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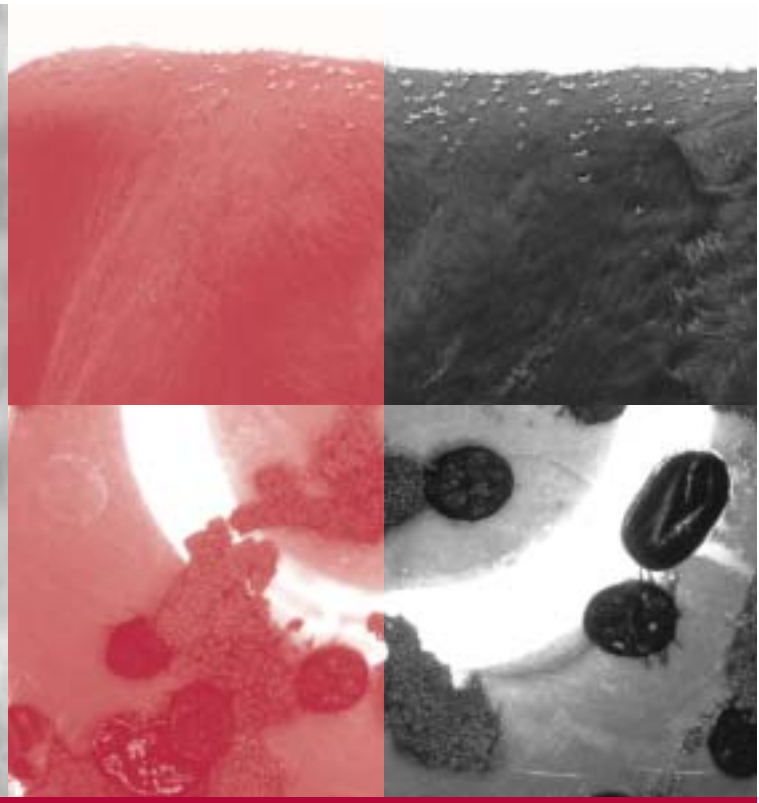

The cattle parasite atlas

A regional guide to cattle parasite control in Australia

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A regional guide to cattle parasite control in Australia

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Contents

The cattle parasite atlas

a regional guide to cattle parasite control in Australia

The 'atlas' of parasite control in cattle has been developed as a rapid reference for advisors and producers on the best practice for parasite control for all the major livestock regions in Australia.

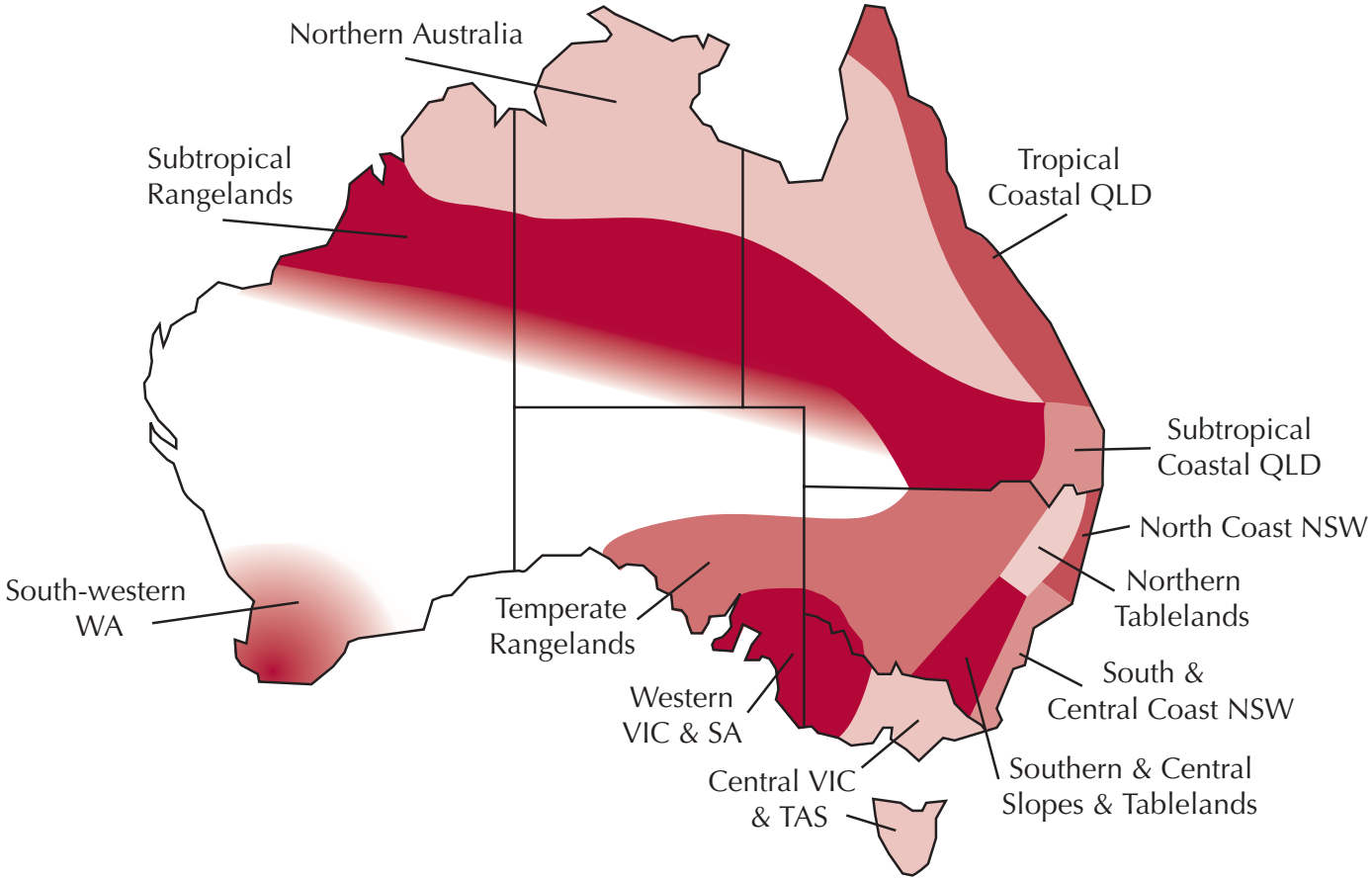
The atlas is divided into two sections. The first section describes the program of treatments and interventions for each climatic and geographical region. The regional guides highlight the main production systems, the most important parasites, management procedures that may be used to assist in their control and, where the information is known, the cost-effectiveness of those programs.

The recommendations for each region are generic and therefore need to be customised to the needs of individual producers and delivered by those with knowledge in the field.

The second section of the atlas examines in more detail the most important parasites, basic principles of parasite control and the range of treatments available.

The atlas is a compilation of available information and represents the end result of 30 years of investigation, research and application by veterinarians, advisors and producers. The publication has relied on the effort and input from a number of sources, particularly from Dr David Buckley who has collated the information and provided unique approaches to presentation and delivery.

Further acknowledgement should be given to Queensland Department of Primary Industries, NSW Department of Primary Industries, Department of Primary Industries, Victoria, South Australian Research and Development Institute, Western Australian Department of Agriculture, Rural Lands Boards in NSW and a number of manufacturers of antiparasitic products. Dr Malcolm Smeal has provided expert technical advice and review.



South and Central Coast NSW

Geography

- Moist, temperate climate
- Uniform rainfall with long, warm summers and cool winters
- Annual rainfall between 800 and 1,600mm
- Moisture levels on pasture during summer can be high

Production system

- Primarily small-holding beef properties with little sheep or cropping
- Mainly a breeding area with most calves born in spring
- Many cattle sold as weaners to other areas for fattening; some retained for sale to the domestic supermarket trade or feedlots at 16–24 months

Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful parasite of cattle in this region. It causes weight loss and scouring in weaners in late winter.*
- *In spring, calving herds drench at weaning, and again in July, followed by a move to 'worm-safe' pasture.*
- *Routine drenching of mature beef cattle is not required.*
- *Drench cattle grazing 'flukey' pastures in May/June and September with a third drench in December on high-risk properties.*
- *Lice are commonly treated but this is not indicated in most cases.*

Significant parasites

- Small brown stomach worm *(Ostertagia ostertagi)*
- Liver fluke *(Fasciola hepatica)*

Other parasites

- Small intestinal worm (*Cooperia punctata* and *Cooperia pectinata)* in early weaned calves
- Lungworm *(Dictyocaulus viviparous)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*
- Stable fly *(Stomoxys calcitrans)* on the Central Coast
- Paralysis tick *(Ixodes holocyclus)* and bush tick *(Haemaphysalis longicornis)*
- Stomach fluke *(Calicophoron calicophorum)*

Grazing management

- Small farm sizes limit the use of worm-safe pasture
- Safe pastures can be prepared by grazing with sheep or cattle older than 18 months from the previous summer

Economics

- Annual cost of strategic *Ostertagia* control in a 100-cow, spring calving herd is $1,240
- Yearlings or sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- Worm control in beef calves is likely to produce similar weight gain increases to those seen in dairy calves (20–44kg)

Calendar for worm and fluke control

Spring calving herds

Age group	Mar–May	Jul	Sep	Dec
Weaners	✓ Weaning	✓	(✓) May be required if previous drench not an ML or in wet seasons	✓
Yearlings/1st calvers	✓	(✓) Pre-calving		(✓)
2nd calvers		(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls				✓ Pre-joining
Liver fluke control				
All weaned cattle	Fi		F	(Fi)

✓ Strategic worm treatment given each year

(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a change to 'low-risk' pastures, especially for young stock.

Fi Both adult and immature fluke present – select a drench that kills all fluke stages

(Fi) Adult and immature fluke present. This drench may not be needed on properties with a low fluke risk.

F Only adult fluke present. Use a drench other than triclabendazole to help slow the development of resistance.

ML Macrocyclic lactone.

