

Protecting yield – chemically

H. Baker

Environmental Director, Australian Cotton Foundation, 729 Elizabeth Street, Waterloo NSW 2017

The theme of this Conference, 'Looking Back, Planning Ahead', is especially applicable to the topic of this paper as I believe we are at the crossroads of chemical use. It is imperative that we make decisions on future directions for not only our research efforts but whether we can argue convincingly for the continued use of chemicals as *an aid* to agricultural production.

Looking back

While it may be of historical interest to note that chemical agents have been used in agriculture since biblical times, the pertinent period for review is the era that was spawned by the introduction of DDT, the broad spectrum insecticide, and 2,4-D, the selective herbicide. These two chemicals, brought into use in the late 1940s, demonstrated that there was an alternative to traditional use of inorganic chemicals or physical methods of control, which in many cases had serious long-term consequences. Their success triggered a major philosophical change in agricultural practices. Coinciding with the leap forward in other technologies as a result of the Second World War, scientists were able to study accurately the mechanisms by which these substances worked and with the knowledge gained they were able to design other biologically active structures for different applications. The cyclodiene insecticides, the earlier organophosphates were rapidly developed together the family of phenoxy herbicides.

The impetus for this rapid development was proclaimed as necessary to feed the increasing world population. Technology was hailed as the only means by which the world could escape the dire Malthusian predictions of world starvation and exhaustion of non-renewable resources. This technological era was entered into with great enthusiasm. In all aspects of the community, the impact of science and the new skills derived from technological advances were felt. Chemical innovation in agriculture was the cornerstone of agricultural development and chemicals were used to enhance yield to previously unheard of levels.

In hindsight, some of the uses to which chemicals were put perverted the designed purpose of the chemical and discredited chemicals in general. The opportunity to break through the constraints of the then traditional agriculture and not only increase yield but also diversify cropping regimes has more than compensated for the errors that occurred.

Between 1950 and 1985, over 500 significant chemical compounds were developed. While several have been discarded, because they have been found wanting in today's strict regulatory regime, the newer substances exhibit the ultimate in chemical sophistication.

The situation today

There can be no argument that the use of fertilisers, pesticides and allied chemicals are an intrinsic part of modern high-yielding agriculture. Proponents of the use of chemicals maintain the benefit to input cost of agricultural chemicals to production is approximately 4:1. However, I believe the benefit is undervalued as it measures purely the value of produce against input cost. The real strength of the use of agricultural chemicals is the opportunity, granted by their use, to adopt measures that are sustainable in the long term. It is not simply the immediate effect of their use against a pest affecting a current crop. Chemicals have allowed land to be brought into production that under other agricultural bounds would not be viable. Post-harvest protection has allowed control of the glut to famine supply situation.

A prime example of the benefits, both direct and indirect, is given by the use of chemicals in the Australian cotton industry. Cotton is a desert plant which has been exploited as a fibre for over 5,000

years. The demanding requirements for cotton to be grown without the use of chemicals are met only by a handful of areas in the world. Prior to the advent of the modern

era of chemicals, even low yielding cotton required large labour inputs and crops were frequently lost. Attempts to grow cotton in Australia stem back to the 1850s, however, the early yields of between 70 and 100 kilogram yield per hectare were not viable.

The modern cotton industry was only successful in Australia *because* of the use of chemicals, such as trifluralin to combat weeds and DDT to control the 30 odd insect pests that find cotton attractive. Use of these chemicals and their replacements has enabled sustained yield levels of between 1,400 and 1,600 kilograms per hectare. This yield, amongst the highest in the world, is a combination of both direct and indirect benefits of agricultural chemicals. Not only the direct control of immediate pests if possible but the ability to adopt minimum till practices and maintain permanent bed structures has ensured that cotton soils are not degraded. A recent environmental audit of the practices in the industry found that soils under cotton production for the last 30 years had actually increased in fertility.

However, the early expectations that were given to the community, which were that pests would be eradicated and there would be food for all, has not been realised. Chemicals are grudgingly regarded as necessary, and the level of support for technological change has waned and this is reflected in the funding levels available for agricultural research.

Planning ahead

The key to attainment of future goals is to take accurate account of the forces that will impact on the attainment of those goals. We have had a 'golden' era of chemical use protecting yield which has allowed us to expand our knowledge in the areas of crop management and pest dynamics. Paradoxically, this information has allowed us to lessen our dependence on the use of chemicals to maintain yield. Using the cotton industry as an example, the insight given by research into improved crop management has allowed for strategic timing of applications, improved application efficiencies and utilisation of chemicals that encourage natural control of pests by predators. On average, these measures have reduced the number of spray applications by three to a current industry median of eight sprays. The cotton industry has had a strong commitment to funding such research to optimise the use of chemicals to protect those chemicals from the impact of pest resistance and to exploit the pest-predator relationships by using 'soft' chemicals in the control programs.

Attainment of goals will depend on the commitment given to long-term crop management research and this is a major factor for the future direction of agriculture. The emphasis of 'immediate return' research will not allow us explore the crucial question of whether the chemical protection pathway is correct and should be progressed or whether there is a viable alternative approach that will lead to the same benefits. Unless a long-term and coordinated program is installed and maintained, a short-term exploitation of the chemical tools is quite likely. Ultimately, this will destroy the ability to protect yield by chemical means. In my opinion, the necessity to install coordinated programs is the most important factor in attaining the goal of protecting yield.

The world-wide concern over the impact of man's activities will impact dramatically on the future use of chemicals in our community. This concern, often misdirected, is the 'wild card' for the future and is frequently dismissed as the expected behaviour of a well-fed society and therefore it is underestimated in its power. Agriculture is no longer regarded as a benign endeavour and the use of chemicals is a focus of attack for those with the 'environmental' message. Chemical use is regarded as unsustainable, especially when the message is expertly sold to a population that is largely divorced from the practicalities of agriculture wrought by the benefits of agricultural chemical use.

In Australia, we have already seen the political impact of this community-mobilised pressure directed towards agricultural chemicals. Recent legislation in NSW under the environmental banner, will erode further the rational use of chemicals as crop protectants. In some instances, such as cotton production, the loss of several key pesticides would jeopardise the viability of the industry as we know it in Australia.

There is not an inexhaustible supply of new chemical groups we can develop. Nor will biotechnology replace conventional chemicals in the foreseeable future. In fact the community acceptance of biotechnology concepts is lower than with many conventional chemical means.

Conclusion

Planning ahead in the context of protecting yield chemically must include research into alternative means of protecting yield. We have enjoyed a golden era brought about by the use of modern chemical agents. However, the forces that will control our future goals may direct this protection to non-chemical means. The spectre of not being able to feed the world has little impact on communities that have not known hunger in this generation and therefore there will be little support for continued use of chemicals to protect yield, if the community regards that their use is not sustainable.