ZQ

Sheep and Beef Cattle Veterinarians
Branch of the NZVA

beef+lamb new zealand

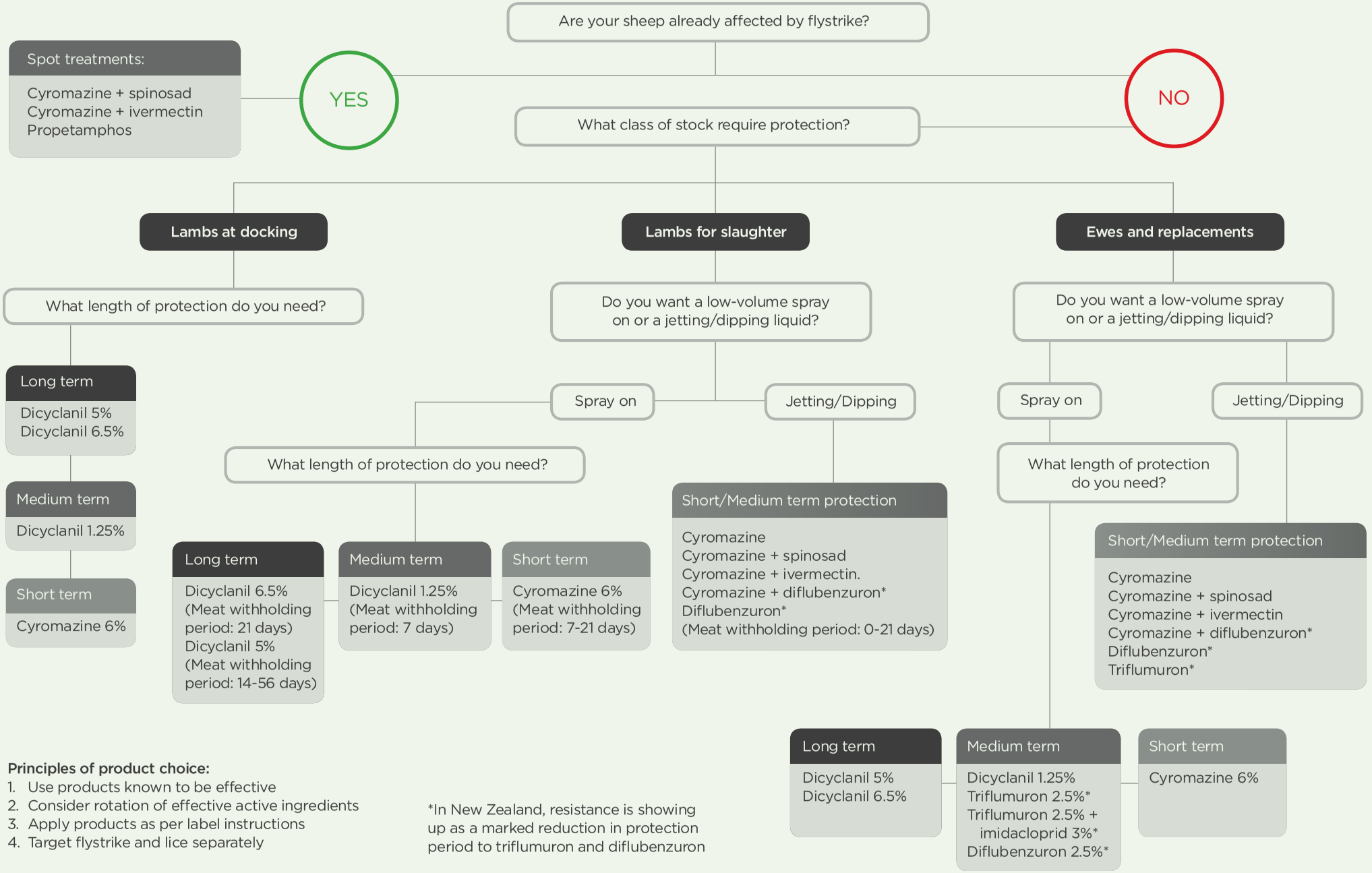
MANAGING FLYSTRIKE AND LICE

A practical guide for farmers

August 2019

Blowfly Strike Prevention & Treatment Decision Tree

This decision tree is designed as a guide only. We recommend you get specialist advice from your vet or a qualified advisor.



Principles of product choice:

1. Use products known to be effective
2. Consider rotation of effective active ingredients
3. Apply products as per label instructions
4. Target flystrike and lice separately

*In New Zealand, resistance is showing up as a marked reduction in protection period to triflumuron and diflubenzuron

Lice Prevention & Treatment Decision Tree

This decision tree is designed as a guide only. We recommend you get specialist advice from your vet or a qualified advisor.

Have you identified lice in your flock?

YES

Review previous years' lice control measures and set up new plan

Long wool

Shear

Long-wool emergency treatment
- Will reduce numbers but not eliminate lice
- Follow up with off-shears treatment using different chemical family
- Consider wool residues

Off-shears pour on

SPYN	Spinosad
IGR+ NEO	Triflumuron + imidacloprid
IGR	Diflubenzuron Triflumuron
SP	Cypermethrin Alphacypermethrin Deltamethrin
IGR + SP	Triflumuron + cypermethrin Diflubenzuron + deltamethrin

Pour on

SPYN	Spinosad
SP	Cypermethrin Alphacypermethrin Deltamethrin

Jetting

SPYN	Spinosad
OP	Propetamphos

Autumn treatments
1-3 months wool

Jetting/saturation
- Treatments must ensure lice are targeted
- Thorough wetting must be achieved
- Use different chemical type to that used off shears

SPN	Spinosad
IGR	Diflubenzuron Triflumuron
OP	Propetamphos

Pour on
Use different pour-on to that used off shears

- Monitor effectiveness of treatment
- Beware of lambs as potential source of lice
- Treat all stock within short space of time
- Rotate effective products

NO

- Inspect flock for lice
- Assess risk of small lice population remaining or possible lice challenge

Treat?

YES

Pour-on off shears and up to 3 months wool

SPYN	Spinosad
IGR+ NEO	Triflumuron + imidacloprid
IGR	Diflubenzuron Triflumuron
SP	Cypermethrin Alphacypermethrin Deltamethrin
IGR + SP	Triflumuron + cypermethrin Diflubenzuron + deltamethrin

Jetting 1-3 months wool

IGR	Diflubenzuron Triflumuron Cyromazine + diflubenzuron
SPN	Spinosad Cyromazine + spinosad
OP	Propetamphos

N.B. Flystrike preventative jetting treatments with lice-effective products may aid in control of low-level lice population, but only if applied to breech and back

NO

Lice resistance: Status of actives
- SP resistant lice widespread in Australia and NZ
- IGR resistant lice widespread in Australia; NZ situation unknown
- OP resistant lice extremely rare
- Spinosad & imidacloprid – no resistance recorded

Maintain lice-free flock by:
- Quarantine treatment of bought-in stock
- Secure boundaries (ideally double fenced, so no sheep-to-sheep contact)
- Inspect flock for lice at key times: pre-tup, scanning, pre-lamb, shearing

Thanks to the Sheep and Beef Cattle Veterinarians of the NZ Veterinary Association for sharing the content of its 2019 publication “Ectoparasites of sheep in New Zealand and their control”. Specific thanks to the publication’s main authors Dr Allen Heath (AgResearch), Colin McKay (Elanco) and Anthony Oswald (Taihape Vet Services). Thanks also to Monica Schwass (NZ Merino) for her input.

Contents

CHAPTER 1

ABOUT FLIES AND FLYSTRIKE

New Zealand’s problem blowfly species	8
Blowfly lifecycle	9
Seasonal behaviour of blowfly species	9
Flystrikes’ impact on sheep production	9

CHAPTER 2

ABOUT LICE

Lice lifecycle	10
Seasonal behaviour of lice	10
Transmission	11
The impact of lice on sheep production	11

CHAPTER 3

CHEMICAL TREATMENTS AND RESISTANCE

Resistance to chemicals	12
Treating flystrike and lice with same chemical	12
Chemical families and their resistance status	12
Combination products	14
Future chemical options	14
Managing resistance	14
Low-volume spray-on/pour-on products available in New Zealand	16
Saturation/jetting products available in New Zealand	16
CASE STUDY: Never trust your dip is working	17

CHAPTER 4

DECIPHERING CHEMICAL PRODUCT LABELS

Flystrike protection periods	18
Factors that compromise protection periods	18
Lice protection periods	19
Chemical residues in wool	19
CASE STUDY: Use chemicals properly	20

CHAPTER 5

DIP APPLICATIONS METHODS

Saturation dipping	21
Automatic jetting races (AJRs)	24
Low-volume pour-on/spray-ons	25
Dipping contractors	26
Hand jetting and gorse guns	26
Disposal of dip concentrates, containers and used dip wash	27
CASE STUDY: Be diligent about equipment maintenance, application rates and technique	27

CHAPTER 6

FLYSTRIKE PREVENTION AND TREATMENT

Chemical tools	28
Non-chemical tools	29
Treatment of an active strike	31
CASE STUDY: Good resistance prevention management lessons	32

CHAPTER 7

LICE PREVENTION AND TREATMENT

Do you have a lice problem?	33
The importance of shearing	34
Using chemicals to treat lice	34
Lice control scenarios	34
CASE STUDY: Lice: Treat every head of stock within a short timeframe	37

Source: *This booklet is based on the New Zealand Veterinary Association's 2019 publication "Ectoparasites of sheep in New Zealand and their control" (ISBN 978-0-473-46442-4). All references and sources are cited in that more detailed document.*

It's been 20 years since this booklet was last published. Over this time, New Zealand has seen significant changes in the flystrike and lice space. Animal welfare standards and awareness are greater; new fly species have arrived; new chemicals are available, while others have fallen by the wayside; climate change has seen fly issues creep further down the country; and awareness of the potential environmental impacts of insecticides has increased. But the biggest change in the past 20 years is the increasing prevalence of chemical resistance.

Unfortunately, there is no "one-size fits all" approach to effectively and safely treating and preventing flystrike or lice. However, this booklet will help you formulate the best approach for your operation.

Flystrike is an ideal scenario for the blowfly, but less so for the host sheep. It is estimated that 2-10% of the national flock is affected by flystrike annually. Impacts on animal welfare, and the subsequent economic effects, can be measured in the millions of dollars. Farmers spend in excess of $15 million annually on sheep dips, alone.

Lice infections are less dramatic and, in the case of strong wool sheep, a nuisance more than a significant financial cost.

However, for fine wool sheep, the financial toll is much greater, due to the impact on wool quality and yield and the pelt.

Alongside the economic impacts of flystrike and lice, there are obvious animal welfare issues. New Zealand's Animal Welfare Act 1999 specifies:

a) All reasonable steps must be taken to prevent, or identify and manage the risk of flystrike in sheep.
b) Affected sheep must receive appropriate treatment at the earliest opportunity.

