Agricultural chemical industries

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It is not difficult to talk about problems facing Australian agriculture at this time; the continuation of dry weather in southern Australia, uncertain and declining export markets and the inexorable rise in farm costs all combine to form a somewhat gloomy outlook. Despite the immediacy and the longer- term implications of the current economic problems of the agricultural industry, I believe these are all over-shadowed by one much understated problem: land degradation.

Because it often develops gradually and insidiously, damage to land tends to receive little publicity. Consequently the financial and physical commitments to overcoming the problem are invariably too little and too late.

Land degradation

Land degradation is, of course, a very broad term. It can be used to include a great variety of unfavourable changes to agricultural and non-agricultural land. In the physical sense it incorporates the various forms of soil erosion, including wind and sheet erosion, gullying and tunnelling. Under this heading must also come the loss of organic matter, acidification, the decline of nutrients in surface soil and salting within a wide range of situations.

There are also the forms of land degradation associated with biological agents. The fungal pathogen Phytophthora cinnamoni continues to cause concern as eucalypt dieback spreads through forests in southern Australia. Weeds can also be seen in this category. Thus Parthenium weed is now distributed over vast areas of Queensland, serrated tussock infests 600700,000 hectares of potentially useful grazing land in New South Wales. In Victoria between 0.5 and 1 million hectares, much of it in relatively inaccessible Crown Lands, is now infested with blackberries, and the area is increasing year by year.

It may seem strange that a representative of the Australian agricultural chemical industry should select this topic for this review of problems facing Australian agriculture. However I believe that the chemical industry has already contributed significantly to the control of land degradation of various forms. This is perhaps ironic in view of the generally negative public reaction to agricultural chemicals in relation to the environment and its protection. I do not intend to discuss the contribution of chemical fertilizers, which in themselves are responsible for an enormous increase in soil fertility and productivity on crop and pasture land.

Most of the agricultural chemicals sold in Australia are herbicides. The problems associated with the control of the three weed problems I have already mentioned still rely primarily on chemicals. The invasion by in-crop weeds such as wild oats and Wimmera ryegrass over the vast area of cereal cropping district in Australia is to a large extent kept in check by the use of herbicides. Without them cultivation would be even more frequent and the consequences of soil erosion greater than the levels currently causing alarm.

Today I would like to select one aspect of this vast subject, namely soil erosion. It would seem a particularly appropriate one since the research centres at Wagga have played such a leading role in gaining an understanding of the problem of soil erosion, and in the development and promotion of control measures.

Soil erosion losses

Obviously it is impossible to measure accurately soil losses over very large areas. However, the Soil Conservation Standing Committee Report of 1978, which is part of the continuing Commonwealth and

State collaborative study, estimates that a minimum sum of $675 million will be required to restore soils degraded since white man came to Australia nearly 200 years ago. Not surprisingly this study has centred on the perceived needs of the non-arid area where most of the agriculture, and particularly cropping, takes place. In fact only $65 million of the total has been allocated to restoration in the arid areas of the continent. The report predictably selects water erosion in cropping areas as a prime source of worry and estimates that 48% of all currently-cropped land in Australia requires treatment.

The importance of the problem is further emphasised in this report by the finding that it would be necessary to spend $593 million before the year 2000, a mere 18 years away.

Quite apart from the effects of inflation since 1978, I think one can argue that $675 million may still be a serious under-estimate of the cost of restoration. With a growing requirement for cereals as world population soars, the extending area of crop sown and the increase in yields are unlikely to match demand. Inevitably this must lead to an increase in demand for cereals from export-orientated countries such as Australia. In the 1950's it was estimated that there was approximately 1/4 hectare of crop per head of population in the world. By 1980 this had been reduced to 1/6 hectare and on current estimates it will fall to 1/8 hectare by the year 2000. Already Australia has begun to respond to this situation, in which the demand for cereals, and particularly wheat, has steadily risen in the last 10 years. The area of cereal crop has grown from 12 million hectares to over 16 million in the space of five years since 1977. In Victoria alone there has been about a 5% increase in cereals grown each year between 1974 and 1979. In the larger crop-growing states of Western Australia and New South Wales, the increases have been more rapid. It is estimated that in recent years 15,000 hectares of 'new' country in the central highlands of Queensland has been brought into crop production each year. Much of this has been converted to crop before adequate land capability studies have been carried out.