Calendar for worm and fluke control

Autumn calving herds

Age group	Dec–Feb	Mar–May	Jul	Sep
Weaners	✓ Weaning	✓	✓	(✓) May be required if previous drench not an ML or in wet seasons
Yearlings/1st calvers	✓	✓ Pre-calving	(✓)	
2nd calvers	(✓)	(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls	✓		(✓)	
Liver fluke control				
All weaned cattle	(Fi)	Fi		F

See over page for ✓, (✓), Fi, (Fi), F, ML key

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in this region is the small brown stomach worm *(Ostertagia ostertagi)*. It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gains) in weaners and yearlings occur on many properties each year, particularly in the wetter, eastern areas.

Excessive worm burdens may be picked up from pastures contaminated by weaners during autumn and winter, and usually occur in late winter and early spring after weaning.

Adult cattle develop a strong resistance to *Ostertagia*. Treatment of individual cows is occasionally required when symptoms (scouring) appear.

Seasonal trends

Numbers of infective larvae on pasture follow a reliable seasonal pattern (see 'Small brown stomach worm' factsheet).

Larval numbers on pasture fall sharply in late spring and remain low over summer due to high temperatures. Infective larvae build up rapidly in late autumn, winter and early spring. In these regions, infective larvae can be present on pasture within two to three weeks of a dung pat being deposited, regardless of the season, if sufficient moisture is present.

During spring, an increasing percentage of *Ostertagia* larvae picked up by grazing cattle become 'inhibited' in their growth in the lining of the stomach. Numbers peak in mid-summer.

Inhibited larvae resume their development in autumn, and by mid-winter few remain. Disease caused by inhibited larvae resuming development *en masse* is most common in the first autumn after weaning for spring born calves and the second autumn after weaning in autumn born calves.

Control

Strategic drenching programs should be designed to prevent young cattle contaminating pasture during autumn and winter. This reduces the exposure of weaners and yearlings to high levels of infective larvae on pasture during late winter and early spring.

Spring born calves should be drenched at weaning. A second drench followed by a move to worm-safe pasture should be administered in July. A third drench in December will remove inhibited larvae.

Autumn born, set-stocked calves should be drenched at weaning with a macrocyclic lactone (ML), then again in March–May, July and December. At the March–May and July drenches the number of inhibited larvae will be low and a wide range of chemicals can be used. Each drench should be combined with a move to worm-safe pasture.

For both spring and autumn born calves, a drench in September may be required in very warm, moist years, particularly where the July treatment is not an ML or is not combined with a paddock rotation.

ML drenches are used by many producers for *Ostertagia* control, but oral 'white' (BZ) drenches at one-third the cost provide effective control (see 'Selecting a worm drench' factsheet).

LIVER AND STOMACH FLUKE *(Fasciola hepatica* and *Calicophoron calicophorum)*

Liver and stomach fluke are present across the region. Their lifecycle's requirement for wet marshy areas means their impact will vary between properties and even between paddocks. Cattle pick up fluke as they graze infested areas such as swamps, springs, flood plains and creeks. Fluke numbers increase during spring and summer and disease is most common in late autumn and early winter in calves, weaners and introduced stock.

Symptoms include reduced weight gain, weight loss, bottlejaw, scouring (stomach fluke) and sometimes death.

Control

Before treatment, a diagnosis of liver or stomach fluke should be made in consultation with a veterinarian.

Denying stock access to fluke habitats by fencing can prevent liver fluke infection. Fluke habitat can also be reduced with drainage, re-vegetation and fencing of creeks and soaks. Stomach fluke can be reduced by similar measures.

Liver fluke control requires drenching in March–May and September. On properties with severe fluke risk a third treatment may be required in December.

Control of stomach fluke can usually be achieved with a single treatment of all stock in August.

LICE

Although lice are common in the region, trials indicate that light infestations of lice do not reduce weight gains but heavy infestations can. Losses may also result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and then decline with increasing temperatures in spring and summer. Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence, and not the cause, of poor nutritional conditions.

Control

Lice problems are usually resolved by increasing feed availability and the rise in spring temperatures. Where cattle are suffering or the rubbing is resulting in hair loss or skin damage, treatment may be required.

Upon diagnosing an outbreak of lice producers should look for, and attempt to remedy, the underlying cause of the stress.

Lice are seldom a problem in herds using ML drenches as part of their *Ostertagia* control program.

Where lice are an on-going problem a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use an ML drench to control lice. This is costly and can increase the risk of the development of resistant parasites. Specific lice control products can be more effective than MLs and integrated pest management (IPM) principles indicate it is preferable to use a narrow spectrum or specific product for each pest.

Southern and Central Slopes and Tablelands NSW

Geography

- Moist, temperate climate
- Uniform rainfall with long, warm summers and cool to cold winters
- Annual rainfall between 550 and 1,400mm
- Most areas have rainfall between 500 and 700mm

Production system

- Breeding and finishing area with calves born in autumn and spring
- Most cattle sold at 16–24 months of age to the domestic supermarket trade or feedlots
- Most properties graze both sheep and cattle. Cropping increases in the flatter, western areas
- Cattle are mainly British breeds and their crosses

Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful cattle parasite in this region.*
- Ostertagia *reduces weight gain in yearlings during spring.*
- *To control* Ostertagia, *drench spring calving herds at weaning and again in July. Rotate to 'worm-safe' pasture after the July drench.*
- *Routine drenching of mature beef cattle is not indicated.*
- *Drench cattle grazing 'flukey' pastures in May/June and September, with a third drench in December on high-risk properties.*
- *Lice are commonly treated but in most cases treatment may not be indicated. Infestations usually resolve with warmer temperatures and improved feed in spring.*

Significant parasites

- Small brown stomach worm *(Ostertagia ostertagi)*
- Liver fluke *(Fasciola hepatica)*

Other parasites

- Small intestinal worm *(Cooperia oncophora)* in early weaned calves
- Nodule worm (*Oesophagostomum radiatum*)
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

- Graze yearlings on worm-safe pasture during spring to improve weight gain
- Worm-safe pastures can be prepared by grazing paddocks with sheep or cattle older than 18 months from the previous summer
- Drench yearlings in December if they do not graze worm-safe pasture during spring

Economics

- Annual cost of strategic *Ostertagia* control in a 100-cow, spring calving herd is $1,240
- Yearlings or sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- The combination of a late July drench for weaners with a move to worm-safe pasture can increase weight gain by 30–60kg per head

Calendar for worm and fluke control

Autumn calving herds

Age group	Dec–Feb	Mar–May	Jul	Sep
Weaners	✓ Weaning	✓	✓	(✓) May be required if previous drench was not an ML
Yearlings/1st calvers	✓	✓ Pre-calving	(✓)	
2nd calvers	(✓)	(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls				✓
Liver fluke control				
All weaned cattle	(Fi)	Fi		(Fi)

✓ Strategic worm treatment given each year

(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a change to 'low-risk' pastures, especially for young stock.

Fi Both adult and immature fluke present – select a drench that kills all fluke stages

(Fi) Adult and immature fluke present. This drench may not be needed on properties with a low fluke risk.

F Only adult fluke present. Use a drench other than triclabendazole to help slow the development of resistance.

ML Macrocyclic lactone

Calendar for worm and fluke control

Spring calving herds

Age group	Mar–May	Jul	Sep	Dec
Weaners	✓ Weaning	✓	(✓) May be required if previous drench was not an ML	✓
Yearlings/1st calvers	✓	(✓) Pre-calving		(✓)
2nd calvers		(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls				✓ Pre-joining
Liver fluke control				
All weaned cattle	Fi		F	(Fi)

See over page for ✓, (✓), Fi, (Fi), F, ML key

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in this region is the small brown stomach worm. It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gains) in weaners and yearlings occur on many properties each year, particularly in the wetter, eastern areas.

Excessive worm burdens may be picked up from pastures contaminated by weaners in autumn and winter and usually occur in late winter and early spring after weaning. During spring an increasing proportion of *Ostertagia* larvae picked up from pasture become inhibited in their growth in the lining of the stomach. Inhibited larvae resume their development in autumn and by mid-winter few remain. Adult cattle develop a strong resistance to *Ostertagia* and treatment of individual cows is only required when symptoms (scouring) appear.

Seasonal trends

The worm levels on pasture follow a reliable seasonal pattern (see 'Small brown stomach worm' factsheet).

Larval numbers on pasture are very low over summer due to the hot, dry conditions. Small numbers of worm eggs and larvae survive in dung pats between November and March to be released by the 'melting' effect of autumn rains. These larvae, in combination with eggs derived from adult worms resuming their development from inhibited larvae, produce the autumn rise in pasture larval numbers.

After the initial autumn rise, cold winter temperatures limit larvae numbers. The warmer temperatures of late winter and early spring give rise to a rapid increase in larvae numbers, until their eventual decline with the hot, dry conditions of late spring.

Control

Maximising weight gains involves reducing exposure of weaners and yearlings to high levels of infective larvae on pasture during late winter and early spring. Yearlings born in the previous autumn and weaners should be drenched in March to May depending on weaning time. In late July, a second drench should be combined with a move to a worm-safe pasture. Worm-safe pasture is best prepared by grazing from the previous summer with sheep or cattle older than 18 months.

Macrocyclic lactone (ML) drenches are used by many producers for *Ostertagia* control, but oral 'white' (BZ) drenches at one-third the cost, provide effective control (see 'Selecting a worm drench' factsheet).

LIVER FLUKE *(Fasciola hepatica)*

Liver fluke is present across most of the region but its lifecycle's requirement for wet marshy areas means its impact varies between properties and even between paddocks.

Clinical disease is most commonly seen in weaned cattle less than three years of age in the late autumn and winter. During dry summers stock pick up fluke as they graze 'flukey' areas such as swamps, springs and creeks in search of green feed. The risk increases until autumn rains generate fresh green feed and stock cease grazing in 'flukey' areas.

Symptoms include reduced weight gain, weight loss and rarely pale mucous membranes, bottlejaw and death.

Control

Before fluke treatment is undertaken the presence of liver fluke on the property should be determined in consultation with a veterinarian.

Denying stock access to fluke habitats by fencing can prevent liver fluke infection. Fluke habitat can also be reduced with drainage, re-vegetation and fencing of creeks and soaks.

