropriation by the Legislature, to cover costs related to the enforcement of this division.

6321. It is unlawful for any person to import into, or transport thereafter within, the state any plant, fruit, or vegetable which is known to be, or may become, a host of any species of the fruit fly family Tephritidae from any territory, state, or district where such species of Tephritidae is known to exist except under permit and regulation of the director if the director finds that the species is harmless to agriculture or that an effective treatment of the hosts eliminates fruit fly risk.

6322. Any plant, fruit, or vegetable which is known to be, or which may become, a host of any species of the fruit fly family Tephritidae, together with its containers and packing, shall be refused entry or transportation within the state.

6323. Any plant, fruit, or vegetable which is known to be, or which may become, a host of any species of the fruit fly Tephritidae, which is imported into, or transported thereafter within, this state shall be immediately destroyed at the expense of the owner or bailee unless it is imported or transported under permit and in accordance with regulations of the director.

Title 7 – Agriculture, Code of Federal Regulations

Chapter III – Animal And Plant Health
Inspection Service, USDA

Part 301 – Domestic Quarantine Notices

Section 301.64 – Mexican Fruit Fly

Section 301.78 – Mediterranean Fruit Fly

Section 301.93 – Oriental Fruit Fly

Section 301.97 – Melon Fruit Fly

Note: Section 105 of the Federal Plant Pest Act (7 U.S.C. 150dd) provides that the Secretary of Agriculture may, under certain conditions, seize, quarantine, treat, destroy, or apply other remedial measures to articles that are, or that the Administrator has reason to believe are, infested or infected by or contain plant pests.



Overview Of Tephritid Fruit Fly Biology

Tephritid fruit flies are a group of small (1/5" to 1/3") to medium-sized (3/4") flies, with general body coloration that can be in the red, orange, yellow or black ranges. Their wings generally have brownish streaks, and may also display scattered dark spots.

Tephritid fruit fly eggs are slender, white, and have an elliptical shape, are less than 4 to 8 hundredths of an inch in length, and typically laid in batches of 3 to 40, under the skin of the host fruit. The larvae (=maggots) lack an easily distinguishable head region, are cylindrical in shape with stubby anterior and posterior ends, approximately 1/2" long, and creamy white in appearance. The contents of their guts are often visible through their skin, and large numbers can colonize the flesh of individual host fruits.

The puparium (pupa case) can be colored either dull white, dark brown or black, is just over an inch long and usually found in soil from 2" up to (rarely) 6" deep. All species are damaging to fruit and some Tephritid species will attack flowers and plant stems as well. The fruit fly host material (FFHM) for some of these flies includes several dozen tropical and temperate species of fruits.

Treatment And Harvest Schedules

Degree Days

Adherence to a treatment and harvest schedule, based on degree-days, provides a very high probability that the risk of fruit infestation by invasive fruit flies has been eliminated and allows growers, packers and shippers to move their product out of the quarantined area legally. Calculations based on average temperatures for each day of the month, using 30 years of climate data, are used to develop this treatment and harvest schedule for the duration of the quarantine.

This schedule takes into account the length of the invasive fruit fly's life cycle throughout the quarantine period. Once it has been calculated, the schedule is distributed to each grower who has signed quarantine compliance and bait treatment agreements. Growers are then required to arrange and conduct their treatment and harvest plans in accordance with this information. The degree-days model used for the grower bait treatment and harvest schedule may be modified during the course of a quarantine.

Life Cycle Projections

The life cycle projection is updated every week using current daily air and soil temperature information. As actual temperature data is collected, the potential emergence dates of subsequent generations of the invasive fruit fly are recalculated and refined, to guide ongoing eradication and regulatory activities.

In some situations, sterile invasive fruit flies, if available, are released over an amount of time equivalent to two life cycles of the pest. Following this, fruit fly trap densities around each of the original invasive fruit fly find sites are increased to 80 McPhail traps per square mile in the core area and 40 McPhails per square mile in the surrounding eight square miles, for one additional life cycle (i.e., the third, often referred to as the "F3"). If no "feral" (wild and fertile) flies are detected, the infestation



will be officially declared eradicated. Only then, upon notification by the staff of the Invasive Fruit Fly Project, will the quarantine regulations be lifted.

Definition: Degree-Days

The total amount of heat required for an organism to develop from one point to another in its life cycle is calculated in units called "degree-days." Temperature controls the developmental rate of all insects, including invasive fruit flies. These insects require a certain range of heat in the fruit to develop from egg to larva, and then in the soil to develop from pupa to adult. The amount of heat required to complete a given stage of an organism's development does not vary – the combination of temperature (between the upper and lower ranges of tolerance) and time will always be the same. This "physiological" time is often expressed and approximated in the units called "degree-days."

The degree days mathematical model incorporates the average temperature over time in a particular area of infestation, and that is used to calculate the length of an invasive fruit fly species' life cycle. Day degrees are the product of the following formula, with all temperatures measured in °F:

[(Minimum Daily Temperature + Maximum Daily Temperature)/2] – °F optimal for the fly species = Day Degrees.

Definition: Life Cycle Projections

Determined by a life cycle formula utilizing degree-days. Invasive fruit fly development from egg to adult can be predicted by measuring the accumulation of degree-days through the daily monitoring of air and soil temperatures within the eradication area. This measurement is an approximation, and involves factoring in the various microclimates that may exist in the eradication area.

Each species of invasive fruit flies requires a defined number of degree-days to complete its development. Each developmental stage of an invasive fruit fly (i.e., larva, pupa, etc.) has its own total heat requirement (accumulated degree-days). Development can be estimated by accumulating degree-days between the temperature ranges of tolerance for invasive fruit flies throughout the season. The accumulated degree-days from a starting point (the date of the first fly find) can help predict when each developmental stage of the fly's life cycle will be reached. When a certain number of days has passed – equivalent to a defined number of life cycles – with no feral invasive fruit flies found in traps, then the eradication efforts can be declared a success and the quarantine restrictions on regulated commodities removed.