Effective prevention and treatment of flystrike and lice involves a multi-pronged approach. This booklet aims to provide you with the detail you need to:

a) Understand the pests' lifecycles and therefore the optimal time to target them, and
b) The treatment options – chemical and non-chemical – available to you.

We recommend you get specialist advice. Your vet or a qualified advisor can help.

CHAPTER 1

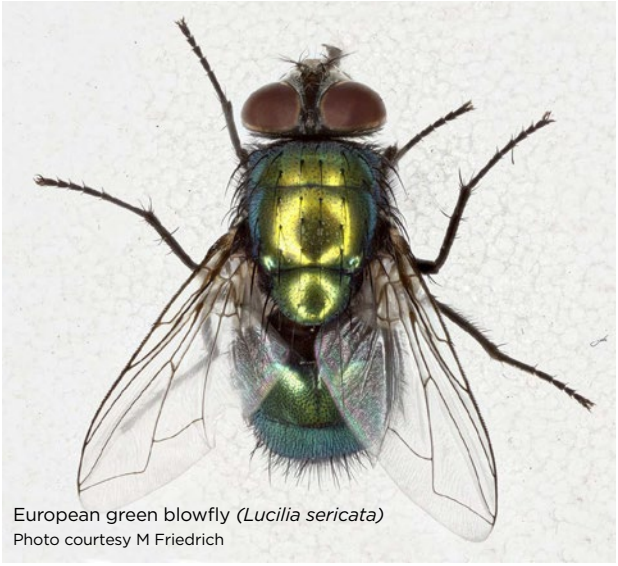
ABOUT FLIES AND FLYSTRIKE

Flystrike occurs when blowflies lay eggs in warm, moist areas on a sheep and these eggs hatch into maggots, which then invade the living sheep. During spring, summer and autumn – and especially when conditions are humid – flystrike can be a significant problem for New Zealand sheep farmers.

New Zealand's problem blowfly species

Four blowfly species cause flystrike in New Zealand. In order of prevalence, they are:
1) Australian green blowfly *(Lucilia cuprina)*
2) European green blowfly *(Lucilia sericata)*
3) Brown blowfly *(Calliphora stygia)*
4) Hairy maggot blowfly *(Chrysomya rufifacies)*

Australian green blowfly *(Lucilia cuprina)*
Photo courtesy G de Lisle



European green blowfly *(Lucilia sericata)*
Photo courtesy M Friedrich

Brown blowfly *(Calliphora stygia)*

Hairy maggot blowfly (*Chrysomya rufifacies)*
Photo courtesy A.C.G Heath

In New Zealand, nearly half of all strikes involve just one species of blowfly and the most common offender is the Australian green blowfly (L. cuprina).

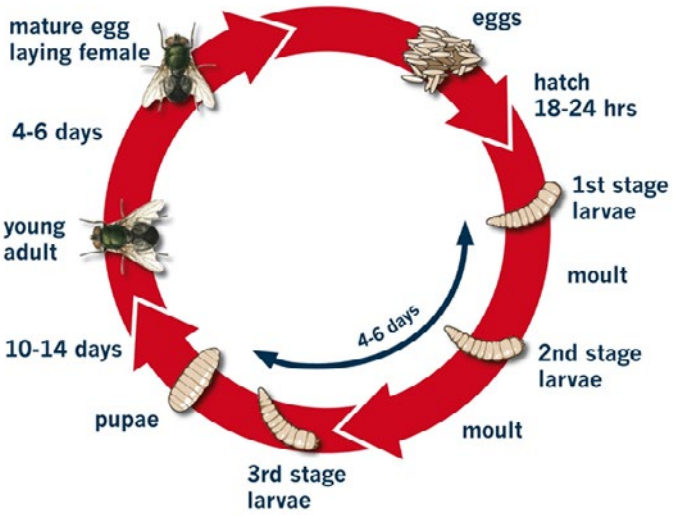
Blowfly lifecycle

Female flies are attracted to the bad smell that comes with damp wool, dags, urine-soaked wool, footrot, pizzle rot, fleece rot and dermatitis. They lay eggs – about 200 at a time – in moist sites close to the sheep's skin, where maggots are most likely to survive.

Females can lay three batches of 200 eggs over their six-week lifetime.

The eggs take 18-24 hours to hatch. The maggots (larvae) feed on the sheep's flesh for 3-7 days. They then drop to the ground and burrow 1-10cm into the soil, depending on the temperature (deeper in cold weather), then become dormant.

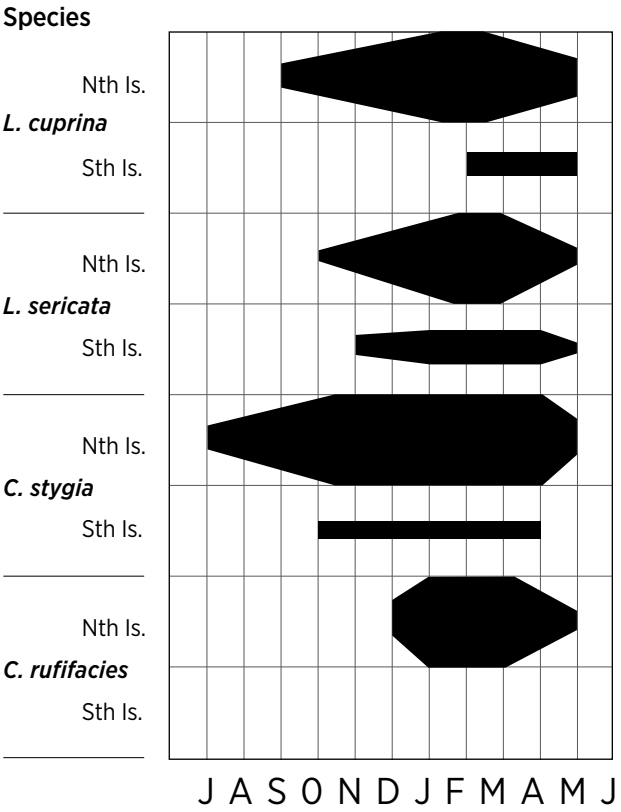
Over this dormant period – which can be all winter – the maggot becomes a pupa and takes on a brown, barrel-shaped appearance. When soil temperatures warm up, the adult fly emerges.



Fly lifecycle Courtesy Elanco Animal Health

Seasonal behaviour of blowfly species

A recent NZ Merino survey, carried out in collaboration with Massey University, indicates that flystrike prevalence is between 1-2% on most farms.



Seasonal patterns of blowflies in the North and South Islands *(Heath and Bishop, 1995)*

Flystrikes' impact on sheep production

Once maggots become established, the sheep loses weight rapidly. Even small areas of flystrike – i.e. less than 15cm diameter – that are not easily visible can cause significant weight loss.

Across several years and hundreds of thousands of ewes, a veterinarian observed about 80% of stuck ewes (treated or otherwise) were empty at pregnancy scanning.

CHAPTER 2

ABOUT LICE

Known as the sheep body lice, biting lice or chewing lice, *Bovicola ovis* has been in New Zealand since the first flocks arrived – and been an on-going problem. Compulsory dipping was introduced in 1838 and was a legal requirement until 1994.

Lice lifecycle

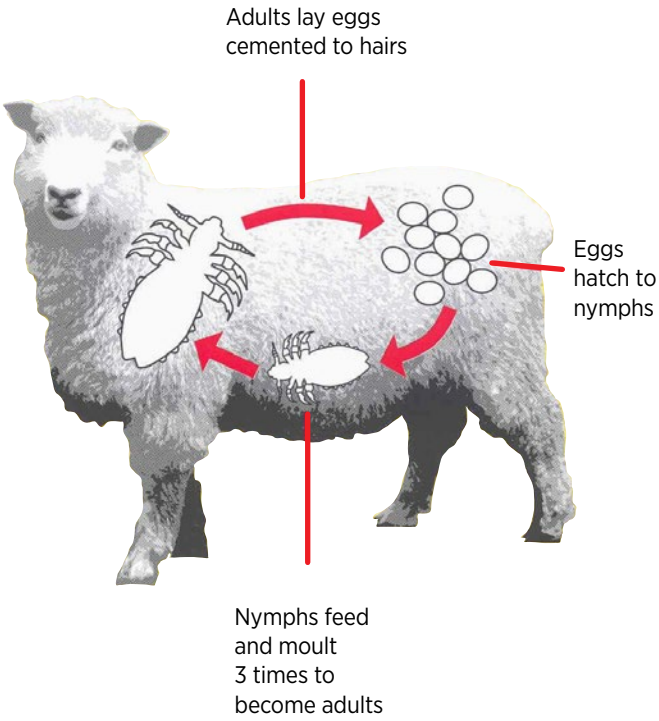
B. ovis is a 1.5-2mm long, yellowish-brown wingless insect. They do not fly or jump; they walk.

The female lives an average of 4-6 weeks, but can live up to 20 weeks. She lays about 30 eggs in her lifetime – about 2 eggs every 3 days. The eggs are laid on wool fibres, within 12mm of the skin surface. Lice prefer temperatures around 35-40°C and, while eggs can tolerate the dry, they don't survive high humidity or saturation.

After 9-11 days, the eggs hatch into nymphs and, another 21 days later, they become adults. The complete egg-to-egg lifecycle takes 34-36 days and is spent entirely on the sheep.

Bovicola ovis. Courtesy *Wallaceville Animal Research Centre*

LIFE CYCLE OF LICE



Seasonal behaviour of lice

Lice populations are generally highest in autumn through to late winter and decline in summer – appropriate given that extreme heat and humidity are lethal to lice.

Shearing can remove up to 80% of lice, depending on the closeness of the cut and, for those that remain, they are left exposed to the elements. Lice can avoid this risk by targeting areas such as the belly, brisket and under the neck.

Transmission

Sheep lice breed on sheep and complete their entire lifecycle on the animal. They do not fly or walk between sheep and are instead transferred by very close contact between sheep, such as when animals are rubbing against each other. Infection from sources such as wool on fences, is highly unlikely.

Within a flock: sheep to sheep

Lice build up slowly on an individual sheep and spread slowly within a flock, except when sheep are in poor condition.

Good nutrition and effective internal parasite control are important components of an Integrated Pest Management (IPM) programme (see Chapter 7). Well-fed and well-conditioned sheep are less prone to lice than undernourished poor conditioned sheep.

Ewe to lamb

A lice-infected ewe will infest her lamb within the first 24 hours, as the lamb feeds and remains close to its mother. Thus it is important to ensure ewes are lice-free before lambing.

How long between dipping and the ewe being lice free? This depends on the chemical used, application method and thoroughness. See the chemical label for the protection period.

