

Plant Protection—Management of Pest Control Techniques

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PLANT PROTECTION

What is Plant Protection? It is the management of pests of plants to maximize profit, pleasure, and leisure. Plant protection involves using detailed information about plants and pests to minimise the activities of pests so that they are not economically, aesthetically or environmentally important.

What are Pests? Pests are biological organisms capable of interfering with plant production. Pests include insects, plant pathogens, weeds, birds, and mammals. When managing the application of pest control techniques the term “pest” should be used to describe all the biological organisms capable of interfering with plant production.

What is Pest Control? The objective of pest control techniques has often been 100% (kill) of the pest or annihilation. This level of “control” may not be achievable and can be biologically undesirable. In the production of clean, pest-free nursery stock, it may be a requirement and this should be achieved using a combination of pest management techniques and not the over use of a single method.

CONTROL VERSUS MANAGEMENT

The propagation of plants for sale usually involves the production of aesthetically acceptable, pest-free material. The individual pest management (control) techniques are often used in isolation in an endeavor to eliminate pests and all pest related damage. For sound ecological reasons integrated pest management programmes, involving the use of as many management (control) methods as possible in a systematic programme of pest suppression, are being implemented.

The currently available individual methods of pest management must be thoroughly understood if they are to be used as components of a total programme directed at managing all pests important in propagation situations. Current pest “control” methods include:

- Physical and cultural control
- Varietal control (resistance to pests)
- Quarantine and hygiene
- Biological control
- Chemical control
- Integrated control

Physical and Cultural Management (Control). These methods include:

- Use of heat or irradiation;
- Open bench types and structures;
- Management of water use and humidity;

- Removal of infested plant material and pests;
- Planting and cultivation practices.

Varietal Control (Host Resistance). Host resistance to pests is an ideal form of long-term pest control. The aim should be to use resistance in the form of tolerance to major pests and not immunity. However, the number and diversity of pests makes incorporation of resistance to all pests impossible. Often plant propagation will be directed at producing plants which incorporate resistance to pests important in long-term crop production but not for pest problems occurring during propagation such as aphids and *Pythium*.

Quarantine and Hygiene. Quarantine is directed at either containing a pest within an infested area or keeping it out of an area. It is under utilized as a pest management technique. An understanding of pest mobility is essential for the successful use of quarantine and this when combined with hygiene practices can be very effective. The management of people movement is essential in the effective use of quarantine techniques. However, pests will endeavor to break down the quarantine procedures and systems put in place by humans.

The production and use of "clean" planting material is basic to the use of this method of pest management. Quarantine and hygiene should and can be used at the individual plant, propagation unit, nursery, local district, state and national levels to frustrate and minimise the activities of pests.

Biological Control. Biological control is the use of beneficial organisms to limit the activities of pests. This would seem to be an "ideal" form of pest management. However, it depends on the activities of beneficial organisms which may be unpredictable and follow peaks in pest numbers. Biological control will be more effective for some pests than for others, and it requires expert development, monitoring, and management. Because of the artificial situation in which plants are propagated, biological control may need to be supplemented and supported by other pest management techniques.

Other pest management methods, particularly the use of pesticides, will be used in a manner which is least disruptive to biological control agents and will involve determining their effects on the beneficials. Biological control agents may be cultured and formulated for application in host/pest situations. Products containing *Bacillus thuringiensis* are currently available for application using conventional systems of pesticide application.

The best aid to the effective use of biological control can be the strategic use of appropriate pesticides. Mixtures of biologicals and pesticides are being used effectively and viruses, bacteria, fungi, and nematodes are currently being investigated as biological control agents. The effective use of biological techniques requires on-going monitoring as pest, host, and environmental factors change in real situations.

Chemical Control (Management). The major factors influencing the successful use of chemical techniques are understanding the target (host/pest), the product, the method of application, and pesticide safety.

Target Identification. Precise target identification is essential. While pesticides are designed to act at a particular biochemical site in the pest, they are often unfortunately applied to the gross physical target—the total area occupied by the host, and not directed at the ecological target—the actual location of the pest.

Products. Pesticides are sophisticated materials designed to kill pests. Factors such as environmental conditions, formulations, and target location/behavior influence the activity of pesticides. Publications such as *Peskem*[®] and *Garden Peskem*[®] (Registered trademarks of Plant Protection at UQG) list products registered for use and should be consulted to assist with selection of the most appropriate pesticide. The directions on the product label, which is a legal document, must be followed and this along with the information contained in the individual product Material Safety Data Sheets (MSDS) provides a detailed product profile.

Application. Depending on the product formulation and target type and location, pesticides can be introduced to targets by granular, dusting, injection, wiping, or spraying techniques. Liquid formulations of pesticides are the most commonly used and spraying using hydraulic, centrifugal, or airshear systems are the most common methods of application. Attention to the choice, maintenance, calibration, and target orientation of the spraying system is essential for the successful use of chemical pest management methods. The use of selective methods of pesticide application will be an important future development.

Safety. Environmental and personal safety are particularly important in the safe use of pesticides. The selection, storage, handling, and application of products particularly the meteorological conditions at the time of application are important in maximising the effectiveness and minimising the environmental effects of pesticide usage. Personal safety includes understanding, using, and maintaining the protective equipment available. Pesticides are designed to kill biological organisms and must be handled accordingly. The development and use of a safety habit is essential for the safe and effective use of pesticides.

Problems of Chemical Control (Management):

- Over use and abuse of sophisticated products
- Public perception of risk
- Residues on products and in the environment?
- Pest resistance
- Used to cover poor management practices

STOP - READ THE LABEL, UNDERSTAND THE TARGET then use pesticides as part of a programme of pest suppression.

Integrated Pest Management (Control). The original definition by Stern et al. (1959), was “applied pest control which combines and integrates biological and chemical control. Chemical control is used as necessary and in a manner which is least disruptive to biological control.” Biological control was used in its broadest sense to include all factors, except pesticides which may influence the development of pest populations. It is an environmentally compatible approach to pest control with the major features being:

- No reliance on a single method of pest management (control);
- No fire-brigade action using pesticides;
- No unnecessary usage of pesticides on a routine basis.

Plant protection is the development and implementation of integrated pest management programmes for use in particular plant production situations. This involves a detailed understanding of plants, pests, and pest management techniques in particular and the application of this information in a dynamic situation where all the interacting factors are continuously changing.

Plant protection could be likened to the construction of a building with the roof, representing an appropriate plant protection programme, which is economically feasible and environmentally acceptable, being supported by as many pillars, the individual methods of pest management (control), as possible. Detailed knowledge and common sense are essential components of successful plant protection.

PROFESSIONAL PLANT PROTECTION SERVICES

The effective management of pests in plant propagation situations requires an understanding of the principles of all the "control" techniques available for managing pests. Pests are dynamic and continuously changing and therefore plant protection programmes will require on-going professional monitoring and adjustment. Plant protection services are necessary if pests are to be managed successfully using environmentally acceptable and economically feasible plant protection programmes in plant propagation situations.

Full-time and continuing professional education programmes in plant protection are provided by the University of Queensland, Gatton College. The graduates are very active in providing plant protection services to clients from the wide range of plant production enterprises.

LITERATURE CITED

Stern, V.M., R.F. Smith, R. van den Bosch and K.S. Hagen. 1959. The integrated control concept. *Hilgardia* 29:81-101.