Where cattle graze fluke habitats, two drench treatments are usually required. The first is given in May to eliminate fluke that have been picked up during summer. The second treatment in September is designed to remove adult fluke that can contaminate pasture in spring. On high-risk properties an additional treatment in December may be required to remove high fluke burdens acquired during the spring.

LICE

Although lice are common in the region, trials indicate that light infestations of lice do not reduce weight gains but heavy infestations can. Losses may also result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and then decline with increasing temperatures in spring and summer.

Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence, and not the cause, of poor nutritional conditions.

Control

Lice problems are usually resolved by increasing feed availability and the rise in temperature during spring. Where cattle are suffering, or the rubbing is resulting in hair loss or skin damage, treatment may be required.

Upon the diagnosis of a lice outbreak producers should look for, and attempt to remedy, the underlying cause of the stress.

Lice are seldom a problem in herds using ML drenches as part of their *Ostertagia* control program.

Where lice are an on-going problem a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use an ML drench to control lice. This is costly and can increase the risk of the development of resistant parasites. Specific lice control products can be more effective than MLs and integrated pest management (IPM) principles indicate it is preferable to use a narrow spectrum or specific product for each pest.

North Coast NSW

Geography

- Moist, subtropical climate with summer dominant rainfall
- Most areas have annual rainfall between 800 and 1,200mm

Production system

- Primarily a breeding area with calves born in spring
- Many cattle sold as weaners. Others retained and sold to the domestic supermarket trade or feedlots at 16–24 months
- Both *Bos taurus* and *Bos indicus* breeds and their crosses are present
- Pastures are a combination of native and naturalised tropical and subtropical grasses and legumes

Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful cattle parasite in this region and reduces weight gain in yearlings during spring.*
- *Young cattle should be drenched at weaning and again in July.*
- *Treatment of buffalo fly burdens of less than 200 flies per animal is not necessary or cost effective.*
- *Stomach fluke are usually controlled by a single treatment to all cattle in September*
- *Weaned cattle grazing liver fluke infested areas should be treated in May and September.*

Significant parasites

- Small brown stomach worm *(Ostertagia ostertagi)*
- Bush tick *(Haemaphysalis longicornis)*
- Paralysis tick *(Ixodes holocyclus)* in young calves
- Buffalo fly *(Haematobia irritans exigua)*
- Liver fluke *(Fasciola hepatica)*

Other parasites

- Cattle tick *(Boophilus microplus)* – if present notify NSW Department of Primary Industries
- Barber's pole worm *(Haemonchus placei)*
- Small intestinal worm (*Cooperia punctata and C. pectinata)* in weaned calves
- Nodule worm *(Oesophagostomum radiatum)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*
- Stomach fluke *(Calicophoron calicophorum)*

Grazing management

- Year-round availability of infective larvae, their rapid development on pasture and their extended survival in dung pats reduce the options for providing worm-safe pasture
- Safe pasture should be prepared for weaners after the July drench

Economics

- Annual cost of *Ostertagia* control in a 100-cow herd is $1,240
- Yearlings or sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- Worm control can increase weight gains by 2–6kg/month in the 9–12 months after weaning
- Positive returns are likely in cattle sold less than two years of age

Calendar for worm and fluke control

Spring calving herds

Age group	Mar–May	Jul	Sep	Dec
Weaners	✓ Weaning	✓	(✓) May be required if previous drench was not an ML	✓
Yearlings/1st calvers	✓	(✓) Pre-calving		(✓)
2nd calvers		(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls				✓Pre-joining
Liver fluke control				
All weaned cattle	Fi		F + SF	(Fi)
Buffalo fly control				
	Start of fly season	Jan		Apr
All cattle	OP (if buffalo flies are a problem prior to January)	Ear tags for buffalo fly when fly numbers exceed acceptable levels (use OP tags for 2 years, then SP tags for 1 year)		If flies continue to be a problem after tags are removed use sprays (OP spray after SP tags and SP spray after OP tags)

✓ Strategic worm treatment given each year
(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a move to 'low-risk' pastures, especially for young stock.
Fi Both adult and immature fluke present – select a drench that kills all fluke stages
(Fi) Adult and immature fluke present. This drench may not be needed on properties with a low fluke risk.
F Select a drench to kill adult fluke.
SF Stomach fluke – consult a veterinarian for treatment options
OP Organophosphate based product
SP Synthetic pyrethrin based product
ML Macrocyclic lactone

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in this region is the small brown stomach worm. It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gains) in weaners and yearlings occur on many properties each year, particularly in the wetter, eastern areas.

Cattle grazing contaminated pastures during autumn and winter ingest large numbers of *Ostertagia* larvae and heavy worm burdens usually occur in late winter and early spring after weaning.

Adult cattle develop a strong resistance to *Ostertagia*. Treatment of individual cows is occasionally required when symptoms (scouring) appear.

Seasonal trends

Numbers of infective larvae on pasture follow a reliable seasonal pattern (see 'Small brown stomach worm' factsheet).

Infective larvae can be found on pasture within two to three weeks of a dung pat being deposited, regardless of season, if sufficient moisture is present.

Unweaned calves contaminate pastures with *Ostertagia* eggs during late summer and autumn. Autumn pastures are also contaminated by yearlings that deposit eggs laid by adult worms which develop from inhibited larvae picked up in the previous spring. Eggs rapidly hatch to produce infective larvae which accumulate during the cooler conditions, with numbers peaking during late winter.

The number of inhibited larvae within cattle increases during spring and peaks in late summer. Inhibited larvae resume development in the following autumn.

Control

Strategic drenching programs in this region should be designed to prevent young cattle contaminating pasture during late summer and autumn. Weaned calves and yearlings should be drenched in April–May, which may coincide with weaning. This drench should be combined with movement to a 'worm-safe' paddock to maximise weight gains. The best option for preparing worm-safe pasture is to graze the paddock with adult cattle for three to four months. Weaners and possibly yearlings should be treated again in July.

If weaning prior to March, drench all cattle under 24 months of age in May. This will ensure that pasture contamination remains low during winter

Macrocyclic lactone (ML) anthelmintics are used by many producers for *Ostertagia* control, but oral white (BZ) drenches at one-third the cost give the same effective control (see 'Selecting a worm drench' factsheet).

Other worms

Less important internal parasites in this region are barber's pole worm *(Haemonchus placei)*, nodule worm *(Oesophagostomum radiatum)* and the small intestinal worm *(Cooperia punctata and Cooperia pectinata)*.

Problems are most commonly seen in beef cattle in their first year after weaning. Strong immunity develops after 12 months of age.

BUFFALO FLY *(Haematobia irritans exigua)*

Buffalo fly is a blood-sucking parasite of cattle in warm, moist areas of northern Australia.

Lifecycle

Adult flies live on cattle. Adult females lay eggs in cattle dung. Larvae hatch within 24 hours and feed in the dung for 9–40 days as they mature to adulthood. In hot, humid conditions the fly lifecycle takes less than two weeks.

Effect on cattle

Blood sucking by flies causes severe skin irritation. Cattle rub vigorously, disrupting grazing time and damaging the hide. Some cattle are allergic to fly bites and rub excessively, causing severe ulcers.

Studies in Queensland showed steers protected from buffalo fly gained an extra 14% body weight over a 13-month period. In another study, cattle protected from flies gained an extra 33kg over a 21-week period. If buffalo fly is not effectively treated it can cost up to $30 per head in lost production.

Control

Cattle can tolerate small numbers of flies without losing production. Treatment is only required when there are 200 flies per animal or when susceptible animals, such as bulls, show 'fly worry'.

A range of chemical and non-chemical treatments are available. Prior to the use of chemical options all non-chemical options should be explored.

Non-chemical options

- Cull hypersensitive animals
- Install buffalo fly traps
- Introduce dung beetles to break down dung pats and reduce fly breeding habitats

Chemical control

A range of chemical options is available (see the 'Buffalo fly' factsheet).

Some chemicals adversely affect dung beetles. This can be minimised by the use of insecticidal ear tags, treating only when necessary, avoiding synthetic pyrethroids (SPs) during spring when dung beetles are emerging and using ML pour-ons in autumn and only when control of other parasites is required.

LIVER AND STOMACH FLUKE *(Fasciola hepatica* and *Calicophoron calicophorum)*

Liver and stomach fluke are present across the region but their requirement for wet, marshy areas means their impact varies between properties and even between paddocks.

Stock pick up fluke as they graze infested areas such as swamps, springs, flood plains and creeks. Fluke numbers increase during spring and summer and disease is most common in late autumn and early winter in calves, weaners and introduced stock.

Symptoms include reduced weight gain, weight loss, bottlejaw, possibly scouring (stomach fluke) and sometimes death.

Control

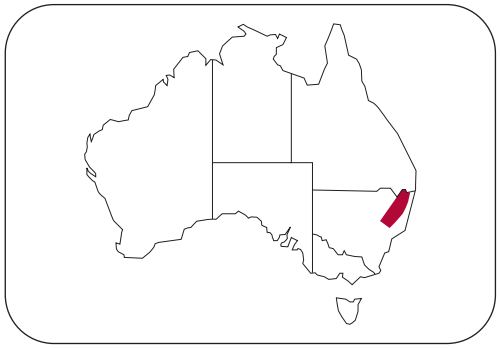
Before treatment, a diagnosis of liver or stomach fluke should be made in consultation with a veterinarian.

Liver fluke infestation can be prevented by denying stock access to fluke habitats by fencing. Fluke habitats can be reduced with drainage, re-vegetation and fencing of creeks and soaks. Stomach fluke can be reduced by similar measures.

Control liver fluke by drenching in March–May and September. On properties with a severe fluke risk a third treatment may be required in December.

Control of stomach fluke can usually be achieved with a single treatment of all stock in September – ask your veterinarian for details.