If infested ewes cannot be treated for any reason, then it is imperative lambs are dipped as soon as practical – be that weaning or shearing.

For a successful lice control programme treat pregnant, shorn ewes as soon as possible after shearing, and also treat the lambs later.

Treat pregnant, shorn ewes as soon as possible after shearing, and also treat the lambs later.

The impact of lice on sheep production

B. ovis does not feed by sucking blood from the host. Instead, it gathers up skin scales, lipid, sweat gland secretions and wool fibres from the sheep's skin. The lice excrement contains antigens and allergens that diffuse through the skin and stimulate an immune response.

The sheep can experience wool damage, reduced wool yield and quality, staining and the pelt defect known as cockle. Furthermore, a lousy sheep will often scratch itself to reduce irritation, which can cause further damage to its skin and wool. Time scratching also means less time grazing.

Tell-tale signs of heavy lice burdens: dark-stained wool on the shoulder (photo top) and the pulled wool on the flanks. This fleece damage shows the host sheep has spent a lot of time rubbing and scratching.

This pulled wool – as a result of scratching to relieve irritation – is a clear case of lice infection.

CHAPTER 3

CHEMICAL TREATMENTS AND RESISTANCE

For centuries, chemicals have been used to control external parasites on sheep. In days of old, the goal was to expose parasites to lethal doses of chemical as a protection against infestation, while avoiding poisoning the host sheep.

Circumstances are a little more complex now. Farmers must also manage chemical residues in meat, wool and the environment, operator health and safety, public perception, animal welfare requirements, and avoid parasite resistance.

These changes mean dipping alone is no longer enough. Effective external parasite control now requires a planned parasite management plan. (See Chapters 6 & 7)

Resistance to chemicals

Resistance to chemicals is the price paid for improved livestock health, welfare and cost-effective animal production. As with any selection pressure, heritable change in the target organism – this case, flies and lice – is inevitable.

While resistance to chemicals is difficult to avoid altogether, strictly following the application instructions and using well-functioning gear to apply the chemicals can slow its foothold.

Treating flystrike and lice with same chemical

Unfortunately – and inconveniently – when it comes to chemical use, fly and lice should be targeted separately.

When it comes to chemical use, fly and lice should be targeted separately.

Chemical families and their resistance status

It is worth noting that New Zealand is historically only two years or so behind Australia in experiencing similar breakdowns in insecticide efficacy.

Organophosphates (OPs)

Control: Blowflies, lice, keds and ticks

Application method: Saturation dip for lice control. Spot treatment of flystrike.

Environmental: Toxic – considerable risk to mammals (including humans), birds and fish. However, do not bio-accumulate in the food chain.

Resistance:

- The strain of *L. cuprina* that entered New Zealand from Australia already carried genes for organophosphate resistance and diazinon, in particular, gave poor results from the start.
- Resistance by lice to organophosphates is very rare and this chemical class remains an effective treatment option for lice.

Regulation and safer alternative chemicals have seen the use and availability of organophosphates decrease in New Zealand. Only two active ingredients remain on the market:

1) Propetamphos – flystrike spot treatment and saturation dip available to approved handlers only
2) Diazinon – likely to be withdrawn from the sheep-dip market in the near future.

Propetamphos still has an important role to play in sheep lice control as a rotation partner to other effective saturation dip options. It is also the only product available with label claims for the control of the New Zealand cattle tick, *(Haemaphysalis longicornis)* on sheep.

Synthetic pyrethroids (SPs)

Control: Lice

Application method: Low-volume pour-on spray.

Environmental: Considered low toxicity to mammals. Highly toxic to fish and persist in the environment.

Resistance:
- Australia – Frequently reported.
- New Zealand – Reported as unreliable or incomplete lice control.

Synthetic pyrethroids are more potent, stable and persistent than their natural pyrethrins. Unfortunately, claimed protection periods found on labels are likely to be compromised, due to the development of resistance by lice to synthetic pyrethroids.

Insect growth regulators (IGRs)

Insect growth regulators (IGRs) describe a broad mode of action, rather than a distinct chemical group. These chemicals affect the ability of immature insects to develop through to adulthood.

With regards to external parasite control on sheep in New Zealand, there are two IGR chemical groups:
1) Benzyl phenyl ureas (BPUs) – diflubenzuron and triflumuron.
2) Triazine and pyrimidine derivatives – cyromazine and dicyclanil.

Benxoyl phenyl ureas (BPUs)

Control: Developing maggots and immature lice.

Application method: Low-volume pour-on spray. Jetting/saturation.

Environmental: Very low mammalian toxicity; quite safe for birds, fish, reptiles, amphibians and other vertebrates; can be highly toxic to soil and aquatic invertebrates; persistent in the environment.

Resistance – fly:
- Cross resistance between diflubenzuron and diazinon resistant strains of *L. cuprina* has been reported in Australia and New Zealand.
- Australia: Complete treatment failures with diflubenzuron resulted in the removal of flystrike protection claims for diflubenzuron-based products in 2008.
- New Zealand: A 2010-11 survey found that North Island strains of *L. sericata* showed high level triflumuron resistance.

Resistance – lice:
- Australia: Resistance to both triflumuron and diflubenzuron widely recorded and these treatments are largely abandoned.
- New Zealand: Unknown but expected to follow Australian situation.

BPU combination products are now also available.

Triazine and pyrimidine derivatives

Control: Developing maggots

Application method: Low volume spray ons. Jetting/saturation.

Environmental: Low mammalian toxicity; narrow spectrum of activity reduces environmental risk.

Resistance:
- Meaningful resistance has not emerged, despite widespread use.
- Australia: Low-level resistance recorded, but remain effective if applied correctly.

Macrocyclic lactone (ML)

Control: Flystrike and maggots

Application method: Non-recycling jetting systems.

Environmental: Minimal risk, when scoured from wool.

Resistance: No resistance by either blowflies or lice recorded.

Macrocyclic lactones are one of the most successful and widely-used parasiticide groups developed. They have broad-spectrum activity against both roundworms and insects at low dose levels. In New Zealand, ivermectin is the only macrocyclic lactone available as a flystrike control. It is on the market as a combination treatment with cyromazine.

Neonicitinoids

Control: Flies and lice

Application method: Low-volume pour-on spray.

Environmental: As a pesticide, has been implicated in cases of colony collapse in bees, but no evidence that its use on sheep may lead to harm to bees.

Imidacloprid is toxic to fish and some bird species, and highly toxic to aquatic invertebrates.

Resistance:
- None recorded in New Zealand or Australia (unsurprisingly, given limited time available).

Neonicotinoids are a relatively new chemical class of synthetic pesticides. There is only one neonicitinoid – imidacloprid – registered for use on sheep in New Zealand and it is available in combination with triflumuron.

Spinosyn

Control: Flystrike, maggots and lice

Application method: Saturation/jetting. Low-volume pour-on.

Environmental: Poses little threat to mammals, birds and fish. Short-lived in the environment.

Resistance:
- No resistance recorded in either flies or lice.
- Fully effective against strains of lice resistant to synthetic pyrethroids.

Spinosyns are one of the newest chemical classes of insecticides and a natural non-synthetic compound. The spinosyn available for use in fly and lice treatment is spinosad. Spinosyn is also available in combination with cyromazine as a saturation jetting formulation.

Managing resistance

There are two principles that underpin managing resistance:

1) Reduce reliance on chemicals – use them judiciously and in a targeted manner
2) Integrated Pest Management (IPM).

Reduce reliance on chemicals

Reliance on a single class of insecticide and its frequent application (e.g. more than once in a season) is a key resistance risk factor.

For lice control, adopt a rotation strategy using dissimilar chemicals from one treatment to the next.

However, rotation strategies for flystrike prevention are difficult to implement in New Zealand, because of the lack of viable alternatives to cyromazine and dicycanil.

Combination products

The reasoning behind combination products is that if a pest is resistant to one component, the other should kill it. However, the risk is that sub-lethal concentrations of a chemical could lead to selection for resistance to one or both chemicals.

In New Zealand, there are several combination products available. Unfortunately, both blowflies and lice have shown an ability to develop cross-resistance to chemicals with unrelated modes of action. For example: organochlorine-resistant lice demonstrated cross resistance to synthetic pyrethroids, while organochlorine-resistant blowflies developed cross resistance to organophosphates, which in turn demonstrated cross resistance to diflubenzuron.

Future chemical options

With the use of organophosphates under increasing regulatory and public scrutiny and the development of resistance by target parasite species to synthetic pyrethroids and IGR benzyl phenyl ureas, the sheep industry needs new chemical options. However, that may not happen, for multiple reasons, such as a lack of commercial motivation to develop new products, alongside food, environmental and operator safety concerns.

A more likely scenario is promoting the best level of parasite control, alongside preserving the effective life of available chemical options.

Tips to slow blowfly resistance:

- Only use chemicals known to be effective.
- Use a different chemical to treat an active flystrike lesion than used for flystrike prevention. E.g. If a flock was treated preventatively with a diflubenzuron jetting liquid and some animals became struck, the spot treatment used should preferably be either an organophosphate, cyromazine + spinosad or cyromazine + ivermectin.
- If using combination sheep dips for flystrike prevention and lice control, consider the efficacy spectrum and resistance status of the products in the combination. Lice control must be complete or exposure to sub-lethal concentrations can select for resistance.
- If lice control in short wool and fly control in long wool is required in the one year, use products from different chemical groups. E.g. If a triflumuron spray-on was used as an off-shears pour-on for lice control, and a long wool flystrike preventative is required, then this could contain either dicyclanil or cyromazine.

Only use chemicals known to be effective.

