
**MASS TRAPPING: A VERY GOOD METHOD FOR THE
CONTROL OF FRUIT FLIES (Diptera:Tephritidae)**

TECHNICAL DOCUMENT

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1. INTRODUCTION: MONITORING AND MASS TRAPPING

Traditionally, traps and attractants have been used to detect fruit fly species and to determine the flight periods and the abundance of adults in these periods. This information is used to decide when and where to apply chemical treatments. This is known as fruit fly monitoring.

For some years now, thanks to improvements in the traps and lures, as well as in the way to implement them, it has been found that a proper placement of a given density of traps in the orchards allows the capture of a number of flies high enough to prevent damage to crops. That is, these improvements have led to the traps not only to be useful for monitoring, but also to control some fruit fly species by mass trapping. In many cases, you do not need to apply any pesticide against fruit flies.

Needless to say that this entails significant health benefits (no residues in fruit and the environment) and ecological (beneficial insects practically not affected).

In the case of fruit flies, mass trapping should allow the capture of the highest possible number of adult flies (especially females) to significantly reduce the population and thus avoid punctures (stings) and oviposition in the fruits.

As will be seen later, this already is being achieved in some species and is being implemented successfully in different countries, especially in the Mediterranean.

2. CURRENT SITUATION IN SPAIN

Since 2006 the area devoted to *Ceratitis capitata* mass trapping has varied between 10000 ha and 30000 ha. These areas include citrus, stone fruits, peaches and grapes.

The olive fruit fly, *Bactrocera oleae*, decades ago is controlled by mass trapping (with liquid attractants) in more than 5000 hectares of olive groves.

Greece, Israel, France and Italy are countries where mass trapping for fruit flies is also established.

3. EFFICACY OF MASS TRAPPING

In Spain, the efficacy of mass trapping has been demonstrated by agricultural research centers (IRTA, IVIA) as well as by public Plant Health Services. Some of these results can be found in bibliography: Alonso & García-Marí 2004; Vilajeliu et al 2007; Leza et al 2008; Navarro-Llopis et al 2008; Martínez-Ferrer et al 2011.

Outside Spain, jobs with equivalent results are numerous (Agunloye 1987; Broumaset al 2002; Mc Quate et al 2005). This is also seen in papers presented at the “International Symposia on Fruit Flies of Economic Importance”, at the meetings of the working group “Integrated Control in Citrus Fruit Crops” of the IOBC/WPRS and at TEAM meetings.

In the case of *C.capitata*, different authors agree that for varieties not too sensitive to fruit fly, a proper application of mass trapping can make unnecessary the application of chemical treatments. However, in highly sensitive varieties, it may be convenient to combine the mass trapping with some additional chemical treatment.

In the case of *B.oleae*, despite being in the process of optimizing the attractants, now there are varieties that are controlled successfully with this technique only.

As recognized by several authors, one of the main advantages of mass trapping in relation to chemical treatments (both general and focused with bait) and to attract& kill is that it is, by far, the most respectful of beneficial insects.

4. FACTORS INFLUENCING THE EFFECTIVENESS OF MASS TRAPPING

A first idea to take into account when making the decision to use the mass trapping as a tool to control fruit flies is that its method of action is clearly different from the traditional application of insecticides.

Insecticides cause strong declines in the population of adults at the time of their application, but they don't affect individuals that at this moment are larvae or pupae. This means that after each application fly populations usually recover quickly, also over wide areas.

Mass trapping, however, has a less drastic action when it is placed, but its effect is continuous: the fly traps, throughout the life of the attractant (between 90 and 120 days), capture continuously the adults emerged in the orchard or coming from neighboring areas.

Therefore, as the mass trapping continuously reduces the population, is a safeguard against damage by sharp increases in population not forecasted.

The main factors to be taken into account when applying mass trapping are the following:

4.1. The attractant

For fruit flies, as it is essential to capture the highest possible number of females, the most effective attractants are alimentary. Of these there are formulated in liquid and there are formulated in dry diffusers.

The liquids are non-specific and may attract different species of fly. The products used are hydrolyzed proteins and diammonium phosphate. In general, liquid attractants are cheaper, but less practical and effective than dry, although for many species are still the only viable option.

Dry attractants, although requiring a development and production more expensive, are easier to handle and, as they tend to be more specific, are clearly more efficient and reduce catches of beneficial insects (Thomas 2003). *C.capitata* is the fly that currently has a wider range of dry attractants on the market, most of them based on the combination of ammonium acetate, trimethylamine and a diaminalcane. For most of the other species there are no dry attractants working well yet.

4.2. The fly trap

It is a main point. Not all traps are equal. They have to facilitate the diffusion of the attractant and the entrance of the flies, and prevent the exit.

The best designs are those that combine:

- a) Color and shape attractive for the fly;
- b) outer surface that doesn't facilitate the escape of the fly once stopped there;
- c) entry points adapted to the external shape of the trap, without obstacles for the fly to accede;
- d) devices inside to difficult the finding of the exit points;
- e) adequate ventilation for proper dissemination of the attractant.

The ideal trap is also easy to use, has low costs of transport and placement in the field, and is made from biodegradable materials.

In addition, in the case of liquid attractants, as one of the problems is that they evaporate very quickly and that to maintain its effectiveness you need to replace them during the season, the best suited traps are those that combine optimally the volume of fluid that may contain, the ventilation (rate of evaporation of the liquid) and a certain ease to refill them.

4.3. Insecticide into the fly trap

When working with dry attractants, for the mass trapping to be effective, it is essential to incorporate some type of insecticide into the trap that prevents the exit of flies caught and does not interfere with the attractant.

Although the insecticides used are volatile (like DDVP) formulated in solid supports, currently the best results are obtained by applying contact insecticides on the inner part of the lid of the fly traps.

4.4. The date of placement

The traps should be placed at least 15 days before the beginning of fruit ripening. Therefore, this date depends on the particular crop cycle (variety, geographic area, weather of the season, ...).

Because the efficacy of the trapping should be highest during the period of fruit ripening, the persistence of the attractant must be known and decide whether to replace it during the season.

4.5. The density of the fly traps in the field

This varies depending on the sensitivity of the fruit (variety) to the fly species to be controlled, the kind of attractant and trap to use, and the characteristics (air temperature, relative humidity, wind) in the area where mass trapping takes place.

As an example, in the following table, recommended densities for *C.capitata* in different crops of the Iberian peninsular area with PROBODELT Maxitrap or Conetrap fly traps and with optimal long-term dry attractants (between 90 and 120 days), are shown:

CROP	DENSITY (traps/ha)
Citrus moderately sensitive (Clemenules)	25
Citrus sensitive (Loretina, Marisol)	50
Peaches and nectarines	70
Kaki	80
Apple	50
Grapes	50

In general, as discussed in the following section, in small plots and in plots with sensitive fruit trees around, it is recommended to increase the density of traps at the periphery of the orchard.

4.6. The surface of the plot and the characteristics of the environment in the area of mass trapping

To go well, the mass trapping areas should be relatively large (not less than 5 ha) with little perimeter (the more square plots the better).

In the case of smaller or very elongated plots is essential to strengthen the perimeter with a higher density of traps, and not be ruled out any additional chemical treatment related to events of fly population increases.

The presence of trees attractive to flies (the case of figs is a paradigm) around the area of mass trapping must bear in mind because they may be a very important source of fly (Alonso & García-Marí, 2011). Before placing the traps, the presence of abandoned fruit trees or plots with fruit on the ground around the orchard should also be investigated because, in these cases, the density of traps in the periphery will have to be increased.

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