Northern Tablelands NSW



Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful parasite of cattle in this region.*
- Ostertagia *reduces weight gain in yearlings during spring.*
- Ostertagia *control requires two drenches (April and July) in the weaners with a rotation to a worm-safe pasture at the July drench.*
- *Routine anthelmintic treatment of mature beef cattle in this region is not indicated*
- *Fluke control requires drenching of at-risk animals in May and July with a third drench in February on high-risk properties.*
- *Lice are commonly treated but in many cases they cause little reduction in weight gain and will resolve with the warmer temperatures and improved feed of spring.*

Geography

- Moist, temperate climate
- Rainfall is summer dominant with long warm summers and cool to cold winters
- Annual rainfall ranges from 550–1,400mm per annum

Production system

- Breeding and finishing area with calves born in autumn and spring
- Few animals sold as weaners with most sold between 16–24 months to the domestic supermarket trade or onto feedlots
- Most properties have both sheep and cattle and the area sown to crops increases in the flatter western areas
- The cattle are almost exclusively British breeds and their crosses

Significant parasites

- Small brown stomach worm *(Ostertagia ostertagi)*
- Liver fluke *(Fasciola hepatica)*

Other parasites

- Barber's pole worm *(Haemonchus placei)* – small numbers of infective larvae infest pasture in summer and autumn)
- Barber's pole worm *(Haemonchus contortus)* – where cattle and sheep graze together and prolonged wet weather occurs in late summer –autumn, heavy adult burdens of *Haemonchus contortus* may occur in cattle of all ages
- Small intestinal worm *(Cooperia oncophora)* in early weaned calves
- Nodule worm *(Oesophagostumum radiatum)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

- Graze stock on worm-safe pastures during spring to improve weight gain
- A worm-safe paddock should be prepared by grazing from the previous summer with sheep or cattle older than 18 months
- Drench yearling cattle in December if not grazing worm-safe pasture in spring

Economics

The annual cost of strategic *Ostertagia* control for a 100-cow spring calving herd is $1,240

- Yearling or sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- Combining a late July drench for weaners with a move to worm-safe paddock can produce weight gains of 30–60kg per head above weaners grazed on contaminated pastures
- It is highly likely that drenching and paddock rotations to control *Ostertagia* will produce positive returns in this region

Calendar for worm and fluke control

Spring calving herds

Age group	Dec	Jan	Feb	Apr	May	July	Aug	Sep
Weaners	✓ (when worm-safe pasture is not used in spring)		(Fi)	✓	Fi	✓ Move to prepared 'safe' paddock F		(✓) May not be needed if ML drench used in July
Yearlings	(✓)		(Fi)	✓	Fi	F (✓)		
1st and 2nd calvers			(Fi)		Fi	F (✓) pre-calving		
	Adult cattle have strong resistance to *Ostertagia* – individual adult cattle showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated							
Others			(Fi)		Fi	F		
Bulls	✓ Prejoining		(Fi)		Fi	F		

✓ Strategic worm treatment given each year

(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a change to 'low risk' pastures, especially for young stock.

Fi Both adult and immature fluke present - select a drench that kills all fluke stages.

(Fi) Adult and immature fluke present. This drench may not be needed on properties with low fluke risk.

F Only mature fluke are present. Use a drench other than triclabendazole to help slow the development of resistance.

Calendar for worm and fluke control

Autumn calving herds

Age group	Dec	Feb	Apr	May	July	Aug	Sep
Weaners/ yearlings	✓ (use a drench with high activity against) inhibited larvae	(Fi)	✓	Fi	✓ Move to prepared 'safe' paddock F		(✓) May not be needed if ML drench used in July
1st and 2nd calvers		(Fi)	✓	Fi	(✓) F		
	Adult cattle have strong resistance to *Ostertagia* – individual adult cattle showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated						
Others		(Fi)		Fi	F		
Bulls	✓	(Fi)		Fi	F		

See over page for ✓, (✓), Fi, (Fi), F key

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in the region is the small brown stomach worm. It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gains) in weaners and yearlings occur annually on many properties, particularly in the wetter eastern areas.

Excessive worm burdens may be picked up from pastures contaminated by weaners in autumn and winter and usually occur in late winter and early spring after weaning.

Adult cattle develop a strong resistance to *Ostertagia* and treatment is occasionally required when symptoms (scouring) appear.

Seasonal trends

The numbers of infective larvae on pasture follow a reliable seasonal pattern (see 'Small brown stomach worm' factsheet).

The high summer rainfall results in continuous release of larvae from the dung pats during summer. These larvae only survive for a relatively short period on warm moist pasture as they rapidly run out of energy.

The low numbers of larvae in dung pats and on pasture that survive over summer infect weaned calves which then contaminate the autumn and winter pasture for the next spring season. Larval numbers are low during autumn until warmer temperatures of late winter and early spring give rise to a rapid increase in larval numbers through the spring until their eventual decline during summer.

During spring an increasing proportion of *Ostertagia* larvae picked up from pasture become inhibited in growth. The numbers of inhibited larvae peak during mid summer. They resume their development in autumn and by mid winter few remain. Disease caused by inhibited larvae resuming development *en masse* is most common in the first autumn after weaning for spring born calves and the second autumn after weaning in autumn born calves.

Control

Maximising weight gains involves reducing the exposure of weaners and yearlings to high levels of infective larvae during late winter and early spring. Weaners and yearlings born in the previous autumn are drenched in April. In late July, a second drench is combined with a move to a 'worm-safe' pasture. Worm-safe pasture is best prepared by grazing it from the previous summer with sheep or cattle older than 18 months.

Macrocyclic lactone (ML) anthelmintics are used by many producers for *Ostertagia* control, but oral Benzimidazole (BZ) drenches at one third the cost give the same effective control.

LIVER FLUKE *(Fasciola hepatica)*

Liver fluke is present across most of the region but its lifecycle's requirement for permanently wet marshy areas means its impact varies between properties and even between paddocks.

Clinical disease is most commonly seen in weaned cattle less than three years of age in late autumn and winter. During dry summers stock pick up the fluke as they graze 'flukey' areas (swamps, springs and creeks) in search of green feed. The risk builds until the autumn rains produce green feed and the stock cease grazing 'flukey' areas.

Symptoms include reduced weight gains, weight loss, paleness, bottlejaw, possible scouring and sometimes death.

Control

Before any treatment is undertaken the presence of liver fluke on the property needs to be determined in consultation with a veterinarian.

Liver fluke can be prevented by fencing to deny stock access to the fluke habitats. Fluke habitat can also be reduced with drainage, fencing of creeks and soaks and re-vegetation.

Where fluke habitats are grazed two drench treatments are usually required. The first is given in May to eliminate fluke that have been picked up during the summer. The second treatment in July or August is designed to remove adult fluke that can contaminate the pasture in spring. On properties with high risk, an additional earlier treatment in February may be required to remove high burdens acquired during spring.

LICE

Although lice are common in the region, trials indicate that light infestations of lice do not reduce weight gains but heavy infestations can. Losses may also result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and decline with increasing temperatures in spring and summer.

Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence and not the cause of poor nutritional conditions.

Control

The problem of lice is usually resolved by the increase in feed availability and rise in spring temperatures. Where the cattle are suffering or the rubbing is resulting in hair loss or skin damage, treatment may be required.

Upon diagnosing an outbreak of lice, producers should look for and attempt to remedy the underlying cause of the stress.

Lice are seldom a problem in most herds using ML drenches as part of the *Ostertagia* control program.

Where lice are an on-going problem, a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use an ML drench to control lice. This is costly and can increase the risk of the development of resistant parasites. Specific lice control products can be more effective than MLs and integrated pest management (IPM) principles indicate it is preferable to use a narrow spectrum or specific product for each pest.

South-western WA

Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful parasite of cattle in this region.*
- *A single drench in mid-summer for weaners, yearling heifers and bulls will provide sufficient roundworm control on most properties. Breeding cows should not be treated in mid-summer to provide a refuge for unselected parasites.*
- *Where there has been a history of worm problems, an additional drench in May is recommended for weaners and yearlings.*
- *Adult cattle develop a strong resistance to* Ostertagia *and treatment of individual cows is only required if symptoms (scouring) appear.*

Geography

- Mediterranean climate with a long, warm/hot, dry summer and cool, wet winter.
- Summer temperatures are hot in the north and warm in the south.
- Rainfall increases in a south-westerly direction and ranges from 500 to 1,200mm per annum.

Production system

- Breeding and finishing area. Most calves are born in the autumn and weaned in early summer.
- Most cattle are sold at 16–24 months to domestic markets.
- Dominant cattle types are British breeds.
- Majority of pastures are based on annual species.

Significant parasites

- Small brown stomach worm *(Ostertagia ostertagi)*

Others

- Small intestinal worm *(Cooperia oncophora)* in early weaned calves.
- Nodule worm *(Oesophagostomum radiatum).*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus).*

Grazing management

- There is considerable potential for rotational grazing between sheep and cattle and the use of stubble to provide 'worm-safe' pastures in this region.
- A worm-safe paddock should be prepared for weaning by grazing for six months with sheep or cattle older than 18 months or by the use of crop stubble.
- Resting pasture during autumn, winter or early spring will have little impact on pasture parasite numbers.

Economics

- The annual cost of strategic *Ostertagia* control for a 100-cow, autumn-calving herd is $400.
- Yearlings or sale stock must gain an extra 2.6kg in weight to breakeven on drench costs.
- The drenching program below provides a seven to nine fold decrease in *Ostertagia* burdens, however the effect on productivity in young, beef cattle is not known.

Calendar for worm control

Class of cattle	Time of Year	
	December–January*	**May**
Autumn born weaners/yearlings	✓ Weaning	(✓)
Spring born weaners/yearlings	Drench at weaning (Mar–Apr)	✓
Heifers/unsold yearlings	✓	(✓)
Adult cows	Worm disease is rarely a problem in mature cows and no routine treatment is recommended. Individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated.	
All cattle	If lice are an on-going problem, a single treatment in early winter will usually provide control.	
Bulls	✓	✓

Adapted from *Worm control in beef cattle in the South West*, Brown Besier, Department of Agriculture - WA

✓ Strategic anthlemintic treatment given each year

(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a move to 'low risk' pastures, especially for young stock.

* During summer, inhibited *Ostertagia* larvae will be present and a drench with high efficacy against these larvae should be used.

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in the region is the small brown stomach worm. It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gain) in weaners and yearlings occurs on many properties each year, particularly in the wetter, western areas on cattle-only properties.

Excessive worm burdens are picked up from the pasture during May, June and July resulting in a 'check' in growth rates in the first winter after weaning.