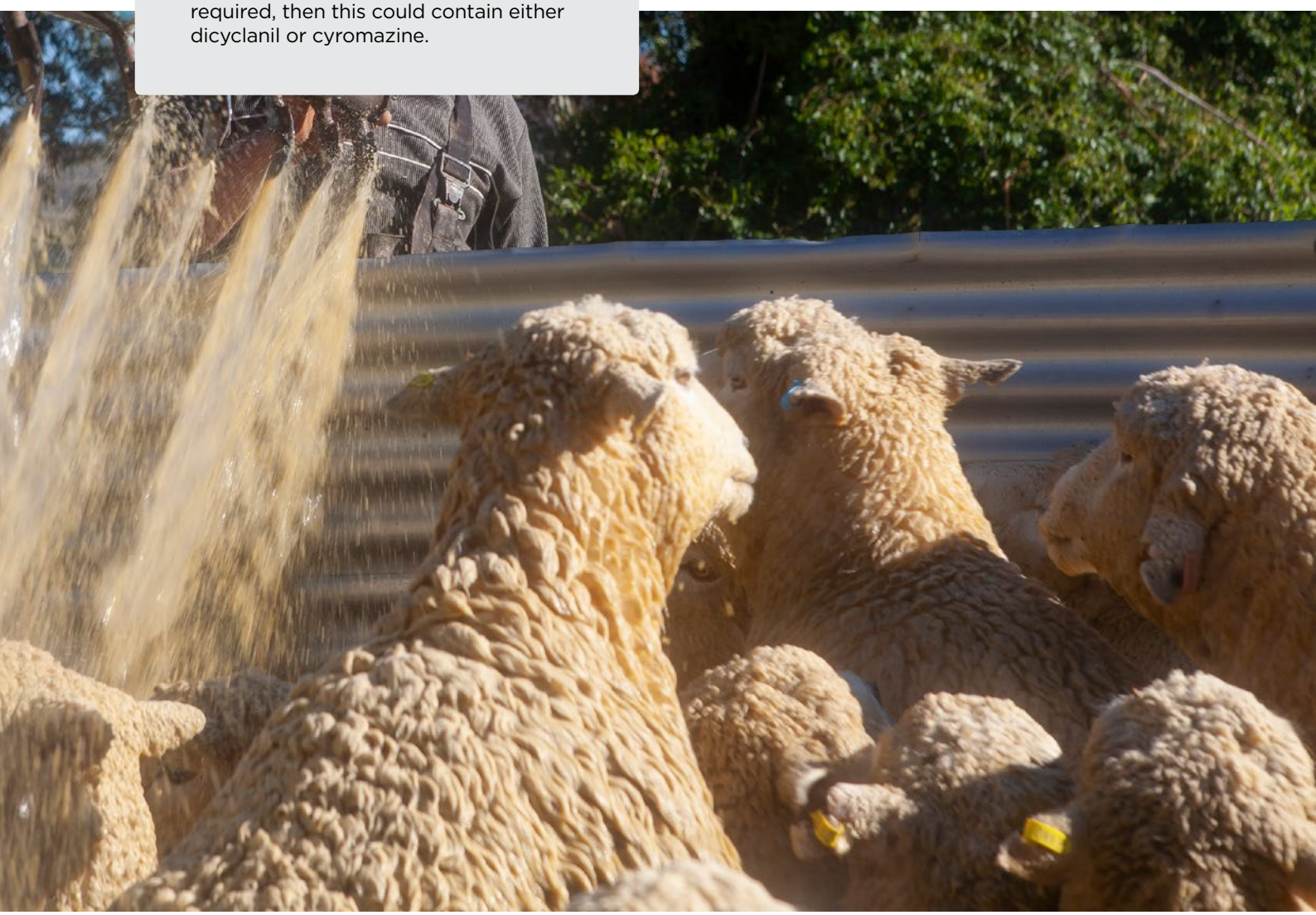
Integrated Pest Management (IPM)

To implement an effective Integrated Pest Management (IPM) plan, you do need to understand the life cycle of both blowflies and lice. (See Chapters 1 & 2)

IPM is about disrupting the pests' behavior and reducing population increase, alongside keeping the sheep host as unattractive to the pest as possible. The goal is to reduce reliance on chemicals and – where they must be used – apply in a targeted, highly selective fashion at precise, critical times of heightened pest activity.

See Chapter 6 for how to use Integrated Pest Management to control flies.

See Chapter 7 for using Integrated Pest Management to control lice.



Low-volume spray-on/pour-on products available in New Zealand (October 2018)

Active Ingredient	Chemical class	Brands	Parasites Controlled	Maximum wool length – lice	Label protection period flystrike	Meat withholding period
Cyromazine 60g/L	Triazine/ Pyrimidine IGR	Vetrazin SO Cyrazin SO Many generics	Flystrike	N/A	Up to 6 – 8 weeks, depending on formulation and dose	7 – 21 days, depending on formulation
Dicycanil 65g/L	Triazine/ Pyrimidine IGR	CLiK Extra	Flystrike	N/A	14 – 26 weeks	21 days
Dicyclanil 50g/L	Triazine/ Pyrimidine IGR	CLiK Strikeforce S	Flystrike	N/A	Up to 18 weeks	14 – 56 days, depending on formulation
Dicyclanil 12.5g/L	Triazine/ Pyrimidine IGR	CLiKZiN	Flystrike	N/A	6 – 9 weeks	7 days
Diflubenzuron 20g/L	BPU IGR	Magnum	Flystrike Lice	Coarse wool: <3 mo Fine wool: off shears	At least 8 weeks	Nil
Triflumuron 25g/L	BPU IGR	Zapp Exit	Flystrike (coarse wool only) Lice	Coarse wool: <6 mo Fine wool: off shears	At least 8 weeks	49 days
Triflumuron 25g/L Cypermethrin 30g/L	BPU IGR + SP	Exit Extreme	Flystrike Lice	Coarse wool: <6 mo Fine wool: off shears	At least 8 weeks	49 days
Diflubenzuron 20g/L Deltamethrin 10g/L	BPU IGR + SP	Comboguard Fleeceguard	Flystrike Lice	Coarse wool: <6 wks Fine wool: <6 wks	Up to 14 weeks	7 days
Trifllumuron 25g/L + imidacloprid 30g/L	BPU IGR + neonicitonoid	Zapp Encore	Flystrike (coarse wool only) + maggots Lice	Coarse wool: <6 mo Fine wool: off shears	At least 8 weeks	56 days
Alphacypermethrin 50g/L	SP	Vanquish	Flystrike Lice	Coarse wool: <10 mo Fine wool: <10 mo	Up to 6 weeks	7 days
Deltamethrin 10g/L	SP	Wipe Out	Lice Keds	Coarse wool: <6 mo Fine wool: <6 mo	N/A	3 days
Cypermethrin 25g/L	SP	Cypercare	Lice Keds	Coarse wool: <6 mo Fine wool: off shears	N/A	14 days
Spinosad 20g/L	Spinosyn	Expo	Lice only	Coarse wool: <3 mo Fine wool: off shears	N/A	Nil

Saturation/jetting products available in New Zealand (October 2018)

Active Ingredient	Chemical class	Brands	Parasites Controlled	Label protection period flystrike	Meat withholding period
Cyromazine 500g/L	Triazine IGR	Vetrazin Liquid Cyrazin Liquid Many generics	Flystrike	Up to 12 weeks	7 days
Cyromazine 500g/L + ivermectin 15g/L	Triazine IGR + macrocyclic lactone	Cyrazin KO	Flystrike + maggots	Up to 14 weeks	21 days
Cyromazine 500g/L + spinosad 12.5g/L	Triazine IGR + spinosin	Cyrex	Flystrike + maggots Lice	Up to 12 weeks	7 days
Diflubenzuron 250g/L	BPU IGR	Zenith Saturate Fleecemaster	Flystrike Lice	Up to 12 weeks	Nil
Triflumuron 480g/L	BPU IGR	Zapp Jetting	Flystrike Lice (coarse wool only)	Up to 12 weeks	42 days
Cyromazine 250g/L + diflubenzuron 1100g/L	Triazine IGR + BPU IGR	Saturate Gold	Flystrike Lice	Up to 12 weeks	7 days
Propetamphos 400g/L	Organophosphate	Seraphos	Flystrike Lice Ticks and keds	Not on label	14 days
Propetamphos 16g/L	Organophosphate	Maggo	Maggots	N/A	14 days
Spinosad	Spinosyn	Extinosad	Flystrike + maggots Lice	2-4 weeks	Nil

Case study

Never trust your dip 100%

Wairoa farmer Bruce MacDonald will never again put 100% faith in a chemical dip product.

Bruce and wife Jayne farm 12,500 stock units on the flystrike prevalent East Coast of the North Island. They'd used their local vet company to treat their Romdales each season and enjoyed many years of reliable, summer-long coverage with *Zapp* and *Exit* (triflumuron). That was, until the summer of 2014/15.

"Within two weeks of dipping, I found the first badly fly-struck sheep. Previously, we'd got 12-14 weeks cover out of the same product. I had absolute faith in it. It was expensive but so good. Up until then, I'd never been aware of any resistance to that product, locally."

Bruce applied a follow-up of *Cyrex* (cyromazine + spinosad) and hobbled through to the end of that season. Ever since, he's continued to apply *Cyrex* and *Cyrazin KO* (cyromazine + ivermectin) to his ewes twice each season, through an electro-dip. "But the last two years – admittedly bad fly seasons – I've seen a big short-coming and we're having to re-dip after a month."

Ewe replacements are treated with *Clik* (dicycanil), because the generous length of cover makes management on the large-scale property more practical.

"But no matter what product you're using or how much faith you have in it, do not just apply and forget about it. Those days are over."

CHAPTER 4

DECIPHERING CHEMICAL PRODUCT LABELS

Older chemical products have often been registered under different criteria and therefore the wording on their labels may not very helpful. (For example, labels describing protection as “long term, medium term or short term”). Since 2003, labels must state the duration of flystrike protection a farmer can reasonably expect from the product, as well as describing conditions that may affect protection periods, such as prolonged heavy rain. However, even this move has not fully clarified the situation for farmers, with some product labels stating protection of “up to 12 weeks” or “at least 8 weeks”.

Factors that compromise protection periods

A label’s flystrike protection period claim is best considered as a guide. Key factors impacting on the protection period include:

Flystrike protection periods

Definition of protection period: The prevention of flystrike (by the particular fly species stated on the label) in at least 98% of the flock, while subject to an active fly challenge.

Flystrike protection periods are described in weeks.

Application of saturation products	
Automatic Jetting Races Gorse guns	Shower dipping Designated hand jetting wands
Typically deliver less wash to the fleece → can result in shorter protection period	*Deliver more wash to fleece, but only if done properly*
Application of low volume spray-on/pour-on products	
Incorrect applicator and application pattern	Correct applicator used with recommended application pattern
Will compromise efficacy	*Critical for chemical effectiveness*
Stock class	
Lambs	Older animals
Marginally more susceptible to strike than older animals	*Less susceptible*

Stock cleanliness		
	Dirty, wounds, footrot, dags	Clean, wound- and dag-free
	More prone to strike	*Less susceptible*
Wool type		
	Coarse wool fleeces	Fine wool fleeces
	Chemicals persist shorter time	*Chemicals persist longer*
Wool length		
	Very short wool	Longer wool
	Cannot "hold" dip chemicals	*"Holds" dip chemical well*
Wet fleece		
	Wet fleece	Dry fleece
	Less dry wool to uptake the dip	*Takes up the chemical well*
Weather after treatment		
	Heavy rainfall*	Dry weather
	Compromises amount of chemical retained in the fleece	*Allows chemical to persist longer*

* The rain-fastness of products should be indicated on the label.

Lice protection periods

As with flystrike protection products, the content of labels varies dramatically.

"Control of lice" is defined as a reduction of pre-treatment lice populations to non-detectable levels at 150 days or longer, post treatment, when used according to product instructions.

