

D Using agricultural chemicals near streams

Objective

To manage agricultural chemicals so that off-site impacts in waterways and riparian lands are prevented.

Recommended management approach

Pesticides are widely used in cotton-growing districts as an integral component of crop-production systems. Adoption of integrated pest management systems and the use of genetically-modified varieties have reduced pesticide use, but the frequency and total amounts of chemicals used in cotton growing remain high in comparison with many other agricultural industries.

'Pesticide' includes insecticides, herbicides, growth regulators, defoliants, conditioners and dessicants.

Many pesticides are highly mobile in the environment, some degrade fairly quickly, but others remain highly toxic — either in their original form or in a different form — over many weeks or months. The four ways pesticides move in the environment are listed below.

1. Through the application process, for example, in spraydrift.
2. Through the soil profile to groundwaters, and then into waterways through sub-surface flow.
3. Through absorption — some pesticides are absorbed onto soil particles, and then move by soil erosion and deposition of sediment into drains and streams.
4. Through uptake by plants and animals and subsequent movement within land or water food-webs (the concentration of some pesticides can increase during this process).

In-stream life is particularly sensitive to some forms of pesticide, wetting agents and boosters that are widely used in the cotton industry. Contamination limits for environmental damage are very low, often in the 1–5 part per million range. Waterways fall under the heading of 'sensitive areas', and there may be statutory requirements regulating what farming operations can be carried out within or adjacent to such areas (refer Appendix B). Particular provisions may relate to actual or potential pollution, for example, the Queensland Code of Practice for Agriculture includes a list of defined sensitive places and how nearby agricultural activities should be managed.

Great care is needed when planning and applying pesticides in cotton growing areas. This includes tailwater drains and channels, and other parts of the farm where chemicals may be moved off-site through break-out points following intense rainfall. An overriding principle for the sound use of agricultural chemicals is to use integrated pest management practices that reduce chemical use to a minimum; these are already widespread within the cotton industry. This may include cropping practices to reduce weed infestation or soil seed stores; the use of agronomic practices to minimise insect pests; and the economic use of chemicals so that minimum amounts are used to achieve crop protection.

Recommended management approaches for agricultural chemicals on cotton farms are as follows.

1. Implementation of the cotton industry BMP Manual. The BMP Manual includes an example of a Pesticide Application Management Plan as well as details about how to manage the storage and handling of chemicals. The Plan should also include:
 - a farm map to identify sensitive areas and potential hazards for pesticide use, including waterways and water bodies, and designated buffer lands around these sensitive areas;
 - measures to ensure good communication between all those involved in planning and applying pesticides, including farm operators, staff and spraying contractors;
 - details about the selection and use of appropriate application methods, as well as use of equipment that will optimise effectiveness while minimising risk;
 - details about the storage, handling and management of pesticides — for example pesticides should be stored at a reasonable distance from any waterway or receiving water body; a container disposal program should be used; and farm disposal pits constructed where there is little risk of seepage into groundwaters;
 - record keeping processes in place that check and report on the use and impact of agricultural chemicals (a legal requirement in NSW). These records also help demonstrate that farm owners and operators are complying with statutory obligations;
 - pesticides only applied during appropriate weather conditions;
 - buffer lands located on the down-wind boundary of fields near sensitive areas;
 - appropriate products are selected for the result required;
 - integrated pest management practices implemented;
 - equipment selected and maintained for different chemicals, property situations and application conditions; and,
 - chemical users are appropriately trained and qualified.

By Rebecca Smith

Jones Air, like many other aerial operators, assists growers to develop their farm Pesticide Application Management Plan so that spray parameters and guidelines protect riparian areas from spray drift. Prior to the season, a member of the Jones Air team meets



with growers to discuss the spray parameters and guidelines for each farm. As one of the pilots, Shayne says “This gives us an opportunity to highlight any changes that have been made to the farm from the previous season, such as new water holding bodies or new homes, so our records can be updated accordingly.” The pilots are issued a colour-coded map that highlights sensitive areas like waterways, dams and wetlands. The grower is contacted prior to the plane entering the paddock and keeps contact with the pilot via the radio during the job. As Shayne comments “This contact helps to avoid any problems associated with the application, and by having an observer on the ground, growers are complying with the industry Best Management Practice”. These efforts have paid off for Jones Air as they are the first Aerial Application company in the world to become ISO14001 certified.