Disease is more likely in seasons when the autumn break is followed by a prolonged, wet autumn and winter.

Adult cattle develop strong resistance to *Ostertagia* and treatment of individual cows is only required when symptoms (scouring) appear.

Seasonal trends

The number of infective larvae on the pasture follows a reliable seasonal pattern (see 'Small brown stomach worm' factsheet).

Few larvae survive the hot, dry conditions on pasture during summer. Following autumn rainfall, eggs in freshly deposited dung pats give rise to a rapid increase in worm larvae on pasture. Larvae numbers on pasture peak between May and July. From August onwards larval numbers decline and are negligible by November.

During spring an increasing proportion of *Ostertagia* larvae picked up from pasture become 'inhibited' in their development in the stomach wall lining. The numbers of inhibited larvae peak during mid-summer. Inhibited larvae resume their development in autumn and by mid-winter few remain. Disease caused by inhibited larvae resuming development *en masse* is rare, but can occur in autumn calving heifers or adult cattle around the time of calving.

Control

Because the major source of pasture larval contamination in autumn is derived from inhibited larvae resuming development to adult worms within cattle, programs in this region are designed to reduce this source of contamination with the use of a single, early summer drench for weaners. An anthelmintic with a high efficacy against inhibited larvae should be used for all drenches during the summer.

For autumn born calves the summer treatment will coincide with weaning. At this drench, cattle should be moved to a worm-safe paddock, ie stubble or a paddock that has been grazed for the previous six months with sheep or cattle older than 18 months.

On properties where internal parasites are an on-going problem, a further treatment in May could be required. Consideration should be given to combining this drench with a move to worm-safe pasture. This will require a paddock for weaners which has been previously grazed by sheep. Alternatively use another form of worm-safe pasture, such as freshly sown pasture or fodder crops. The ideal program is to provide worm-safe paddocks at both the weaning and May drenches. This can be achieved by a six-month rotation with sheep.

Spring born calves should be drenched at weaning and again in early May. The May treatment should be given irrespective of the time of weaning. At the May drench, spring born calves should be moved to a worm-safe pasture, preferably one that has been grazed by sheep since the previous summer.

By the end of the first spring after weaning, autumn and spring born calves will have accumulated high levels of inhibited larvae. To prevent the inhibited larvae resuming development to adult worms in the following autumn and producing disease, yearlings should be drenched in the December after weaning.

LICE

Although lice are common in the region, trials indicate that light infestations of lice do not reduce weight gains but heavy infestations can. Losses may also result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and then decline with increasing temperatures in spring and summer. Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence, and not the cause, of poor nutritional conditions.

Some producers report that their animals do better following lice treatment. This perceived response is probably due to improved coat condition together, with the improved seasonal conditions that often follow the autumn–winter break.

Control

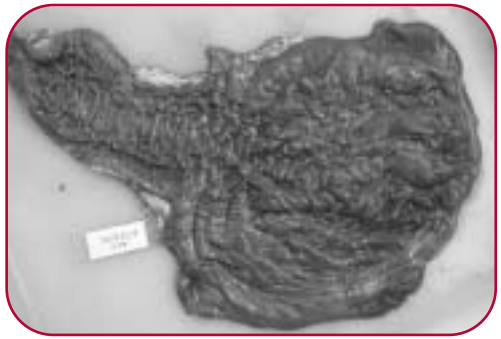
Increasing feed availability and a rise in spring temperatures usually resolve lice problems. Where cattle are suffering or rubbing is resulting in hair loss or skin damage treatment may be required.

Upon diagnosing an outbreak of lice, producers should look for and attempt to remedy the underlying cause of the stress.

Lice are seldom a problem in herds using ML drenches as part of their *Ostertagia* control program. Where lice are an on-going problem, a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use an ML drench to control lice because of the extra internal parasite control provided by this class of chemical. However, lice control products can be more effective than the ML drenches in controlling lice. The 'just in case' use of chemicals should be avoided as it increases the risk of parasite drench resistance and carries an unnecessary cost. Integrated pest management strategies indicate it is preferable to use a narrow spectrum or specific treatment for each pest.

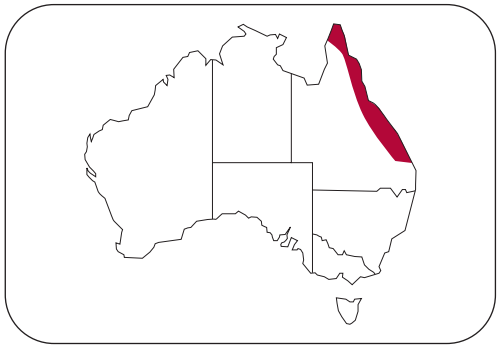
Acknowledgements
Brown Besier, Senior Parasitologist, Department of Agriculture - Western Australia.



Severe Ostertagia infestation (small brown stomach worm) in the fourth stomach (abomasum)

Dr M.G. Smeal, Southern Beef Advisory

Tropical Coastal QLD



Summary

- *Cattle should be vaccinated against tick fever at three to nine months of age.*
- *Stomach fluke can be controlled by treating all cattle in August.*
- *Only stock sold within 12 months of weaning are likely to benefit from roundworm control.*
- *Treatment of buffalo fly is not usually necessary or cost effective when animals have less than 200 flies.*

Geography

- Tropical climate with summer dominant rainfall
- Summers are hot and humid
- Annual rainfall ranges from 630–1,400mm in the south and central areas, to over 1,400mm in the north

Production system

- Mainly a breeding area
- Calves born in spring at start of the wet season
- Cattle almost exclusively *Bos indicus* and crosses
- Many cattle sold to the live feeder market
- Finishing of retained stock may take several years
- Pastures are a combination of native and naturalised tropical and subtropical grasses and legumes

Major parasites

- Buffalo fly *(Haematobia irritans exigua)*
- Paralysis tick *(Ixodes holocyclus)*
- Cattle tick *(Boophilus microplus)* and tick fever *(Anaplasma spp. and Babesia spp.)*
- Barber's pole worm *(Haemonchus placei)*
- Noduler worm *(Oesophagostomum radiatum)*
- Small intestinal worm *(Cooperia punctata and Cooperia pectinata)*
- Stomach fluke *(Calicophoron calicophorum)*
- Lungworm *(Dictyocaulus viviparous)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*
- Black scours *(Coccidiosis)* – at weaning

Grazing management

- Year-round availability of infective larvae, rapid larval development on pasture and extended survival in dung pats reduce options for providing 'worm-safe' pasture
- Grazing paddocks with adult cattle for four months is often the only option for providing safe pasture
- A two-paddock rotation, at four-monthly intervals, can reduce the numbers of cattle tick

Economics

- Vaccination against tick fever produces excellent economic returns
- Treatment for buffalo fly in cattle with less than 200 flies per animal is unlikely to be cost effective
- Buffalo fly protection in steers has increased weight gains by 33kg over a 21-week period
- Cattle with over five-eighths *Bos indicus* blood are largely resistant to cattle tick
- Worm control may increase liveweight gains by 2–6kg per month in the 9–12 months after weaning
- Positive returns from roundworm control are likely in cattle sold at less than two years of age

Calendar for worm, fluke, tick and fly control

Buffalo fly Chemical options All cattle	**Start of fly season** OP (if buffalo flies are a problem prior to January)	**Jan** Ear tags when fly numbers exceed acceptable levels (use OP tags for two years, then SP tags for one year)	**Apr** If flies continue to be a problem after tags are removed use sprays (OP spray after SP tags and SP spray after OP tags)
Ticks (rarely required in cattle with greater than 5/8 *Bos indicus* blood – for other cattle breeds refer over)	**Start of wet season** Treatment avoids excessive build-up in tick numbers during wet season	**End of wet season** Autumn treatment reduces tick populations before winter – treat with two dips, 21 days apart, or a single long-acting pour-on	**Jun–Dec** Additional treatments should be considered when 20 ticks or more, 5mm or greater in length, are counted on one side of several animals
Stomach fluke	A single treatment in September will usually control stomach fluke in 'flukey' areas, eg swamps, inundated areas, river flood plains		
Worm control	**Nov**	**Jan–May**	
Weaners/yearlings	✓	(✓) Additional treatments as required Faecal egg counts may be a useful diagnostic tool in young stock	

✓ Strategic treatment given each year
(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a move to 'low-risk' pastures, especially for young stock.

SF Consult a veterinarian for treatment options
OP Organophosphate based treatments
SP Synthetic pyrethroid based treatments

CATTLE TICK

Cattle tick is endemic to coastal Queensland. Ticks are most active from November to July in the south and all year round on the north coast, although they are less active during the dry months of April to November.

Control

The innate resistance of *Bos indicus* breeds and crosses with at least five-eighths *Bos indicus* largely eliminates the need for routine treatments. Despite this innate resistance, tick numbers in Zebu cattle do rise during autumn as feed quality declines. Treatment at either end of the wet season usually maintains adequate control and coincides with mustering. Additional treatments during the dry season are only needed when more than 20 ticks larger than 5mm are seen on one side of several animals.

Cattle that require more intensive treatment can use a combination of dipping, pour-ons and TickGuard vaccine. Refer to DPI Notes on-line (http://www.dpi.qld.gov.au/thematiclists/1175.html) or your local stock inspector for local advice on the best combination of strategies.

Paddock rotations to produce tick-safe pasture can be utilised for high-risk animals. Tick-safe pastures can be created by spelling paddocks for four months. A two-paddock rotation at four-monthly intervals can reduce tick challenge. Cattle rotate between paddocks in September, January and May.

TICK FEVER

Although Zebu cattle have an innate resistance to cattle ticks, the risk of tick fever still remains. Ticks spread the blood-borne parasites *Babesia* and *Anaplasma*. Cattle with more than five-eighths *Bos indicus* breeding have a greater resistance to *Babesia* but are very susceptible to *Anaplasma marginale*. Vaccination against tick fever can produce substantial economic returns. All cattle should be vaccinated at 3–9 months of age for life-long immunity.

INTERNAL PARASITES

The most important internal parasites in this region are barber's pole worm *(Haemonchus placei)*, nodule worm *(Oesophagostomum radiatum)* and the small intestinal worm *(Cooperia punctata and Cooperia pectinata)*.