"Aids in control of lice" is a greater than 95% reduction in lice numbers from pre-treatment for 90 days.

Wool length

The more residual wool left after shearing (for example, as occurs with cover-combs lifters and blades) the lower the efficacy of low-volume backline treatments for lice. In these cases, use the longer wool dose rate.

The more residual wool left after shearing, the lower the efficacy of low-volume backline treatments for lice. In these cases, use the longer wool dose rate.

Chemical residues in wool

The use of chemicals is necessary to control and prevent the losses associated with flystrike and lice. Unfortunately, an inevitable result is the presence of chemical residues in wool.

While beneficial to animal welfare, these residues have the potential to create issues around wool marketing, environmental protection and occupational health and safety.

Woolgrowers should make every attempt to adhere to industry guidelines for chemical withholding periods (below), but without compromising animal welfare.

Wool type	Days
Crossbred	60
Mid micron	100
Fine	180

NB Spinosad products have no withholding period.

Case study

Treating lice? Do it properly

North Otago dipping contractor David Ludemann has seen plenty of chemical families come – and then go. Many arriving amid claims of being 'the dip to end all dips', that farmers would never need anything else.

After 52 years' working alongside farmers, David says the increase in tolerance to some chemicals – including those used in pour-ons – is making fly and lice management more challenging.

"Dipping is an important part of the animal health programme. A farmer looks at a contractor's bill and says it's expensive – at $1-$3 per head – but the job is done properly. It's a solid investment, when you consider the high cost of fly and lice damage."

The biggest problem David sees in his line of work is poor chemical application. "Farmers might save money by doing their own dipping, but many are not putting anywhere enough chemical on. They simply don't apply the volume needed to get enough chemical on. You've got to saturate them to the skin to get good results."

David uses a shower dip and each animal gets a good 3-4 minutes inside, depending on the length of wool.

The other advantage of using a contractor is that they know which chemical is doing the job in your area, in that season.

David says lice and fly control can be achieved through good management. "Dip regularly over summer and autumn with an effective chemical and you shouldn't have too many problems."

CHAPTER 5

DIP APPLICATIONS METHODS

During the past three decades, there has been a marked shift from saturation, to low-volume dipping methods. A 2016 survey of more than 1200 New Zealand farmers revealed the following methods were used to prevent flystrike (categorised by wool type):

	Fine/Medium Wool	Coarse Wool
AJRs (Automatic Jetting Races)	45%	37%
Pour-on / spray-on	56%	26%
Hand jetting	25%	25%
Shower dip	17%	9%
Plunge dip	7%	1%

Saturation dipping

There are anecdotal reports of increased interest in reviving saturation dipping practices in flocks with ongoing significant lice issues.

Plunge dipping

Plunge dips are essentially a large bath with a capacity of 4000-10,000L, filled with dip wash. Sheep enter one end and swim to the other, being submerged at least twice along the way.

Tips for plunge dipping:

1) Each animal should remain in the dip for 15-30 seconds and be completely immersed twice, pushed back and down using an appropriate tool.
2) After the first few sheep have been through the dip, allow several minutes for shaking and soaking in, then check the back of their necks to ensure they are being completely saturated.

Plunge dipping: Check the back of the sheep's neck to ensure they are being completely saturated.

Advantages	Disadvantages
• The whole sheep is treated • At short wool lengths (2-6 weeks wool growth) complete saturation to skin level is more easily achieved	• Not suitable for sheep with more than 8 weeks wool • Stresses on sheep are high • Labour-intensive • Hygiene standards for bath and dirt traps must be high to avoid breakdown of dip chemical and build-up of bacteria • Risk of infection if shearing cuts have not healed before dipping • Large volumes of dip wash are required and must be disposed of • Not suitable for heavily pregnant ewes • High operator and staff exposure to dip chemicals

Shower dipping

Shower dipping involves diluting and pumping dip wash from a sump through an overhead boom and bottom spray nozzle. Depending on the size of the dip pen, 30-70 animals are treated together.

Tips for shower dipping:

1) Sheep need to be a similar size and able to mill around during showering.
2) The top nozzles are the most important for saturation and should remain on during the whole showering period.
3) Depending on wool length, body size, wool type, shower operating efficiency, etc, showering length is usually 7-9 minutes per pen.
4) Check the first few pens of sheep for complete saturation. In a shower dip, the most difficult area to wet is under the neck. Again, allow several minutes before examining the animals, then adjust showering time accordingly.

Shower dipping: Check under the sheep's neck to ensure complete saturation.

Advantages	Disadvantages
• Less labour-intensive than plunge dipping • Generally safer for the operator	• If sheep have more than 2-6 weeks wool growth, they are hard to wet to the skin • When sheep are dipped too soon after shearing, there is a risk of infection as shearing cuts are unlikely to have healed • Sumps must be emptied and cleaned regularly • Mechanical breakdowns are possible and most shower dips are at least 40 years old, so spare parts may not be obtainable • Uneven application with some shower dips due to poor nozzle configuration • Because of expected time saving, operator may run the machinery too fast • High operator and staff exposure to dip chemicals • Comparatively inefficient dip application, especially on fine wool sheep

Shower dipping

Beware operator technique

Saturation methods of dipping are arduous and faulty technique is usually to blame for poor results.

Saturation dipping: Faulty technique is usually to blame for poor results.

Wash pollution

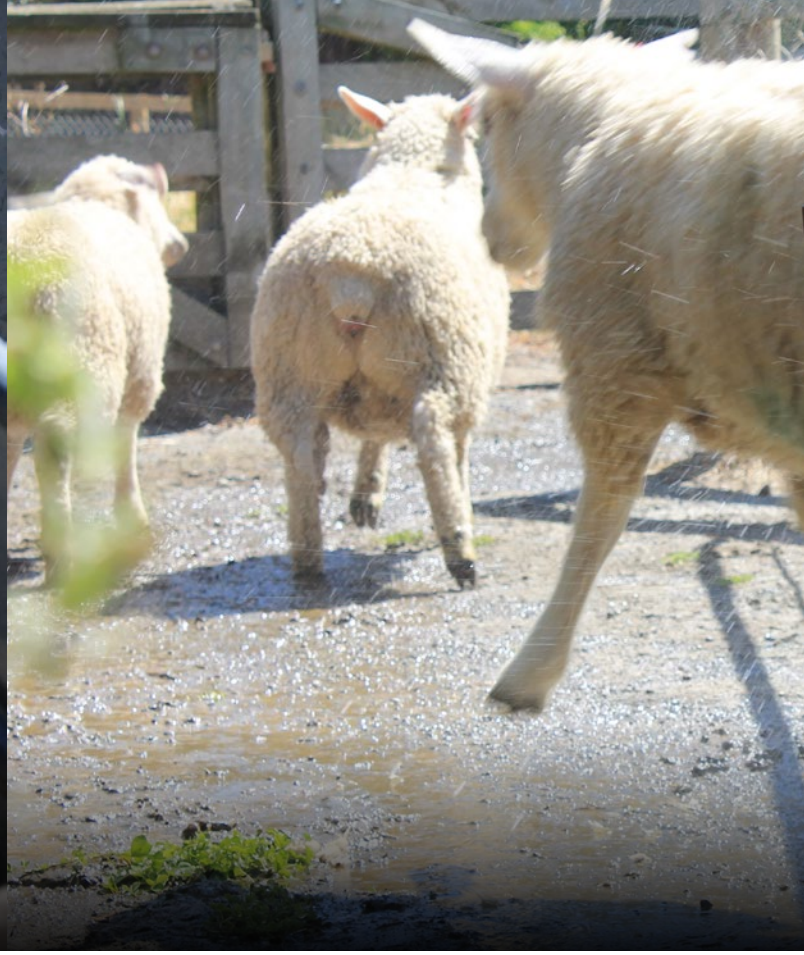
With saturation dipping, it is inevitable that the dip wash becomes contaminated with soil, faeces, urine and wool grease.

Excessively polluted wash is referred to as "stressed". The result is a lowered concentration of chemical in the wash and the effectiveness of dipping is markedly reduced or, in extreme cases, nullified.

Tips for keeping dip wash free of contamination

Sheep	- Muster the day before and rest overnight - Provide drinking water, but no food - Allow stock to "empty out", ideally on a slatted floor - If the sheep are "daggy", crutch at least 4-6 weeks before dipping - Health problems (such as, diarrhoea, foot-rot, foot abscesses, grass-seed abscesses, flystrike and so on) should be treated well before dipping
Dipping facilities	- Concrete yards and races leading to the dip help reduce the amount of contamination carried in on the feet
Dipping procedures	- Realistic allowance of wash = one sheep dipped for every 2L of sump working volume - Keep an eye on levels of contamination during dipping - Do not dip wet sheep, as this will dilute the dip wash
Draining time	- Wash from the draining pens is usually heavily stripped and contaminated - The benefits of saving dip chemical by prolonged drainage are minimal, while the risk of excessive wash contamination is high - Keep draining times short to decrease sump contamination
Dirt traps	- Clean regularly
Sump volume and design	- No more than one sheep should be dipped for every 2L of the sump's initial working volume. (E.g. A 500L constant-replenishment shower sump must be emptied and cleaned out after every 250 sheep)
"Dipping out"	- "Dipping out" is not recommended for use with modern dips - The potential saving in sheep dip concentrate by "dipping out" does not justify the high risk of jeopardising the dipping process
Storage of unused dip-wash	- Depending on the active ingredient and use of a bacteriostat, large volumes of unused wash can usually be stored for seven days - Check manufacturer's recommendations for retention times - All treated wash, *even if unused*, should be disposed of after 14 days storage - Dip wash containing spinosad should only be used on the day of mixing and not stored
Plant maintenance	- **All sumps must be securely covered to prevent children or stock drowning** - At the end of dipping, sumps should be emptied, cleaned out and filled with water to prevent deterioration and cracking - Carry out maintenance at the end of each dipping season and again shortly before the start of the next

Control sheep speed to ensure adequate wetting



Automatic jetting races (AJRs)

Modern automatic jetting races (AJRs) were developed for rapid application of flystrike preventative treatments to the back and breech of sheep.

