Development of a protocol for the planning and implementation of a pilot trial using SIT against codling moth in Europe

Dates: 13 – 17th February 2017

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Figure 1: most of the attendees of the workshop.

Headline

These bullet points (between 1-5 as guidance) should be written to flag up key grower-relevant highlights that will encourage a reader to continue exploring the report. The bullet points should succinctly answer the question: "As a result of this travel grant, what could the UK Protected Crops and Outdoor Ornamentals sector look out for?"

- Sterile Insect Technique (SIT) involves the mass release of sterilised males in sufficient numbers to outcompete the wild males and therefore block production of the next generation.
- SIT provides a method for controlling or the complete removal of specific insect species from targeted areas without applying chemical pesticides or any other environmentally damaging materials.
- The technique has been used successfully to control several insect species in large geographic areas.

- SIT may be highly suited to controlling insects in protected crops due to the closed environment reducing influxes of wild insects.

Background

Text highlighting the organisational aspects of the visit: who attended: crops covered: value of the event, etc (max 200 words).

This event was organised by the Okanagan-Kootenay Sterile Insect Release Program (OKSIR) and the International Atomic Energy Agency (IAEA) which also hosted the workshop. The attendees included scientists from around Europe, the USA, and Canada. The list of attendees was as follows: Dr. Chris Adams and Prof. Larry Gut from Michagan Stage University, Agnès Verhaeghe from Le CTIFL, Claudio Loriatti from FMACH, Dr. Philippos Ioannidis (independent), Dr. Herman Helsen from Wageningen University, Prof. Johannes Jehle from the Julius Kühn Institute, Dr. Massimo Cristofaro at ENEA, Dr. Panagiotis Milonas at the BCL, Dr. Sylvia Bluemel at the University of Natural Resources and Life Sciences in Vienna, Dr. Marc Vreysen and Dr. Rui Cardoso Pereira from the IAEA.

The main crops being discussed were Pome fruit with additional comments on the suitability of SIT for strawberry, raspberry, cherry, and grapevines.

Travel Findings

Text that expands on the Headline bullet points and explains in more detail what/why/how/when the 'advance' could be put in to practice by growers/consultants/researchers. This is the main text body of the report which may include: relevant financial info, action points, and sources of related information – anything that the Travel Grant Recipient thinks an industry member would find useful to put that 'Highlight' in to practice. (500-1500 words)

The main output of the event was the creation of a document that outlines the protocol stakeholders should use to run field trials to investigate and develop the use of Sterile Insect Technique (SIT). The target pest is *Cydia pomonella* (codling moth) in apple, pear, and walnut crops, but the methods and processes discussed are applicable to a wide range of crop pests. It was discussed several times that SIT is suitable for control of pests in closed environments such as protected crops. It was reported that SIT has been developed for pests such as *Liriomyza bryoniae* (tomato leaf miner) and *Trialeurodes vaporariorum* (greenhouse whitefly) but were not yet commercially available. It has also been proposed that the glasshouse pests *Frankliniella occidentalis* (western flower thrip) and the species from the genera Sciaridae and Mycetophilidae (fungus gnats) are also suitable candidates for SIT.

Codling moth is the principal pest of pome fruit and walnuts that growers must control to produce marketable crops. Without effective control, losses can exceed 50% of the crop (Wise et al., 2015). Managing this key pest has become quite challenging for fruit growers due to loss of compounds through legal restrictions or insecticide resistance, coupled with the high cost of the development of new insecticides. Growers around Europe apply up to 4-5 insecticide sprays per season to control codling moth, and in the UK insecticide sprays to control the pest account for well over one third of total applications. These have substantial input costs for the grower. Increasing costs, lack of control options, concerns about worker safety and the public's interest in reducing the use of chemical

insecticides have placed traditional spray practices under increasing scrutiny and heightened grower impetus to adopt alternative pest controls.

For several insect species SIT has proved effective as a means of greatly reducing population densities over a wide area (Klassen and Curtis, 2005). The approach entails sterilization of reared insects that are subsequently released in large numbers to compete with the wild males for mating with wild females. The goal is to greatly reduce or even eliminate fertile matings and thus offspring (Lance and McInnis 2005).

An area-wide program using SIT for codling moth management has been conducted since 1994 in the pome fruit producing areas of the south-central part of British Columbia. The pest's population density and damage to fruit in the target region have been substantially reduced over the years; however, the pest has not been completely eradicated. Maintaining the necessary over-flooding ratio of 40 sterile moths to 1 wild moth (Proverbs et al., 1982) has proved difficult, as has the programs ability to eliminate codling moth from residential and other non-commercial properties. One of limitations to using SIT for large areas is influxes of wild populations migrating into target areas after or during deployment of the SIT moths. This upsets the ratio of sterile to wild moths required for elimination of the next generation in that area. However, this problem should be much easier to manage for protected crops, as the closed environment means influxes of large numbers of wild insects are much reduced.

One of key technical difficulties of implementing SIT is producing the required number of sterile males at the correct time. There are three important factors to consider: identifying the correct time for release, accurately estimating the wild population number, and timely mass rearing of the insects at the production centre. Identifying the correct time for release can be achieved by monitoring of the pest and/or damage, as well as pest prediction methods such as population modelling. To accurately estimate the number of individuals in the population, tools for pest monitoring (e.g. sticky traps) need to be calibrated against real data. When these two pieces of information are known the SIT centre must be able to deliver the correct number of sterile males at the correct time.

Another important aspect to consider for any SIT projects is the public perception. Both irradiating and genetically modifying insects to produce sterile males is likely to raise concern in the general public and potential users of the technology. Therefore, any projects investigating the use of SIT should contain a component of public relations and information dissemination. In the case of irradiated insects, it should be made clear that the insects being released are not themselves radioactive, and the technique has been used for many years with great success and no known environmental risk. The released insects are safe for other animals to eat and do not pose a health risk to humans.

In summary, the use of Sterile Insect Technique has been used successfully to control many insect pest species. The technique has huge potential for use a pest control method in protected crops that does not rely on chemical pesticides. There are some important challenges that need to be overcome in order to successfully develop an SIT system. However, building on the work already underway in this area, for example for control of Codling moth, will greatly speed up development of systems for other insect pests.

Personal Statement: This section should describe how the work has impacted on you and why it is (or will be) of particular interest to the UK horticultural industry (50-150 words)

The workshop provided an excellent forum for meeting experts in crop protection from Europe, USA, and Canada. Most of the attendees (including myself) gave a short presentation on some of the work they or their organisations do in horticulture, giving us the opportunity to learn about other research groups, areas of expertise, and identify potential collaborations.

With the information I learned on the use of SIT in horticulture I am now much better prepared to discuss the technique with industry and other potential researchers, or to develop a research proposal should the opportunity arise. After the workshop I have been in contact with a Producer Organisation and a company involved in plant protection regarding the use of SIT.

Contact details: Please include your contact details of where a reader may contact you for further information.

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