Problems are most common in beef cattle in their first year after weaning. Strong immunity develops after 12 months of age. Barber's pole worm may cause outbreaks of disease in adult cattle due to weaker immunity to this parasite.

Temperature and humidity in this region are sufficiently high to enable hatching and development of parasite eggs year-round. Larvae can develop within one week during summer and two to three weeks in winter.

Control

Due to the constant availability of infective larvae there are fewer options available for worm control compared to temperate areas and limited opportunity to provide 'worm-safe' pasture.

Worm control in young stock delays the development of resistance. This improves weight gain in young cattle, however the benefits are eroded in the second and third year after weaning. Only stock sold within 12 months after weaning are likely to benefit from worm control.

To control worms, drench early in the wet season (November). This prevents heavy contamination during summer. Additional treatments may be required between January and May but should only be given if symptoms (scouring and weakness) appear. If disease occurs the most common parasite, barber's pole worm, is highly susceptible to low cost drenches based on levamisole.

Worm-safe pastures can be prepared by resting paddocks for two months or grazing with adult cattle for four months.

STOMACH FLUKE

(Calicophoron calicophorum)

Stomach fluke are present across the region. They require seasonally wet marshy areas so the impact varies between properties and even between paddocks. Cattle acquire fluke as they graze infested areas such as swamps, springs, flood plains and creeks. Disease is most common in late autumn through winter in calves, weaners and introduced stock.

Symptoms include reduced weight gains, weight loss, scouring and sometimes death.

Control

Before treatment, a diagnosis of stomach fluke should be made. Infection can be prevented by denying stock access to wet areas with fencing and reduction in potential fluke habitats with drainage and re-vegetation.

Control of stomach fluke can usually be achieved with a single treatment in September. Discuss options with your veterinarian.

BUFFALO FLY

(Haematobia irritans exigua)

Buffalo fly is a blood-sucking parasite of cattle in warm, moist areas of northern Australia.

Lifecycle

Adult flies live on cattle and feed between 10–40 times a day. Adult females lay eggs in cattle dung. Larvae hatch within 24 hours then feed in the dung for 9–40 days as they mature to adulthood. In hot humid conditions the whole lifecycle may take less than two weeks.

Effect on cattle

Flies suck blood and cause severe skin irritation. This causes cattle to rub vigorously, disrupting grazing and damaging hides. Some cattle are 'allergic' to buffalo fly bites and rub excessively causing severe ulcers. Bulls, older cattle and those in poor conditions usually carry heavy burdens.

Where heavy infestations of buffalo fly are not effectively treated, it may cost up to $30 per head in lost production.

Control

The presence of buffalo fly should not mean treatment is immediately instituted. Cattle can tolerate a small number of flies without losing production. Treatment is required when there are more than 200 flies per animal (100 on each side) or when susceptible animals, such as bulls, show 'fly worry'.

A range of chemical and non-chemical treatments are available. Prior to the use of chemical options all non-chemical options should be explored.

Non-chemical options

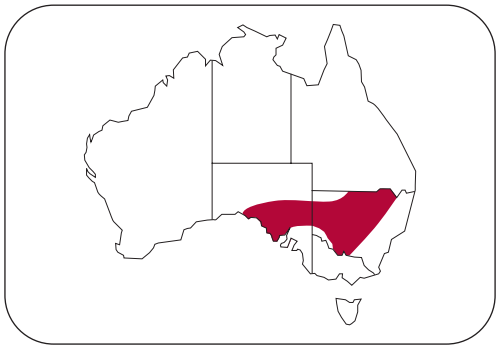
- Cull hypersensitive animals
- Install buffalo fly traps
- Introduce dung beetles to break down dung pats and reduce fly breeding habitats

Chemical control

A range of chemical options is available (see Table 1 of the 'Buffalo fly' factsheet).

Some chemicals adversely affect dung beetles. This can be minimised by the use of insecticidal ear tags, treating only when necessary, avoiding synthetic pyrethroids (SPs) during spring when dung beetles are emerging and using ML pour-ons in autumn and only when control of other parasites is required.

Temperate Rangelands



Geography

- Dry-hot climate with uniform but highly variable rainfall
- Temperatures warm in the south and hot in the north
- Median rainfall, generally less than 400mm per annum
- Sown pastures are uncommon; cattle graze and browse native perennial and annual grasses, shrubs and native trees

Production system

- Small breeding herds, but most cattle purchased for finishing during good seasons
- Purchasing rather than breeding allows stocking rates to be sufficiently flexible to allow for the highly variable conditions in this region
- Cattle usually mustered once a year at which time they are removed for sale, young stock are weaned and breeding stock selected

Summary

- *The incidence of internal parasitism in cattle is low due to the hot dry climate, native vegetation and low stocking rates in this region.*
- *Routine parasite control programs are not required.*
- *Routine drenching in semi-arid areas carries an increased risk of development of drench resistance.*
- *Lice are commonly treated but in most cases treatment is not indicated.*

Significant parasites

- No formal investigation has been undertaken on the incidence of cattle parasites in the region
- It is likely that the parasites present mirror those found in sheep: these include small brown stomach worm *(Ostertagia ostertagi)* in southern areas and barber's pole worm *(Haemonchus spp.)* in northern areas

Other parasites

- Ornate Kangaroo Tick *(Amblyomma triguttatum)* occurs occasionally and requires treatment in some years
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

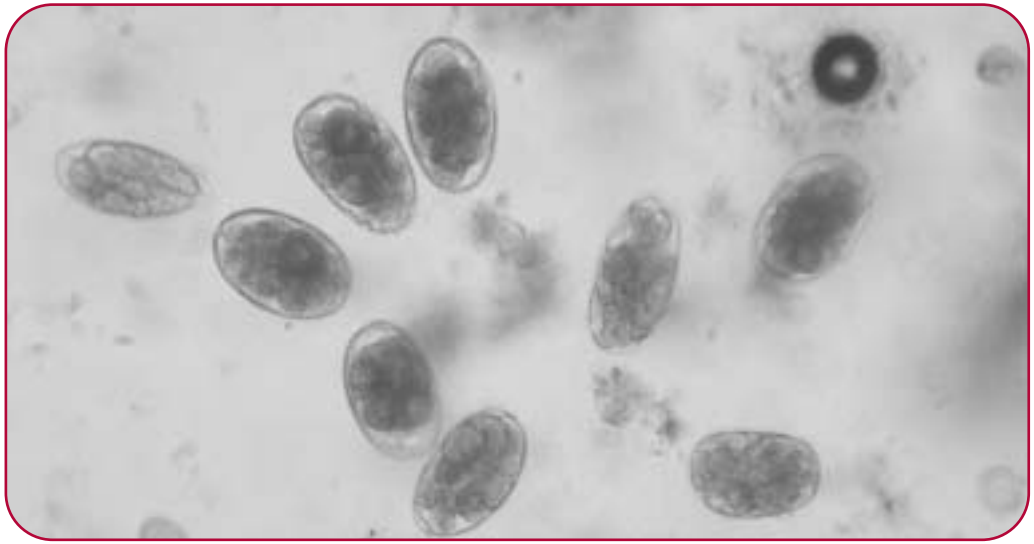
- Specific grazing strategies to control parasites seldom required or practical
- Due to the limited exposure of cattle to parasites, careful attention should be paid to animals during seasons of above average rainfall or when cattle are moved to higher rainfall areas

Economics

- Routine treatment of internal parasites unlikely to be cost effective in this region
- Recent anecdotal evidence suggests that an economic response to macrocyclic lactone (ML) drenches has been observed in cattle failing to perform despite excellent seasonal conditions

Calendar for worm control

- There are no routine treatments recommended in this region.



Worm eggs in faeces - several types of worm can be found in the Temperate Rangelands
Dr Gareth Hutchinson, NSW Department of Primary Industries

Epidemiology

The hot dry climate, low rainfall, low stocking rates and native vegetation do not assist the lifecycle of any internal parasites of cattle. A build-up in worm numbers may occur sporadically in very wet seasons, or with a succession of good rainfall years.

Because of the extensive grazing systems few management strategies are practical or required.

Routine drenching is not recommended.

In this region the relative incidence of disease conditions other than parasites that cause failure to perform is high. Prior to treating for parasites it is advisable to seek an actual diagnosis. If worms are considered a possibility, faecal egg counts can be obtained to check the type and numbers present.

LICE

Although lice are common in the region, trials indicate they are unlikely to reduce weight gain. Economic losses may result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring, before declining with the increasing temperatures in spring and summer.

Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence of poor nutritional conditions and not the cause.

Some producers report that their cattle perform better following lice treatment. This perceived response is probably due to improved coat condition together with the improved seasonal conditions that often follow an autumn–winter break.

