Progress in Controlling Disease in Hardy Nursery Stock

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INTRODUCTION

Modern nursery techniques combined with market requirements for quality in quantity have created growing conditions which favour development of epidemic disease. This has been exacerbated by restrictions in pesticide usage and an associated decline in the availability of effective fungicides. This paper outlines three new developments in alternative disease control and illustrates the radical changes in disease management which will be essential for growers in the 1990s.

ALTERNATIVE DISEASE CONTROL METHODS

Biological Control. Biological control agents (BCAs) offer a natural, environmentally-friendly means of controlling disease. In 1991, Grace Sierra began to test market GL 21 in the U.S.A. This product, based on the fungus *Gliocladium virens* and formulated as an easy-to-use prill, shows considerable activity against the damping-off fungi *Rhizoctonia* and *Pythium* (Lumsden and Locke, 1989).

Previous attempts to introduce BCAs into practical use have often been frustrated by difficulties in establishing stable populations of the organisms in the growing medium. Lumsden and Locke (1989) found that *G. virens* remained effective over a period of at least 60 days.

In comparative tests with the fungicide PCNB (quintozene) the control of *Rhizoctonia* stem rot of antirrhinum usually was as good as, if not better than, that achieved with the chemical (Locke et al., 1988).

The performance of GL 21 was not affected by a range of fungicides or insecticides applied before the introduction of the BCA. The fungus is active over a range of conditions but declines above pH 7.9 and where the compost remains wet for long periods of time.

Polymer-Forming Films. There are available several products which, when sprayed onto plants, form a thin flexible anti-transpirant film. These are based mainly on terpenic polymers and products include Vapor Gard, Nu Film P, and Emerald.

At SAC Auchincruive, anti-transpirant films are being evaluated for their potential in disease prevention. Used at the propagation stage, they offer the interesting possibility of reducing transpiration stress without recourse to polythene covers or mist. By reducing the relative humidity around the cuttings the opportunity for the growth of pathogens such as *Rhizoctonia* and *Botrytis* should be drastically reduced. In trials with *Rhizoctonia*, the foliage of all cuttings of *Erica cinerea* 'Alba Major' and *Weigela florida* 'Foliis Purpureis', placed under polythene and inoculated with the fungus two weeks after striking, were dead when assessed 2 weeks later. In contrast, when cuttings were treated with 5% Vapor Gard pre-inoculation none of the cuttings died and only 20% of heath and 30% of weigela

cuttings suffered minor foliar damage. Rooting of weigela was relatively unaffected by a low humidity environment, but rooting of heath was more variable than under polythene.

Tests in established plants so far have been concerned with agricultural crops, but the protectant principles apply equally to hardy nursery stock. A reduction in powdery mildew on barley of 94% compared to untreated and an 83% reduction in brown rust of broad beans using a 2% spray of Vapor Gard illustrates the very effective disease prevention possible using antitranspirant films.

Disease Diagnosis Kits. Stem-base and root problems are a major cause of concern for all HNS growers. Faced with wilting or dying plants urgent action is needed. However, obtaining a diagnosis using standard plant clinic procedures takes so long that by the time a result is obtained the crop may have been consigned to the skip.

For a number of years, attempts have been made to improve pathogen diagnosis using serological techniques. Kits for the detection of virus diseases have been available for some time, but it is only recently that it has been possible to identify fungi using this technology. The kits, detecting *Phytophthora*, *Pythium,* and *Rhizoctonia*, were introduced in the U.S.A. in the late 1980s by Agri-Diagnostics Associates. They are available not only in the standard multiwell plate format, but as unique on-site detectors. These are designed for use by growers and provide results in a remarkable 10 minutes.

McDonald et al. (1990) compared the detection of root pathogens on ornamentals in California using the multiwell kits and standard culture plate techniques. Overall, there was an encouraging degree of correlation between the two methods. A number of samples gave marginal positive results with serological tests, but proved negative by culture plate. This could be related to samples collected from a nursery routinely drenching with metalaxyl and highlights a major problem with culture plate techniques in trying to isolate fungi from fungicide-treated plants. In just a few cases the kits did not detect a pathogen whereas culture plating did. This could have been influenced by the procedure used in selecting tissue for the test.

According to McDonald et al., (1990) the accuracy of the multiwell kits is estimated at 75% when the proportion of diseased to healthy tissue is 0.4%, rising to 95% when the proportion of disease tissue is 1%. Benson (1992) found that both the multiwell and on-site kit formats could reliably detect *Rhizoctonia* on stems of poinsettia cuttings when the lesions were only 1 mm long.

A potentially very valuable application of the kits is in monitoring re-circulating irrigation water for propagules of *Pythium* and *Pythophthora*. As the test kit result is quantitative as well as qualitative, it is possible to detect the build-up of pathogens in water. This promotes the timely application of the first and repeat fungicide treatments and avoids unnecessary pesticide usage (Ali-Shtayeh et al., 1991).

DISCUSSION

There can be no doubt that, for both economic and environmental reasons, the coming years will see radical changes to crop protection in horticulture. Effective disease control will require growers to adopt integrated pest management programmes based on a better understanding of the pathogens and the application

of new technologies. The three areas discussed in this paper are good examples of innovative approaches which already are at, or close to, practical application.

GL 21 promises to be one of the first effective BCA products against important damping-off fungi. It meets environmental requirements and appears not to have the phytotoxic disadvantages which the commonly used fungicides have been shown to cause at the rooting stage of many nursery stock subjects (Holmes and Litterick, 1990). Anti-transpirant films offer considerable advantages over conventional fungicides. They are broad spectrum in activity, simplify crop protection management decisions, are safe for operators, environmentally friendly, and reduce transplant shock. Diagnostic kits offer a revolution in the detection and management of root and stem-base pathogens. Early and accurate corrective action will reduce losses and avoid unnecessary pesticide usage. Importantly, they will enable growers to identify the 50% of situations where root problems are of a non-pathogenic origin. Over the next few years it can be anticipated that a much wider range of kits will be available to growers, not only for the diagnosis of pathogens but for monitoring pesticide residues, resistance of pests to pesticides, etc.

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