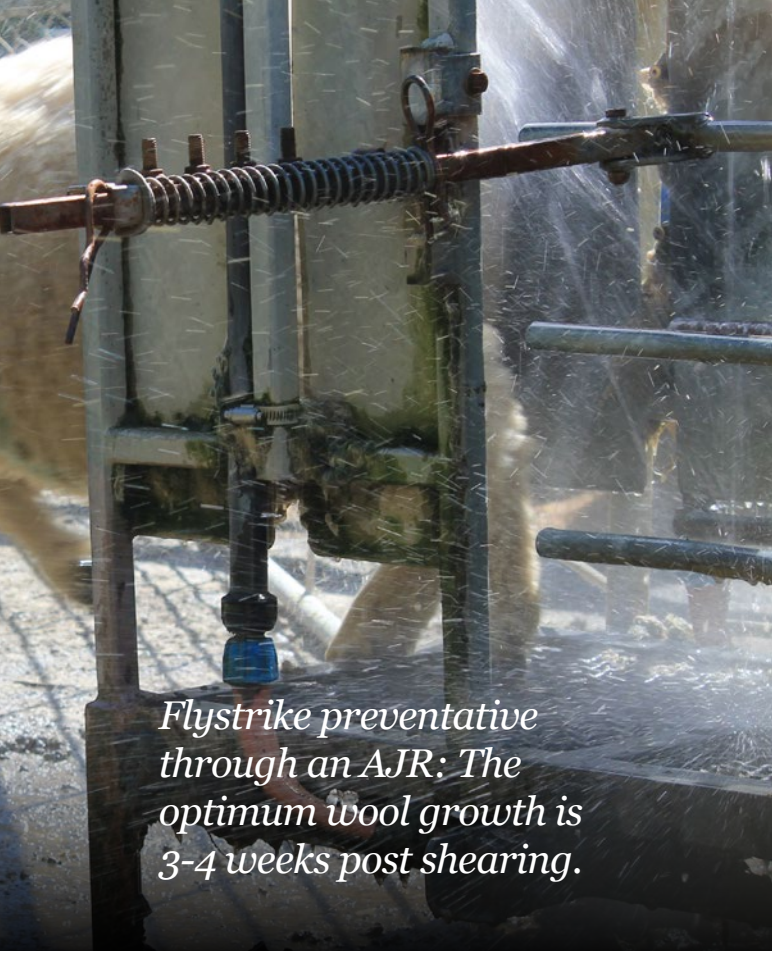
Advantages	Disadvantages
• Large number of sheep can be treated in a short time • Only clean wash is applied • Low labour requirement • Low water consumption • Wash is not recycled, so there is no contamination and stripping of the active ingredient • Equipment is portable	• Application of dip wash can be variable between animals within a flock • Incomplete wetting and lack of contact time can result in poor lice control • Low volume of dip wash applied may result in a shorter than expected period of flystrike protection, compared to product label claims • Avoid inhalation of misted dip wash

AJRs for flystrike protection

To be effective, the sheep must be wet to skin level along the backline, over the rump and around the crutch area.

Tips for wetting sheep to the skin:

- Arrange the nozzles so that the target areas of the fleece are sprayed more than once. I.e. Position multiple spray bars across the flow of sheep or use multiple nozzles in line with the sheep flow.
- Good penetration is only achieved with a solid stream of dip wash. Do not use fan or cone nozzles or small diameter solid stream nozzles under high pressure.
- Spray height is important. The closer the nozzles are to the fleece, the more effective and efficient the application will be.
- Enough spray needs to be retained in the fleece, so that some jetting fluid runs around on the body of the sheep.
- Spray pressure should be high enough to achieve the required flow rate, but not so high as to break up the solid stream. Spray pressures above 65psi (450kPa) are significantly better at wetting sheep than those below 65psi.
- Pump size is specified by its pressure/volume characteristics. Five to six litres of jetting fluid applied at a pressure of at least 65psi are required to adequately wet sheep carrying more than 8 months wool.
- For adequate wetting, sheep speed must be controlled to less than 1 sheep per second.
- For mobs of different sized animals, draft into even lines before treatment and set the jetting race accordingly.



Flystrike preventative through an AJR: The optimum wool growth is 3-4 weeks post shearing.

Flystrike protection periods

Claimed protection periods against flystrike for many saturation or jetting formulations were established using saturation shower dipping. The speed of treatment provided by AJRs results in a corresponding reduction in the protection period.

The quantity of dip wash applied to each animal should be calibrated and care must be taken to ensure all animals are treated effectively.

The current New Zealand industry recommendation for jetting product dose volume is a minimum of 2L dip wash with an additional 0.5L per month of wool growth.

While sheep of any wool length can be treated with a flystrike preventative through an AJR, the optimum wool growth is 3-4 weeks post shearing, when animals become at risk of being struck.

AJRs for lice treatment

Most AJRs now feature extra banks of nozzles targeting the flanks and neck/brisket areas of sheep to allow for application of lousicides.

When using AJRs for lice treatments, ensure all jets are on and there is sufficient pressure to get sheep wet to the skin. Slowing the sheep down as they run through the AJR also ensures more dip wash is applied.

The optimal time to treat is off shears or, at least, on to as shorter wool as possible.

Low-volume pour-on/spray-ons

The terms pour-on and spray-on are essentially interchangeable – both are applied by hand-held manually operated apparatus delivering 10-50mL per dose. Pour-ons are typically administered using a T-bar or drench nozzle fitted to an applicator, while spray-ons are applied using a fan spray nozzle. To get best results, use the manufacturer's approved applicator.

Low volume pour-on/spray-on products are available for:

- prevention of flystrike
- flystrike plus lice control, and
- lice control alone.

Advantages	Disadvantages
• No mixing or water required • Fast and easy to use • Equipment portable and cheap • Measured dose per animal • Little stress on sheep • Variety of products and formulations available	• Backline application for lice control is compromised by the distance of lice from site of application • Success of treatment relies heavily on correct application technique: - Lice control – apply from poll to tail along the midline - Flystrike protection only occurs to the areas where product is applied • Maximum lice control may take up to 7 weeks, even where knock-down active ingredients are used. If treating after pre-lamb shearing, there is often insufficient time before lambing and the opportunity for lice transfer to lambs • Product is applied at high concentration. Take care in handling and applying product and note label recommendations regarding personal protective clothing

Low-volume pour-on/spray-on products for flystrike protection

In the case of flystrike prevention, only the treated area will be protected. Therefore, the back and crutch regions are the main target areas, with additional consideration given to the head and pizzle of rams, and lamb tailing/castration wounds at marking.

Low-volume flystrike preventative treatments are best applied from about 4 weeks after shearing, when animals become more at risk of being struck and wool length allows better retention of dip chemical.

Flystrike prevention: Only the treated area will be protected, so target the back and crutch regions. Treatments are best applied from about 4 weeks after shearing.

Low-volume pour-on/spray on products for lice control

Active ingredients include:

- Synthetic pyrethroids (deltamethrin, cypermethrin and alphacypermethrin)
- Benzyl phenyl urea insect growth regulators (triflumuron, diflubenzuron)
- Neonicitonoid (imidacloprid – only available in combination with triflumuron)
- Spinosad.

Combinations of benzyl phenyl urea insect growth regulators and synthetic pyrethroids are also available.

Synthetic pyrethroids, imidacloprid and spinosad all have a rapid knockdown effect against adult and juvenile lice. Triflumuron and diflubenzuron affect the ability of juvenile lice to reach adulthood, but have no effect on adult lice.

Pour-on application

Tips for pour-on lice control:

- The most effective time to apply low-volume pour on/spray on lousicides is within 24 hours of shearing.
- To prevent under-dosing, base the dose on the heaviest animal or longest-woolled sheep.
- Apply product from the poll to tail, along the mid line.
- Use approved applicator.

Dipping contractors

Dipping contractors remain a viable option, particularly for lice control in the South Island.

Advantages	Disadvantages
• Savings in time taken to treat animals • Skilled operators • Superior results • Lack of capital tied up in equipment	• Lack of flexibility in treatment timing • Increased cost per animal treated

Hand jetting

Hand jetting involves the use of a specially-designed hand wand attached to a tractor tank/pump with the wand combed individually through each animal's fleece.

Treatments target the most flystrike prone areas – i.e. along the backline, from the back of the neck to the rump, and around the breech.

Advantages	Disadvantages
• Clean wash only is applied • Saturation to skin level easily achieved • When calibrated, a known volume of wash can be applied to each sheep • No used dip wash to dispose of • Dip is placed only where needed	• Hard, slow work • Not suitable for lice control, other than application of emergency treatments

Tips for hand jetting:

- To calibrate a jetting wand, set the pump at 70psi (490kPa) and run the fluid into a bucket, timing how long it takes to deliver a litre.
- To soak the fleece to skin level, a minimum of 2L of wash per animal is recommended for adult sheep and 1L for lambs.
- Longer wool lengths requiring greater wash volume.

Gorse guns

While popular with farmers, gorse guns were not designed for jetting sheep. They are slow and hard to use for long periods and marker dyes in weed killers are not scourable from wool.

The variability of chemical application achieved when using gorse guns generally means this method does not provide effective flystrike control.

Disposal of dip concentrates, containers and used dip wash

Disposal of surplus dip concentrates, dip containers and spent dip effluents must comply with the Resource Management Act 1991 and the regulations of regional councils.

Disposal of containers and unwanted dip concentrate

The Agrecovery Rural Recycling Programme is a free nationwide collection and disposal system for unwanted and expired agrichemicals.

Contact Agrecovery:

- 0800 AGRECOVERY (0800 247 326)
- chemicals@agrecovery co.nz
- www.agrecovery co.nz

FREE RECYCLING
AGRECOVERY
agrecovery.co.nz

Disposal of used dip wash

Two methods of discarding dip wash are considered adequate:

- Store the dip wash in a safe holding tank until it can be collected by a specialist contractor
- Spread the dip wash onto suitable land at low application rates.

Disposal of dip wash onto land is controlled by regional council regulations, therefore they should be contacted before proceeding with this method.

Photo courtesy Hawke's Bay Today

Case study

Be diligent about equipment maintenance, application rates and technique

When it comes to fly strike prevention, Sefton Alexander is a stickler for ensuring his equipment is running well and the correct amount of chemical is being applied thoroughly to each animal.

Sefton and wife Amanda farm 11,500 stock units – including 4000 Romney/Coopworth ewes – on 1280 hectares at Nuhaka in Northern Hawke's Bay.

Alexanders had been happily using *Zapp* (triflumuron) concentrate through their *Electrodip* AJR for several years, but the dream run came to an end four years ago, when the chemical simply stopped working.

"Within two weeks, we were getting struck sheep, when we'd been getting up to 12 weeks cover, previously. It came as a complete surprise. I knew there was resistance in other parts of the country, but it was working sweet for us."

Sefton moved to cyromazine products, which are acceptable within his Wools of New Zealand contracts. He keeps a critical eye on the chemical's performance, but also his own application practice.

"You've got to be so vigilant, when it comes to preventing flystrike. It's important your gear is running correctly, that you're applying the right amount of product and your dipping technique is good."

CHAPTER 6

FLYSTRIKE PREVENTION AND TREATMENT

The best and most cost-effective approach to preventing flystrike is to use a combination of strategies that keep sheep as unattractive to flies as possible. This is called Integrated Pest Management (IPM).

Integrated Pest Management aims to keep pressure on a pest throughout all stages of its lifecycle and involves both chemical and non-chemical tools. It is about attacking maggots and flies from different angles, at different times.

