



Insect Growth Regulators

One attraction of insect growth regulator insecticides (IGRs) is their selective toxicity. IGRs interfere with biochemical pathways that are not present in humans or other mammals. This makes them relatively safe to human health but not completely without some hazards. The solvents used in some IGR products may cause a mild skin or eye irritation unless operators adhere to label directions regarding proper use and personal protection.

Sheep producers should be familiar with two classes of Insect Growth Regulator (IGR) insecticides. These are:

- Benzoylphenyl ureas eg. diflubenzuron and triflumuron (NB. These are now only registered for lice control)
- Triazine and pyrimidine derivatives eg. cyromazine and dicyclanil (NB. These are registered for flystrike control and are not effective against lice)

The two classes are unrelated but both inhibit the normal growth of insects. Most insect groups are affected by benzoyl phenyl ureas but only a few groups, particularly immature flies, are affected by the triazine and pyrimidine derivatives.

By targetting physiological systems unique to arthropods (insects, spiders, crustaceans), compounds with extremely low toxicity to humans can be produced. One target is the external skeleton (cuticle) of insects which must be shed and rebuilt every time an immature insect moults. This is a very vulnerable stage not only for maggots and lice but for all arthropods. Consequently the benzoylphenyl ureas are quite toxic to many species of aquatic insects and crustaceans and so, are of environmental concern. The potential for these IGRs to kill non-target insects, especially aquatic insects, has important implications for the on-farm disposal of spent dip wash and jetting fluids. It is important that pesticide wastes do not enter watercourses where they may cause environmental harm, or accumulate in areas grazed by animals. IGRs bind tightly to soil and degrade slowly. Currently recommendations for the safe disposal of spent dip and jetting fluids are being developed by the Australian Pesticides and Veterinary Medicines Authority in consultation with other agencies.

It is thought that both classes of IGRs target the cuticle but in different ways. The structural integrity of normal cuticle is achieved through a matrix combining chitin and protein. Benzoylphenyl urea insecticides prevent the formation of chitin thus weakening the exoskeleton. This weakness prevents immature insects moulting and inhibits insects hatching from eggs laid by affected females. *Lucilia cuprina* has three maggot stages and must moult between stages.

Diflubenzuron and triflumuron are widely used to control lice on sheep. Until 2008 diflubenzuron was also registered for the prevention of flystrike on sheep but resistance, first reported in 2002, rendered diflubenzuron products ineffective.

Cyromazine and dicyclanil are generally the pesticides of choice for flystrike prevention. They only act on maggots and have no apparent effects on adult flies or lice. Cyromazine and dicyclanil inhibit moulting thereby preventing maggots from growing. The precise way this is achieved is unknown but is not the same as for diflubenzuron or triflumuron. Importantly, when tested by Industry & Investment NSW, diflubenzuron resistant sheep blowfly maggots were found to be susceptible to both cyromazine and dicyclanil.

When properly applied cyromazine and dicyclanil provide exceptional protection from flystrike. Dicyclanil spray-on carries a label claim of 18-24 weeks whereas cyromazine spray-on has a claim of 11 weeks. Cyromazine jetting fluid will protect sheep for up to 14 weeks if applied thoroughly. Dicyclanil is not registered for dressing flystrike wounds and cyromazine jetting fluid carries the warning that maggots may take 3-4 days to die. Insect growth regulators have little effect until the next moult. When a sheep producer finds a sheep struck the maggots have usually reached the third growth stage (instar). This is the last stage before they drop off the sheep and pupate. Treatment of third instar maggots with an IGR will have little effect on larvae until they attempt to pupate. As such they are not the best choice for treatment of individual strikes unless all maggots are removed from the struck area.

The long periods of protection against flystrike provided by cyromazine and dicyclanil and the sustained effectiveness of diflubenzuron and triflumuron against lice results from the persistence of these insecticides in the wool of treated sheep. This persistence also means higher residue levels on shorn wool. The IGRs used in the sheep industry break down slowly in the fleece on the sheep's back. The half-life depends on the insecticide used, how deeply it penetrates the fleece and, climatic conditions. In terms of wool producer responsibilities in this area, as with all products, it is a legal requirement to adhere to the withholding intervals displayed on the label.