2. Design the farm so that it has the capacity to retain the initial runoff from storms and intense rainfall events on the property. The first flush of this runoff is likely to carry considerable quantities of pesticides with it, particularly when paddocks are bare or the crop is at an early growth stage, and when soils are already saturated from previous rainfall or irrigation. On irrigated farms, the tailwater collection and return system may provide some capacity to store this first-flush runoff, with culverts, drop-boxes and stilling ponds used to hold this water and allow the majority of sediment to settle before it is recirculated. In some situations, holding limited quantities of runoff on the lower paddocks of the farm for up to 24 hours can also be used to ‘polish’ runoff waters and reduce pesticide concentrations.

Pesticides

Pesticides, including herbicides and insecticides, can find their way into river systems through spraydrift, surface runoff, stormwater escape and sub-surface water movement. Urban stormwater and industrial waste may also contain pesticides. Many insecticides and their decay products are highly toxic to aquatic animals, while some herbicides can damage aquatic plants.

Data for pesticides found in the river system are available for the Namoi catchment for the past decade. Water quality continues to be monitored throughout the Namoi catchment, to assess the impact of current and future land management practices, to collect information for better management of water resources and to monitor change over time (*Water Quality in the Namoi Catchment, NSW DLWC, 2000*). Pesticide residues are regularly detected in the river system between Gunnedah and Walgett. The most frequently detected chemicals in 2000–01 were herbicides. Atrazine was the most commonly found herbicide, followed by Metolachlor, Fluometuron, Prometryn, Diuron and Simazine (though not all of these herbicides are used by the cotton industry). Some samples from the Cox’s Creek at Boggabri contained residues of all six herbicides.

The insecticide Endosulfan was detected in the 2000–01 samples at four sites in the lower Namoi Valley. However, as shown by the graph below, the concentration of Endosulfan detected in the lower Namoi has dropped significantly over the last ten years. It is believed that this reflects significant changes in farm and crop management, with less of the insecticide being applied, and growers’ success in preventing losses off-site. This provides an excellent example of what can be achieved through development of industry standards for best practice and their rapid adoption by individual growers.

Growers believe that herbicides are now the main issue to be addressed to protect water quality, and this may focus future attention on the chemicals used on-farm and management practices that will help to reduce off-site movement.

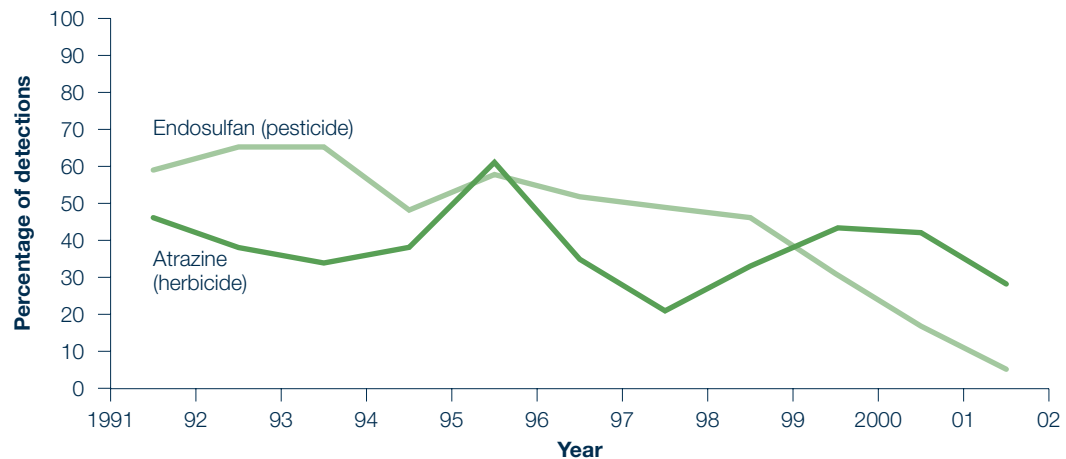


Figure 8: Percentage of detections of common pesticides for all samples collected across sites in the Namoi, Gwydir and Macintyre Valleys from 1991/92 through to 2001/02. Source: Warwick Mahwinney.

Fertilisers

The majority of soils on which cotton is grown in Australia are inherently fertile. However, growing cotton can result in high rates of nutrient removal, and the industry is a significant user of applied fertilisers, particularly nitrogen and phosphorus. Loss of phosphorus to waterways, through either overland flow (e.g. attached with soil particles) or through sub-surface flows, has been implicated in increasing frequency and severity of algal blooms in inland rivers, including blooms of toxic blue-green algae. In the northern hemisphere, management of nitrogen to protect the quality of surface waters and prevent contamination of groundwaters has become a major component of farm and catchment management. There is little information about the movement of nitrogen and phosphorus on cotton farms, or its significance (if any), compared with other land uses.