Integrated Pest Management is about attacking maggots and flies from different angles, at different times.

For example, weekly monitoring using small offal-baited fly traps detects when blowflies become active. This then triggers actions that will reduce the attractiveness of sheep to blowflies, such as:

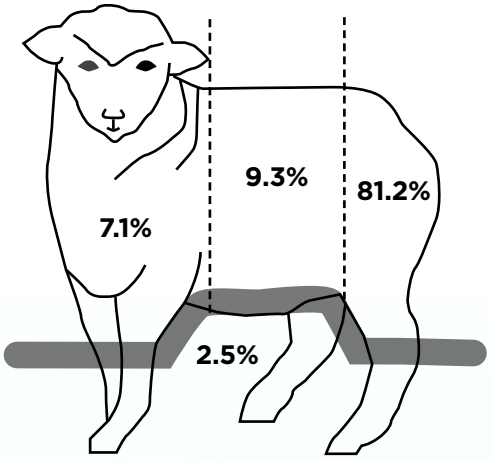
1) Shearing, crutching or dagging
2) Moving sheep to higher ground where temperatures are cooler and wind speed higher
3) Keeping sheep away from scrub or shelter
4) Avoiding intensive grazing and therefore a concentration of sheep odours.

Chemical tools

Facts about blowflies:

- Only a small percentage of the overall population affect sheep.
- Almost always attracted to the breech area.
- They have a seasonal activity pattern of onset and population increase, so treatments can be timed accordingly.

These three factors mean use of a preventive chemical product can be limited to a specific time and to the breech area, on the most susceptible animals (e.g. lambs at or before weaning).



Distribution of flystrike on sheep (Heath and Bishop, 1995)

Preventative treatment: When is the best time?

A preventative approach is strongly recommended (i.e. treating at-risk classes of stock with an effective product just before the annual risk period).

Treat at-risk classes of stock with an effective product just before the annual risk period.

The timing of preventative treatments will be dictated by:

- The local challenge (i.e. fly trap evidence)
- Shearing dates and frequency (remember: shearing, crutching or dagging after preventative treatments can remove chemical and reduce protection – and wool withholding periods should be adhered to)
- Application method
- Personal considerations (e.g. holidays)
- Class of stock, and
- Labour availability.

Tips for at-risk stock classes:

Lambs at docking	- Docking wounds are a fly attractant. - Apply a low-volume spray-on cyromazine or dicyclanil formulation to the marking wound. - Leave docked tails the right length.
Lambs for processing	- Reliable effective protection combined with a short meat withholding period are essential. - There are low-volume spray-on and saturation products with 0-14 day meat withholding periods.
Ewes and ewe replacements	- Products which provide reliable long-term protection against flystrike are preferable, particularly prior to and during mating. - Anecdotal evidence strongly suggests that ewes or ewe hoggets that get struck are very unlikely to get in lamb.

Non-chemical tools

Moisture is the critical factor for strikes to develop. For eggs to hatch and larvae to establish, they need at least 24 hours of moist conditions in the fleece.

Moisture is the critical factor for strikes to develop.

Husbandry

Effective internal parasite control and use of specialist high tannin crops or clean pasture result in less dags, which in turn, make sheep less attractive to flies.

Footrot, pizzle rot, urine stain, blood, fleece rot and lumpy wool are also major fly attractants that provide moist conditions in the fleece.

Shearing and crutching are partially effective flystrike preventatives, because they reduce fleece moisture and contaminants.

Tails which are either too short or too long increase the risk of flystrike.

Tail length influences the risk of flystrike. This image shows the ideal length – neither too short, nor too long. Photo courtesy David Scobie (AgResearch)

Dead stock

Carcases of all types – including possums and rabbits – will support a maggot population. Because strike flies normally only attack a carcase in the three days after death, carcases should be buried, put down an offal pit, or burned as soon as they are discovered.

The adult flies also need a feed of protein (e.g. from a carcase, mucus or dung) before they can reproduce.

Farm hotspots

Some areas of a property are likely to be more attractive to flies than others. Hotspots include sheltered scrub-lined gullies, patches of thistles, bush margins and the lee of shelterbelts.

Sheep camps, with accumulations of droppings are likely to have higher concentrations of flies. When fly pressure is high, if possible, move stock to windy exposed pastures which flies don't favour.

Genetic improvement

Increased resistance to body strike and breech strike can be gained by selecting fine wool breeds for resistance to fleece rot and for less skin wrinkle.

Cull sheep that get flystrike. There is scientific evidence that ewes that get struck are more likely to die during the following year. If they survive, they will be lower in live weight and rear fewer lambs.

Sheep with a naturally bare breech should be considered in breeding programmes. These are available in a number of breeds from breeders throughout New Zealand. B+LNZ Genetics has incorporated DagScore into its ram selection tools.

Monitoring
Weather conditions

Australian work shows that early season preventative treatments that coincide with the emergence of flies from the soil can help reduce the total overall fly population throughout the season, as can large-scale traps set in action early in the fly activity season.

Record keeping

Keeping an accurate diary of when stock was treated and local weather conditions, along with regular stock checks will provide a guide as to whether a flock may require re-treatment.

Continuous heavy rainfall following treatment may have an impact on protective chemicals used, so be sure to read the product label to understand conditions which may reduce protection period.

Anticipation is the key to good flystrike management. Adopt a preventative rather than a reactive approach.

Anticipation is the key to good flystrike management. Adopt a preventative rather than a reactive approach.

Monitor fly traps, either purchased ready-made such as Gordys Flytrap Fitting or home-made (see next page) are an excellent way to predict the onset of blowfly activity.

If there are very few flies around, there will be very few in the trap. Equally, if there are lots of flies, then there will be lots in the trap. However, it is critical to check the traps regularly or it defeats employing them as a monitoring tool.

Set your traps up in early spring near the woolshed or homestead, or at a frequently-used gateway, where they can be easily and regularly checked. Look for green or golden-brown blowflies. Ignore all other fly types.

How to make the “Anderson Trap”

Pete Anderson is a Marlborough vet and sheep/beef consultant. He initially developed the trap as a flystrike prevention strategy. “I thought fly trapping might reduce the incidence of flystrike by reducing the number of flies.”

In line with other experiments investigating the mass capture of flies, the trap’s impact on the overall fly population was minimal. However, it did work well as a monitoring tool. “For $2.50 each – at the time – these yellow buckets were a cheap trap.

But there were issues. They need to be anchored down or blow away, you need to remember where you put them, and they do need re-baiting every week.”

Pete says a great feature of these small portable traps was how easily they could be shifted with mobs and act as surrogate sheep, drawing fly activity away from sheep and towards the trap.

1) Take a bucket that has a clear lid and drill two 32mm holes on opposite sides, halfway up the bucket.
2) Get a piece of 25mm internal diameter polythene (or similar pipe) and cut it slightly wider than the bucket with a bevel cut.
3) On the bottom side of the polythene pipe drill two 15mm holes.
4) On the top side of the polythene pipe drill 10 x 3mm holes above the 15mm holes.
5) Bait the bucket with sheep liver. (One liver is able to bait several traps.)
6) Check and recharge the bait every 7–10 days. Although, as long as the bait stays moist it will last for some time.

Treatment of an active strike

Flystruck sheep need to be treated quickly:

1) Clip back any longer wool around the struck site. (If the affected area is large, do not shear the struck area to the skin, as this exposes it to sunburn which will delay healing.)
2) Soak the struck area with an approved dressing.
3) If dipping or jetting fluid is used instead of a flystrike dressing, ensure it contains a “knockdown” active ingredient (such as spinosad, ivermectin or propetamphos).
4) Provide the affected animals with food, water and particularly shade, because infection causes fever.
5) If affected animals recover, cull them at the next opportunity.

Case study

When resistance rears its ugly head

North Waikato farmer and vet Jeremy Leigh clearly remembers resistance to triflumuron gradually coming to light in his patch.

"It was the summer of 2005/2006 and there was a lot of general talk about flystrike. The shearing contractors were talking about it, farmers were talking about it. Then farmers found flies were striking a couple of weeks after treatment. *Zapp* had been a good product up until then, so people were caught unaware.

"The key message at the time and one we all remember is 'switch chemical families and never go back'."

At a regional level, the agricultural sector did its part. "The local companies stopped carrying that chemical family – and they still don't carry it."

There were other valuable lessons. "Many farmers were treating stock straight off the shears. While that's ideal for lice treatment, there isn't enough wool for good chemical coverage against flystrike. It's much better to wait three or four weeks.

"It was also a timely reminder of the importance of keeping sheep clean, killing live maggots by burying dead animals quickly, and rainfall – that's a biggie. If you've treated for flystrike then there's a lot of rainfall, unless it's a rain-fast product, your treatment is seriously compromised."

In line with other patterns of resistance emerging in New Zealand, the onset of European green blowfly *(L. sericata)* resistance to triflumuron followed soon after Australian farmers recording resistance to the similar chemical, diflubenzuron, by the Australian green blowfly *(L. cuprina)*.

CHAPTER 7

LICE PREVENTION AND TREATMENT

Eradication of lice would seem a possible target, but without every sheep in every flock throughout the country being dipped thoroughly within a short period of time, there is little chance. Despite sheep flocks being dipped in New Zealand for the past 150 or so years, lice are still common in the national flock.

Do you have a lice problem?

Ask yourself:

1) Have signs of lousiness been obvious over winter?
2) Are lice treatments being applied for peace of mind or are you treating an actual problem?

Well-fed and well-conditioned sheep are less prone to lice than undernourished poor conditioned sheep. This means the lightest in a mob are the best indicators of potential lousiness.

The lightest sheep in a mob are the best indicators of potential lousiness.

Every summer and/or autumn just before shearing, select at least 10 of the lightest sheep in your flock, or those sheep showing obvious signs of rubbing their fleeces.

How many lice are present?

Make 10cm partings in the fleece at the:

1) Throat (both sides of the midline)
2) Chest (both sides of the midline)
3) Lower shoulder
4) Upper shoulder
5) Hindquarters
6) Withers
7) Belly (both sides of the midline)

Lice favour the midline of the back and shoulders. Also check under the neck.

Checking for lice

Assessing lice numbers

Infestation level	Average number of lice per parting	Total number of lice
Light	Less than 1	Less than 5000
Medium	1-5	5000-250,000
Heavy	More than 5	More than 250,000

Source: The Sheep: Health, Reproduction and Disease 3rd Edition. D.M. West, A.N. Bruere and A.L. Ridler 2009

You end up with a total of 14 partings per sheep. Count the lice and total up.

NB: When lice are few, it may be necessary to make three partings at each site.

Tip: Lice favour the midline of the back and shoulders, but also check under the neck.

