EMERGING TECHNOLOGIES IN PLANT PROTECTION

D.A. EVANS

*Zeneca Agrochemicals, Fernhurst, Haslemere,
Surrey GU27 3JE, United Kingdom*

ABSTRACT

Crop protection chemicals, in conjunction with other technologies such as improved seeds, fertiliser use and good husbandry, have played a crucial role in helping farmers feed the burgeoning world population. Given the expectation of the doubling of the world's population in the next fifty or so years, taken together with the requirement for greater food quality and variety world-wide, a combination of the best available technology will be required to continue this record of success. Thus, the integration of crop protection effects delivered via the gene, through chemicals, and using biological control agents will be critical in providing agricultural outputs safely and by sustainable methods. This review provides coverage of some recent highlights of progress in these areas and comment upon progress with integration.

A future perspective for crop protection chemicals

The last years of the millennium represent a time of enormous change within the crop protection world. For over fifty years, organic chemistry has provided a reliable mainstay, but its prominence is being challenged by exciting developments based upon biotechnology. The organic chemists have responded by using biotechnology to greatly augment the input to high throughput 'smart' screens dedicated to unearthing chemistries which are effective at low use rates and which are environmentally and toxicologically benign. Novel screens are challenged with vastly increased numbers of chemical entities, obtained by exploiting advances in combinatorial chemistry, robotics and compound libraries. The emergence of genomics and bioinformatics to aid target identification and validation holds enormous promise for the elucidation of novel pathways for exploitation in crop protection and crop enhancement strategies.

There have been notable advances in formulation and application technology. There has been a move to sophisticated solid formulations with benefits such as controlled release and improved operator safety. One of the most spectacular advances has been in the area of precision agriculture in which irregularities across terrain (eg. pH, organic matter, nutrients) have been mapped using Global Positioning Systems (GPS), accurate to within a few metres. In turn, boom sprayers with adjustable outputs have been developed to deliver an optimal but varied dose across a planted crop.

As a postscript it should be noted that there are at present no promising broadscale alternatives to the use of chemical herbicides. Thus, it is likely that chemicals will remain a keystone of crop protection methods for decades to come.

The potential contribution of bioscience to agriculture

This impressive progress in crop protection chemistry has been matched by advances in the harnessing of bioscience to meet agricultural needs. In 1996, the first transgenic crops were introduced into a few major markets with significant success. Whereas biotechnology-based solutions will not be relevant to all pest, disease and weed problems, there will be many applications which will find favour with farmers and growers. In addition, transgenes will be employed to improve both the quality (eg. flavour) and agronomics (eg. cold tolerance) of crop plants. Thus, the farming of transgenic crops will dramatically change the basis of competition within the crop protection industry. Traditional price structures will change, as will marketing strategies. Public perception of genetically-modified crops presents a most interesting picture. Several groupings hail biotechnology-based agriculture as a green revolution whilst others oppose its use as an unnatural process which unnecessarily tampers with Nature. Processors and retailers beyond the farm gate reflect the uncertainty over the outcome of this issue, and

understandably favour food labelling to provide the consumer with choice. The identity preservation required to support labelling presents significant logistical problems. In the various countries of the world, regulators have the unenviable task of providing legislation to resolve these issues.

Thus, the coming years promise to be nothing if not fascinating. The author believes that the imperative of providing a safe supply of food will dictate that pragmatic solutions be reached on a world-wide basis, albeit with some countries adopting outlying positions. This provides a picture of a world in which integrated crop management, employing effects delivered optimally by combinations of chemicals, genes and biological control agents, will prevail.

Keywords: Emerging technology, biotechnology, chemicals, biological control