It is important that nutrient additions be matched with crop requirements, and cotton growers have access to the NUTRIpak and SOILpak decision-support systems to assist them in determining crop requirements and application rates and times. Recent estimates based on field samplings suggest that cotton crops remove only about a third of the total nitrogen applied. Around 20% remains in the soil largely associated with organic matter, while around 40% is assumed to be lost from the system through denitrification, volatilisation or leaching.

Self-assessment

If a Pesticide Application Management Plan is developed and implemented it will contain record keeping processes that will enable cotton growers to check progress and ensure they are achieving best practice in using agricultural chemicals near streams.

Planting trees for multiple on-farm gains

Mike and Robin Logan — ‘Oakville Pastoral Company’, Narrabri

By Rachel Holloway

Oakville Pastoral Company commenced a tree-planting project in 1996 with a goal to plant 1 kilometre of tree lines per year. Most of the property has been used for grazing and cropping purposes over the years, and a key goal was to increase vegetation on the farm. The trees provide a spray drift buffer, a vegetative corridor from the river to surrounding remnant vegetation, habitat for wildlife, and improve the aesthetics on the farm. Between 1996–2000 over 10,000 seedlings have been planted, with six different tree line sites planted on the property.

The property is divided between a flat black cracking clay soil, which runs parallel with the Namoi River (Narrabri Creek) and graduates to a hill with red ridges. The irrigated cotton and other crops are grown on the flat black soil. Oakville is located 5 kilometres from the edge of residential development, and the property shares a boundary with Narrabri industrial estate, council owned land, travelling stock route, landholders and residential holders. One of the main goals for tree planting was to create a natural buffer zone where possible around the farm due to the sensitive nature of growing cotton among close neighbours.

Site preparation involves deep ripping the soil six months before planting to ensure a good moisture profile for the new trees. At the same time, to keep the area weed free both cultivation and herbicide applications are used. A residual herbicide, Simazine, is applied six weeks before planting; this herbicide is used because it does not affect native trees.

Planting of the tree lines was trialed in spring and autumn. The Logans found that spring plantings have good establishment rates due to good soil moisture availability, whereas autumn plantings can mean the trees are prone to frosts and lack good growth during the winter months. Trees selected for the first planting were sourced from southern NSW, with later tree lines using indigenous trees from north-west NSW. After six months, the trees from the north-west were more established and had a greater tolerance to drought, frost and insect attacks.

As more experience was gained from planting trees, one of the goals was to ensure diversity in the species planted. The initial planting only had four species of Eucalyptus trees compared to the later plantings where trees and shrubs of up to 10 to 30 species were selected. The species that have done exceptionally well are River Red Gums, Yellow Box, Bimble Box, Belah, Bull Oak, Swamp Oak, River Cooba and Cooba.

After experiments with machine and hand planting, hand planting was favoured due to the clay content of the soil inhibiting how well the mechanical planter functioned. Hiko seedlings were used for all plantings, these seedlings are 6–12 months old and are very cost effective (approx. \$0.55 per plant). The trees were planted with a ‘potti putki’ hand-planting implement. Each tree was guarded with a cardboard milk carton and two bamboo stakes. It was important to ensure a good seal between the soil and the tree roots, as well as a good seal between the milk carton and the soil to stop the wind drying the seedling out. The guards were also used to stop hares and rabbits eating the whole tree.

The tree lines range from four to five rows of trees, to a small wood lot with nine rows of trees. The tree lines are 25 metres wide and about 1 kilometre long. Shrubs and trees are mixed and the trees are planted 4 metres apart, the rows are 6 metres apart to allow a slasher to maintain the tree lines once established.

The tree line shown in the photo below is close to a main road and has generated a great deal of interest from the local community. Through the drought these trees have looked extremely healthy. Other benefits have been an increase in birds on the farm, beneficial insects for the cotton crop and a very effective visual barrier.

Trees and shrubs planted in 1996 — Bimble Box, Grey Box, River Red Gum, Yellow Box.

Trees and shrubs planted from 1997 onwards — Belah, Berry Saltbush, Bimble Box, Black Box, Blakley's Red Gum, Blue Mallee, Brigalow, Bull Oak, Butterbush, Carbeen, Cooba, Coolibah, Grey Box, Kurrajong, Mugga Iron Bark, Old Man Saltbush, Red Bottlebrush, River Cooba, River Red Gum, Rough Barked Apple, Silver Leaved Iron Bark, Swamp Oak, Weeping Bottlebrush, Western Golden Wattle, White Box, White Cloud Tree, Whitewood, Yellow Box.

Scientific names for all these plants can be found in Appendix D.



Above, treeline planted 1998 on Oakville boundary near Wee Waa Road, Narrabri. Below and right, same spot and in between rows, April 2003. Photos Rachel Holloway.