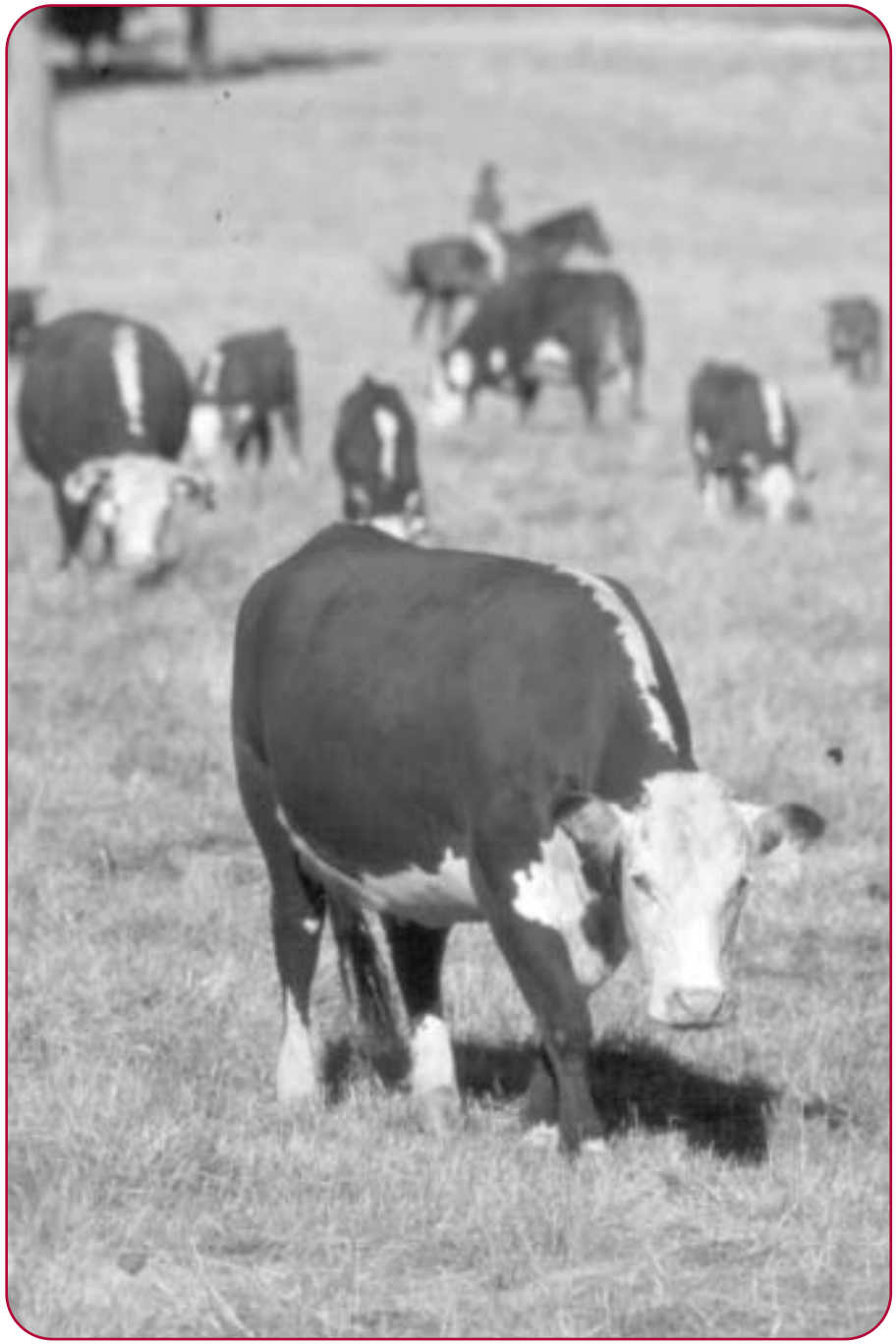
Control

Lice problems are usually resolved by increasing feed availability and a rise in spring temperatures. Where cattle are suffering, or rubbing is resulting in hair loss or skin damage, treatment may be required.

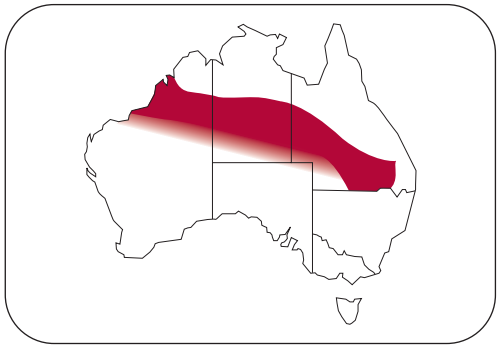
Upon diagnosing an outbreak of lice producers should look for, and attempt to remedy, the underlying cause of the stress. Where lice are an on-going problem a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use a macrocyclic lactone (ML) drench to control lice. This is costly and may promote the development of resistance in other parasites. In this region especially, internal parasite burdens are usually very low and lice control products are just as effective as the ML drenches in controlling lice.

Acknowledgements
Greg Curran, Veterinary Officer Broken Hill
(NSW Department of Primary Industries)



Subtropical Rangelands



Geography

- Very dry, hot-warm climate
- Wetter areas have a median annual rainfall of up to 400mm declining to less than 150mm in the drier parts
- Few sown pastures
- Cattle graze and browse native perennial grasses, annual grasses, shrubs and native trees

Production system

- Cattle bred on extensive, low stocking rate operations
- During good seasons or flooding in the channel country, large numbers of cattle purchased for finishing
- Purchasing, rather than breeding, allows stocking rates to accommodate the highly variable conditions
- Cattle usually mustered once a year, at which time they are removed for sale, young stock weaned and breeding stock selected

Summary

- *Due to the hot dry climate, native vegetation and low stocking rates in this region, the incidence of internal parasitism is low.*
- *Routine parasite treatment programs are not required.*
- *Lice are commonly treated but in most cases they cause little reduction in weight gain and will resolve naturally with warmer temperatures and improved feed in spring.*
- *Blacks scours (Coccidiosis) is a common problem in young cattle at weaning time.*

Significant parasites

- The area is free of cattle tick *(Boophilus microplus)* and tick infestations must be reported
- Occasional buffalo fly *(Haematobia irritans exigua)* incursions occur in wet seasons
- Black scours *(Coccidia)*

Other parasites

- Roundworms: sporadic outbreaks occur in very wet years or due to crowding of young stock
- Barber's pole worm *(Haemonchus placei)*
- Nodule worm *(Oesophagostomum radiatum)*
- Small intestinal worm *(Cooperia punctata and Cooperia pectinata)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

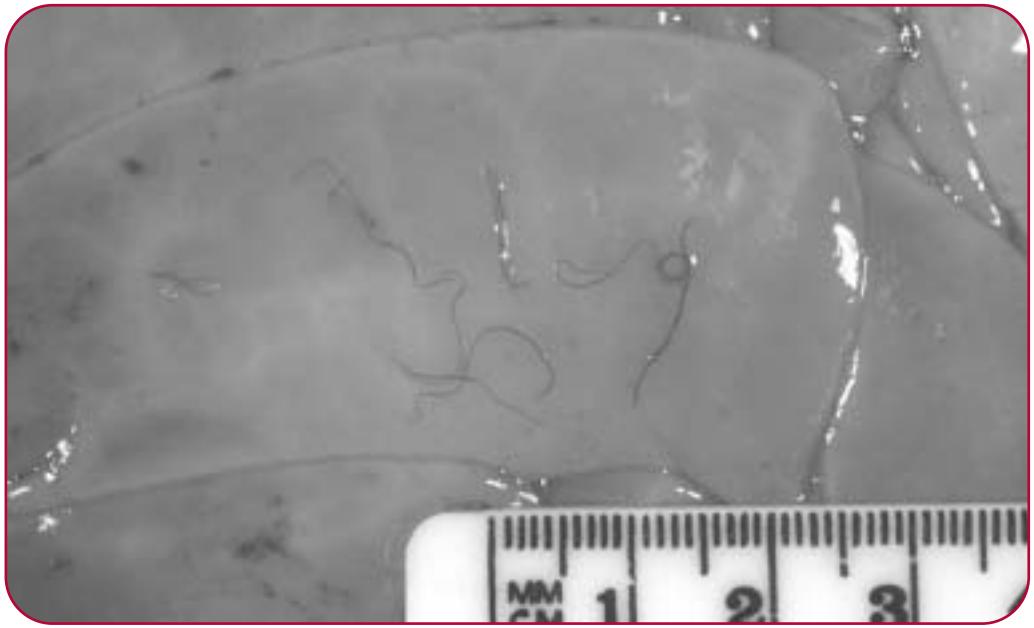
- Specific grazing strategies to control parasites seldom required or practical
- Due to the limited exposure of cattle to parasites, careful attention should be paid to animals during seasons of above average rainfall or when moved to higher rainfall areas
- Cattle moving to tick endemic areas should be vaccinated against tick fever a month prior to travelling

Economics

Routine treatment of internal parasites is unlikely to be cost effective in this region.

Calendar for worm and fluke control

- There are no routine treatments recommended in this region.



Barber's pole worm (Haemonchus placei) - one of the parasites found in the Subtropical Rangelands. Here pictured on the wall of the fourth stomach (abomasum).

Dr Gareth Hutchinson, NSW Department of Primary Industries

Epidemiology

The hot dry climate, low rainfall, high pasture variability, low stocking rates and native vegetation are not conducive to the lifecycle of any internal parasites in cattle. A build-up in worm numbers may occur sporadically in very wet seasons or following a series of good rainfall years.

Due to the extensive nature of grazing systems, few management strategies are practical or required.

Routine drenching is not recommended.

LICE

Although lice are common in the region, trials indicate they are unlikely to reduce weight gains. Economic losses may result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and then decline with increasing temperatures in spring and summer.

Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence, and not the cause, of poor nutritional conditions.

Some producers report that their animals do better following lice treatment. This perceived response is probably due to improved coat condition and improved seasonal conditions rather than due to the lice treatment itself.

Control

Increasing feed availability and a rise in spring temperatures usually resolve lice problems. Where cattle are suffering, or rubbing is resulting in hair loss or skin damage, treatment may be required.

Upon diagnosing an outbreak of lice, producers should look for and attempt to remedy, the underlying cause of the stress. Where lice are an on-going problem a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use a macrocyclic lactone (ML) drench to control lice. Not only is there an increased cost associated with this practice, it may also promote the development of resistant parasites. In this region especially, internal parasite burdens are usually very low and lice control products are as effective as the ML drenches in controlling lice.

BLACK SCOURS *(Coccidia)*

Coccidia are microscopic organisms that live in the small and large intestine of young cattle. *Coccidia* occur in all areas. Severe infection produces a profuse, dark, watery diarrhoea and dirty tails and hindquarters. Infected animals become dehydrated and some will become recumbent and die. Recovered animals often have a long period of low food consumption and poor weight gain. Disease is most commonly seen in young cattle up to 250kg, around the time of weaning or prolonged yarding.

Lifecycle

Coccidia have lifecycle stages in the host and on the pasture. The host stage breeds and multiplies in the wall of the small and large intestine. Eggs (oocysts) are excreted in the faeces. These divide to the infective stage (sporozoites) that, after ingestion, penetrate the gut wall and the lifecycle is complete.

Disease

The multiplication of sporozoites in the intestinal wall damages the lining of the gut. The intestinal wall becomes swollen and sections of the gut lining become severely damaged. The first sign of the disease is profuse watery diarrhoea. This often contains blood, clots and shreds of intestinal lining. Faeces often cover the hind legs and the base of the tail. Affected animals become depressed, dehydrated and weak.