With the decline in profitability of the livestock industry in comparison to cropping, it is inevitable that more marginal cropping country will be brought into production. This will include the higher-rainfall areas with undulating and rocky country. In New South Wales alone there is an area of more than one million hectares sown to improved pasture and a proportion of this must have cropping potential. At the other end of the spectrum, parts of the semi-arid fringe of the cereal belt will be cropped.

The soil loss problems posed in these land categories are likely to be much greater than those encountered on existing cropping country, where soil loss problems in many instances have already reached a critical stage.

In continuing to face the soil erosion problem and to attempt to solve it, a great deal more research is still required. For the agricultural science profession there is great scope for the development of appropriate soil cultivation techniques, plant cultivars and, in the more general sense, new approaches to whole farm systems of management. Already a great deal has been achieved in a technical sense and I will speak briefly about this later.

Perhaps the biggest problem we have is in convincing the farmer and the public at large that the problem is immense, continually growing, and that it won't go away. Surveys to date indicate that many farmers are well aware of the general implications of soil erosion and that they do think beyond the next few years in terms of their farm profitability and productivity. We cannot, however, expect farmers in general to undertake costly control measures or new cultivation techniques unless they are either subsidised by the Government or, alternatively, such techniques can be clearly shown to offer rewards in a reasonably short period of time.

Economic justification of soil conservation

Unfortunately there are few studies on the economic value of soil conservation programmes. Two such studies relate to the Eppalock Shire in Victoria and the Allora Shire in Queensland. These studies demonstrate internal rates of return of 25% and 12% respectively. However, such programmes involve a variety of improvements in farm management practices and so the benefits cannot be solely attributed to

the control of soil erosion, and in fact derive mainly from pasture improvement and other land use and management practices used to reduce the loss of soil.

Simulation modelling studies by Arch and Dumsday relating to a rotational livestock/cropping enterprise in northern Victoria indicate a high return to a 'conservative' system as compared to an 'exploitative' system over a 19- year period. Of interest in this study is that in addition to the striking reduction in soil losses, the benefit in cumulative revenue comes from increased livestock production using conservation techniques and not from the cropping enterprise, where yields are virtually equal under an exploitative or conservation system. However the revenue from cropping would almost certainly change over a longer period of time, since 50% of the top soil under the exploitative system had already been lost. Overall the conservation programme in this study, when undertaken fully at the owner's cost, yields a higher return within five years at a discounted rate of 10%.

Clearly there are major problems in understanding farmer motivation, in providing the necessary evidence in clear quantitative terms to obtain wide- scale adoption of conservation practices.

Conservation tillage practices

Despite the scale of the soil erosion problem in Australia and the difficulties that one can foresee in trying to cope with it, it is most heartening to see the development of conservation tillage techniques over recent years. It is now well documented that minimum cultivation techniques can lead to quite spectacular reduction in run-off and soil losses. At the Wagga Soil Conservation Research Centre, where simulated rainfall of 45mm per hour for 50 minutes was applied to plots of conventional tillage, reduced tillage and direct-drilled, run-off and soil loss was reduced to approximately 50% under the direct-drilled treatments as compared to the conventional.

My own company, ICI, has been involved very much with the development of direct-drilling. I believe there is a good example of where the agricultural chemical industry has in fact contributed positively and significantly in combating major environmental damage. The increasing interest in recent years in aspects of minimum cultivation has been spectacular and much research has been carried out by State Departments of Agriculture and the CSIRO. It is most heartening to see the rate of acceptance by the farming community. From our own records it appears that the area sown by direct- drill technique has increased from 50,000 hectares in 1976 to 800,000 hectares in 1981, and may reach 1.1 million hectares in 1982.

A factor precipitating interest in the minimum cultivation techniques was the fuel crisis of the mid-1970's. Paradoxically this may yet prove to be one of the less important benefits from direct drilling and minimum cultivation. Farmers have now learnt that they can sow their crops more quickly on the opening rains, they can extend the amount of grass available to stock, and that the soil structure has been improved and erosion reduced.

To date the greatest successes with the direct drilling technique have come in southern Australia on the wetter fringe of the wheat belt, where fallowing is not normally practised.

Obviously great potential also exists for the use of chemicals as a substitute for tillage in fallowing across much of the Australian wheat belt. There is a particular need to examine these techniques where a variable summer rainfall pattern coincides with the highly erodible cropping soils of northern New South Wales and southern Queensland. Here the range of weeds and the crops grown are considerably greater than in the southern cropping areas. The need for change is recognised by leading farmers and agricultural scientists, but the problems are complex and the solutions in terms of minimum cultivation and no-till are likely to take some years to solve.