16

Formulation of biological control agents

D.J Rhodes

16.1 INTRODUCTION

Biological control, in the broadest sense, could be defined as the use of living agents to control pests, plant pathogens and weeds; in this context both the activities of man and the use of resistant plants might be included. This chapter addresses only the formulation requirements of microbial agents used for crop protection and public health. Although some success is being achieved with the use of parasitoids and predators, especially in the glasshouse industry, and some ingenious formulations have been developed for this purpose, these applications are beyond the scope of this book.

During the past decade, biological control has received increasing attention from the scientific community, the press and the public. This has been fuelled by a desire for non-chemical means of controlling plant pests, pathogens and weeds. The research effort expended in this area has increased dramatically in both public and private sectors over this period, and this is beginning to be reflected in the number of biological control products available in the marketplace. Although sales volume remains modest, these products are achieving substantial rates of sales growth (Wood Mackenzie, 1991) which, in general, outstrip those of the crop protection market as a whole, providing a further impetus for research.
Interest in microbial pest control has also benefited from the anticipated impact of recombinant DNA technology on the exploitation of microorganisms as delivery vehicles for novel peptides and proteins, with the expectation that genetic manipulation may allow inherent deficiencies to be overcome, and greater levels of efficacy to be achieved. The use of genetic manipulation appears likely to raise the development costs of microbial products, costs which must be recouped by increased sales and profits.

Industry, government, and the public, therefore, share high expectations of microbial control. If these expectations are to be fulfilled, appropriate formulations will be required which are capable of exploiting and optimizing the intrinsic properties of biological control agents. Until recently, the published research in this area is disappointingly sparse, in comparison with the considerable volume of literature on intrinsic activity, genetics and mode of action. This may, in part, be due to the fact that much of the information exists as 'trade secrets'; it is frequently difficult to protect formulations adequately through patents. Nevertheless, the development of formulation technology which addresses the requirements of microbial agents will be essential if microbial control agents are to offer realistic alternative approaches to crop protection.

16.2 PRINCIPLES OF FORMULATION

Almost all active ingredients used in crop protection and public health are formulated prior to distribution and sale. Formulation is necessary in order to present the product in a usable form and in order to optimize the efficacy, stability, safety and ease of application of the product. The type of formulation used in any situation will depend both on the application technology which is available and on the active ingredients which are registered for that purpose. Any one active ingredient is likely to be sold in a variety of formulations, depending on local custom in the area of sale, the purposes for which the product will be used, and on the physicochemical properties of the active ingredient such as solubility, volatility, melting point and behaviour at the target site (Barlow, 1985). In addition, the formulations available in the marketplace are constantly changing in response to demands from the user and availability of new formulation and packaging technology. Of prime concern, especially in recent years, has been safety to the user and to the environment, which has tended to favour the use of disposable or degradable packaging, and has increased demand for solid and water-based formulations.

A great variety of formulations are therefore available, and this has led to a need for a standardized nomenclature. All formulation types