The importance of shearing

Shearing can remove up to 80% of lice, depending on the closeness of the cut, and a high lice kill at shearing can be further enhanced by off-shears lice dipping.

Wool protects lice and their eggs from the sun's ultra violet (UV) radiation. Therefore, the more wool left on a sheep after shearing and the shorter the sunshine hours, the more likely lice will breed rapidly. For instance, cover comb or blade shearing in autumn or winter is a high-risk combination. Add to this the difficulty of dip penetration in long wool and you have a recipe for a big lice problem.

Shearing can remove up to 80% of lice and a high lice kill at shearing can be further enhanced by off-shears lice dipping.

Using chemicals to treat lice

Dipping provides the most effective, persistent protection against on-going lice challenge. But, first, take the time to understand how different products work and the limitations of various application methods.

Facts about lice:

- The whole population exists on the sheep and never leaves except to transfer from one animal to another. Therefore, the lifecycle can only be broken on sheep.
- The best time to treat lice is when lice numbers are at their lowest, which is usually in summer and/or immediately off shears – not in winter, as is widely believed.

Tips for chemical use on lice:

- Use effective chemicals and do not use the same chemical year after year.
- There may be benefit in using two actives together where the actives target different stages of the life cycle, such as in the pour-on Zapp Encore which contains imidacloprid and triflumeron.
- Where complete saturation is achieved in a plunge or shower dip, there is no advantage in using more than one active.
- To reduce selection for resistance, do not use two actives that both target the same life cycle stage (e.g. not to use spinosad and ivermectin*) at the same time.
- Apply all products strictly as per label.
- Rotate products from different effective chemical groups at consecutive treatments.
- If treatment for flystrike prevention and lice control is required at the same time, use chemicals from different chemical groups.
- Maintain accurate records regarding all treatments.
- Dip each mob at the most appropriate wool length and time for that mob. Focus on on-farm eradication of lice.
- Dip off-shears. It is the most effective way of controlling lice.
- Quarantine dip all sheep brought onto the property.
- Secure boundary fences.
- Do not mix treated sheep with untreated sheep.
- Check that treatments have worked.

The best time to treat lice is when lice numbers are at their lowest, which is usually in summer and/or immediately off shears.

Dip off-shears. It is the most effective way of controlling lice.

Lice control scenarios

Pre-lamb shorn fine/medium wool sheep

The value of the wool is a major part of the income on farms running fine and medium wool sheep and to maximise wool returns, sheep are usually shorn once a year, pre-lamb.

Lice control on these farms is both difficult and important.

Tips for lice control:

- Effective off shears treatment.
- Monitoring of lice burdens at weaning. Carry out lice counts on a proportion of the light condition sheep.
- If lice are present, use an effective summer/autumn treatment – ideally one with a different active from the off shears treatment.

Off shears treatment options:

1) Pour-ons

- Best done straight off shears.
- Allow sufficient time between treatment and lambing to prevent lice transfer to lambs:
  - At least 4 weeks for products that contain spinosad, imidacloprid or a synthetic pyrethroid.
  - At least 6 weeks for products that contain an IGR.

2) AJRs

- Ensure all jets are on to get maximum coverage. Only need relatively low pressure due to short wool length.
- Best product to use is spinosad.
- Other options would be ivermectin*, an organophosphate or a diflubenzuron (would need to be used at least 6 weeks before the start of lambing due to being an IGR). If using diflubenzuron or ivermectin, it would be better to have sufficient wool grease for the active to bind to – therefore timing would need to be 1-2 weeks following shearing with a cover comb and 3 weeks following shearing with a flat comb.
- Can be done straight off shears (when using spinosad or propetamphos), as risk of causing infection to shearing cuts is low due to no recycling of dip wash.

3) Saturation

- Not recommend off-shears due to potential infection of shearing cuts.
- Allow at least 1 week post-shearing.

Shower dipping

- Could use spinosad, and propetamphos or diflubenzuron (used at least 4 weeks before the start of lambing).
- Do not use ivermectin* as it strips.
- If using diflubenzuron, then sufficient wool grease is required as described above.

Plunge dipping

- Not recommend for heavily pregnant ewes.

Lousy sheep

Summer/autumn treatment options:

1) Saturation

- The best option, especially on farms where there is a history of lousy sheep or if significant lice numbers are found.
- Factors that need consideration:
  - Finding a functional plunge or shower dip. There are some contractors with mobile plunge dips.
  - Disposal of the used dip wash.
  - Product options – spinosad, propetamphos, or diflubenzuron. Consider wool residue profiles when selecting product to use.

2) AJRs

- The more common method of application, but has limitations for lice control as full saturation is unlikely.
- Tips:
  - Ensure all jets are on and use adequate pressure to get sheep wet to the skin.
  - Product options are spinosad, propetamphos, ivermectin*, diflubenzuron. Consider wool residue profiles when selecting product to use.

Where adequate lice control is proving difficult to achieve, there is the option of using a combination of actives that provide knockdown (spinosad, propetamphos or ivermectin*) and an IGR (diflubenzuron). This combination approach should only be required when using AJRs and should not be required where saturation methods are used, assuming sheep are getting fully saturated and the active used is effective.

Strong wool sheep

Lice are much less of an issue in strong wool sheep.

Reasons for this include shearing patterns, timing of shearing and the relatively lower value of wool. High lice burdens are considered more of a nuisance, than a financial cost.

In some situations, six-monthly shearing alone is enough to control lice burdens.

In almost all situations – regardless of 6, 8, or 12 month shearing patterns – the sheep will be shorn in the summer/autumn period with a flat comb. The key to adequate lice control is to tie in chemical use with summer/autumn shearing.

Strong wool sheep: The key to adequate lice control is to tie in chemical use with summer/autumn shearing.

Control options:

1) Off-shears pour on with an effective product
- Options include spinosad, imidacloprid, triflumuron, diflubenzuron, or an synthetic pyrethroid.

2) Off shears through an AJR
- This is the ideal time to use spinosad or propetamphos.
- When using diflubenzuron or ivermectin* it would be better to have sufficient wool grease for the active to bind to it. Timing would therefore need to be 1-2 weeks following shearing with a cover comb and 3 weeks following shearing with a flat comb.

3) 3-4 weeks post shearing through an AJR
- This means lice control coincides with post shearing fly treatment.
- Use a product or combination of products that contain a flystrike prevention active (cyromazine) and a lice control active (spinosad, ivermectin*, diflubenzuron or propetamphos).

4) Saturation dipping
- Not commonly used in strong wool sheep.
- Not recommended off shears, due to potential infection of shearing cuts.
- Would be used 3-4 weeks post shearing (as the above). The only difference is that ivermectin* can not be used, as it strips.

Lice control is often done on sheep using all the above methods, but at times when the sheep have more wool length that described above. While this can still be effective, as a general rule the more wool a sheep has, the harder effective lice control will be – regardless of active chemical or application method.

The more wool a sheep has, the harder effective lice control will be.

Having a lice control programme that targets treating sheep off shears or with shorter wool lengths will increase efficacy and potentially decrease selection pressure for resistance.

Long wool emergency treatments

Large lice burdens invariably show up at the worst time for treatment – in ewe flocks with more than 6 months' wool growth, just prior to lambing.

You have two options:

1) Do nothing. Further wool damage will occur and lambs will become lousy.

2) Apply a long-wool lice knockdown treatment to the ewes:
- The preferred option is applying spinosad through an AJR.
- Spinosad pour-on at emergency dose rate.
- Using propetamphos through an AJR is also an option.
- If jetting equipment is not available, an alpha cypermethrin-based low-volume pour-on with label claims for use up to 10 months wool is available.
- Shower or plunge dipping is an option. Sheep will take a lot of dip wash to get saturated. Spinosad would be the active of choice for wool residues.
- Full saturation dipping of heavily pregnant ewes is NOT recommended.

Large lice burdens invariably show up at the worst time for treatment – in ewe flocks with more than 6 months' wool growth, just prior to lambing. The preferred treatment option is applying spinosad through an AJR.

No long wool treatment will eradicate lice. Rather it will simply prevent further fleece damage and reduce the numbers of lice available to transfer to lambs but it will not stop that transfer.

Both ewes and lambs should still be considered lousy and treated when next shorn with a product from a different chemical group to that used as the long wool treatment.

A review of previous lice control measures should also be carried out and improvements made.

**Ivermectin – Cyrazin KO is currently the only product available in New Zealand that contains ivermectin and this product has no label claim for lice treatment. Cyrazin KO also contains cyromazine.*

Case study

Lice: Treat every head of stock within a short timeframe

Canterbury hill country Merino farmer Peter* inadvertently found himself dealing with a bad lice problem, after two lousy ram lambs from a neighbouring property found their way into his two-tooth ewe mob.

He'd never had a lice issue before, so the subsequent fall out from the two rams' unwelcome visit came as a surprise.

Not only did the rams infect the mob with lice, they sired about 20 early lambs. So, while Peter diligently treated the two-tooth mob for lice post-shearing and pre-lambing, the early lambs provided a perfect refuge for a small population of lice to re-infect the flock again at the first possible opportunity.

That was three years ago and Peter is still trying to get on top of the problem. This year, he believes will be the year. "I've got the vets on the job and it looks like some management changes are going to be the answer. I shear and treat my hoggets about a month after the ewes. And half my ewes go to black-face rams, so I've kept them separate and I haven't worried about dipping them."

But Peter says the answer lies in treating every head of stock in as short timeframe as possible. "So that's the plan this season. Hopefully that will do the trick."

What about the cost of the lice infestation on his wool cheque? Fortunately, the issue only affected about one third of Peter's wool. It lost him about $2-3/kg on those bales – and created a lot of extra work in the shed – but was a manageable financial hit.

* Not his real name

Notes

Safety and first aid

Safety

- Treat all dip chemicals as potentially harmful to humans.
- Read the label before using any dip and follow the safety directions.
- The person operating the dip must inform staff/ helpers about hazards and provide appropriate protective clothing.
- Before shearing, check the product's withholding period has elapsed.
- Lock dip containers in a child-proof facility after use.

Poisoning

Severe poisoning

Follow the first aid instructions on the product label.

But first:

1) Make sure it is safe for you to help the victim.
2) Remove the victim from the contamination source and remove contaminated clothing, taking care not to contaminate yourself.
3) Make sure the victim is breathing.
4) Dial 111.
5) If you can't get medical assistance immediately, call the National Poisons Centre on 0800 764 766.

Chemicals on the skin

1) Remove the clothing ASAP.
2) Wash the skin with soap and cold water.

Chemicals in the eye

1) Wash the eye with cold water for 15 minutes.
2) See a doctor.

Do not hesitate to seek medical advice, if there is any sign of illness.

National Poisons Centre: 0800 764 766

ZQ

Sheep and Beef Cattle Veterinarians
Branch of the NZVA

beef+lamb new zealand