Signs

- Sudden onset of severe, foul smelling diarrhoea which may be blood-stained – either dark, tarry stain or fresh, red clots – and may also contain shreds of gut lining
- Straining
- Anaemia
- Decreased appetite
- Usually seen in weaners under 250kg
- Dehydration and recumbency
- Death

Epidemiology

The parasite lives and proliferates in the lining of the intestines. Almost every animal becomes infected with *coccidia* during their life, usually as a calf or weaner. In most cases the infection passes uneventfully and the animal becomes immune. In some cattle the infection can become overwhelming, particularly when the animal is experiencing some other form of stress, such as weaning, poor nutrition or close confinement.

During weaning or confinement, yards or areas around watering holes rapidly become contaminated with faecal material from infected animals. The parasite then spreads through young, susceptible cattle. The sporozoites are tough and survive for long periods in the soil. If a set of weaning yards become infected, producers should consider moving future weaning to new yards.

After infection, cattle develop strong immunity to *coccidiosis*. A small number of animals may become permanent carriers, shedding small numbers of eggs in their faeces.

Risk factors

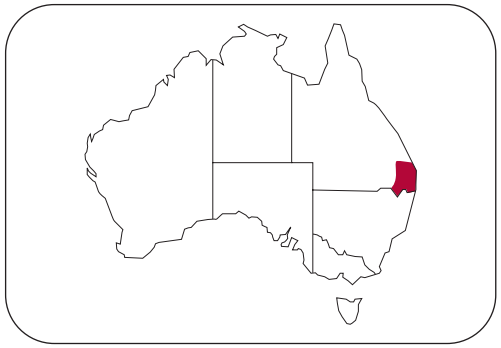
- Young animals (calves and weaners)
- Low body weight at weaning
- Confinement in small areas
- Feed or watering points contaminated with faecal material
- Stress such as weaning, cold weather or poor nutrition

Control

Where early weaning occurs, or weaners are held in yards for more than a week, preventative measures should be used. *Coccidiosis* can be prevented by feeding a medicated ration or supplement containing monensin. Monensin is included in the diet at the rate of 10–20mg per head per day.

Infected animals should be isolated and overcrowding eased. Electrolytes can be added to the water and water troughs should be raised to prevent faecal contamination. Once a calf has severe scours, treatment is difficult and consists largely of supportive therapy to correct dehydration. Electrolyte solutions should be administered.

Subtropical Coastal QLD



Summary

- *Young cattle should be drenched in March–May and July.*
- *Cattle grazing liver fluke infested areas (southern areas) should be treated in April and September.*
- *Treatment of buffalo fly is not usually necessary or cost effective when animals have less than 200 flies.*

Geography

- Moist temperate climate with uniform rainfall, a long hot summer and a mild winter
- Most areas have an annual rainfall between 800 and 1,200mm

Major parasites

- Cattle tick *(Boophilus microplus)*; bush tick *(Haemaphysalis longicornis)*
- Buffalo fly *(Haematobia irritans exigua)*
- Barber's pole worm *(Haemonchus placei)*
- Nodule worm *(Oesophagostumum radiatum)*
- Small brown stomach worm *(Ostertagia ostertagi)* in the south of the region

Production system

- Breeding and finishing area with calves born in spring
- Few animals sold as weaners; most sold to the domestic supermarket trade or to feedlots at 16–24 months of age
- Cattle are both *Bos taurus* and *Bos indicus* and their crosses

Other parasites

- Paralysis tick *(Ixodes holocyclus)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*
- Stomach fluke *(Calicophoron calicophorum)*
- Small intestinal worm *(Cooperia punctata and C. pectinata)*
- Liver fluke *(Fasciola hepatica)*

Grazing management

- Year-round availability of infective larvae, their rapid development on pasture and extended survival in dung pats reduce the options for providing 'worm-safe' pasture
- Grazing paddocks with adult cattle for four months is often the only practical option for providing worm-safe pasture

Economics

- The annual cost of control for a 100-cow herd is $1,240
- Sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- Worm control may increase liveweight gains by 2–6kg per month in the 9 to 12 months after weaning
- Positive returns from roundworm control likely in cattle sold at less than two years of age

Calendar for worm and fluke control

Spring calving herds

Age group	Mar–May	Jul	Sep	Dec
Weaners	✓ Weaning	✓	(✓) May be required if previous drench was not an ML	✓
Yearlings/1st calvers	✓	(✓) Pre-calving		(✓)
2nd calvers		(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to internal parasites (except fluke) – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls				✓Pre-joining
Liver fluke control				
All weaned cattle	Fi	F		(Fi)

✓ Strategic worm treatment given each year

(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a move to 'low-risk' pastures, especially for young stock.

Fi Both adult and immature fluke present – select a drench that kills all fluke stages.

(Fi) Adult and immature fluke present. This drench may not be needed on properties with a low fluke risk.

F Only adult fluke present. Use a drench other than triclabendazole to help slow the development of parasite resistance.

ML Macrocyclic lactone

CATTLE TICK

Cattle tick is endemic to coastal Queensland. Ticks are most active from November to July in the south and all year round in the north, although they are less active during the dry months of April to November.

Control

Bos indicus breeds and crosses with at least five-eigths *Bos indicus* have an innate resistance to cattle tick. Treatment at either end of the wet season will usually provide adequate control and coincides with mustering. Additional treatments during the dry season may be needed when more than 20 ticks larger than 5mm are seen on one side of several animals.

Paddock rotations to produce tick-safe pasture can be used for high-risk animals. Tick-safe pastures can be created by spelling paddocks for four months. A two-paddock rotation at four-monthly intervals in September, January and May can reduce tick challenge.

Tick treatments

Treatment	Regime
Dip or spray	Six treatments at 3-week intervals commencing October
Acatak	Two treatments at 12-week intervals commencing October
TickGARD PLUS	Treatments throughout the year at 10–12 week intervals
Macrocyclic lactone drench	At start of tick season in place of one dip or spray
All cattle should be vaccinated against tick fever between three and nine months of age	

Source: Queensland DPI&F

TICK FEVER

Even though *Bos indicus* cattle have an innate resistance to cattle ticks, the risk of tick fever (Babesiosis) still remains. Ticks spread the blood borne parasites *Babesia* and *Anaplasma*.

Vaccination against tick fever can produce substantial economic returns (see Table 1 in the 'Tick fever' factsheet).

All cattle should be vaccinated at three to nine months of age.

INTERNAL PARASITES

The most important internal parasites are barber's pole worm *(Haemonchus placei)* and nodule worm. In the south, the small brown stomach worm *(Ostertagia ostertagi)* is also present.

Seasonal trends

High temperature and humidity allow hatching and development of parasite eggs throughout the year. Larvae can develop in just one week during summer and 2–3 weeks in winter.

Unweaned calves heavily contaminate pastures with *Ostertagia* eggs during late summer and autumn. Yearlings also deposit eggs produced by adult *Ostertagia* worms which have resumed development from inhibited larvae picked up during the previous spring. The eggs rapidly hatch into infective larvae which accumulate in the cooler conditions to reach their highest levels during late winter. Disease due to *Ostertagia* is most common in late winter when high levels of infective larvae combine with seasonally low nutritional levels.

Calves born in late winter and early spring pick up heavy burdens of *Haemonchus* during late spring. By autumn they are passing high levels of eggs in their faeces. These hatch following autumn rains. Disease due to *Haemonchus* is most common in late summer and early autumn. The number of inhibited *Haemonchus* larvae rises during late summer and autumn. They resume their development in early spring.

Strong immunity develops to most worms, with the exception of *Ostertagia*, by 12 months of age. The development of resistance to *Ostertagia* is not complete until 18 months of age.

Control

Due to the constant availability of infective larvae fewer options are available for worm control than in temperate areas and limited opportunity to provide worm-safe pasture.

Worm control in young stock delays the development of resistance and improves weight gain in young cattle. However the benefits are eroded in the second and third year after weaning. Only stock sold within 12 months of weaning are likely to benefit from worm control.

Producers should reduce exposure of weaners and yearlings to high levels of infective larvae on pasture during late winter and early spring to maximise weight gain. Drench in March–May at weaning. In late July, a second drench should be combined with a move to worm-safe pasture. Worm-safe pasture can be prepared by grazing with adult cattle for the preceding four months.

BUFFALO FLY

(Haematobia irritans exigua)

Buffalo flies are small blood-sucking parasites.

Lifecycle

Adult flies live on cattle and feed between 10 and 40 times a day. Adult females lay eggs in cattle dung. Larvae hatch within 24 hours then feed in the dung for 9–40 days as they mature to adulthood. In hot humid conditions the whole lifecycle may take less than two weeks.

Effect on cattle

Flies suck blood and cause severe skin irritation. This causes cattle to rub vigorously, disrupting grazing and damaging hides. Some cattle are 'allergic' to buffalo fly bites and rub excessively causing severe ulcers. Bulls, older cattle and those in poor conditions usually carry heavy burdens.

Where heavy infestations of buffalo fly are not effectively treated, it may cost up to $30 per head in lost production.

Control

Treatment is only required when there are more than 200 flies per animal (100 on each side) or when susceptible animals, such as bulls, show 'fly worry'.

A range of chemical and non-chemical treatments is available. Prior to the use of chemical options all non-chemical options should be explored (see 'Buffalo fly' factsheet).

Some chemicals have an adverse effect on dung beetles. This can be minimised by the use of insecticidal ear tags, treating only when necessary, avoiding synthetic pyrethroids (SPs) during spring when dung beetles are emerging and using ML pour-ons in autumn and only when control of other parasites is required.

LIVER AND STOMACH FLUKE

(Fasciola hepatica and *Calicophoron calicophorum)*

Liver fluke is mainly present in the south while stomach fluke is present across the region. Their impact will vary between properties and even between paddocks depending on the presence of fluke habitats. Stock pick up fluke as they graze infested areas such as swamps, springs, flood plains and creeks. Fluke numbers increase during spring and summer and disease is most common in late autumn and early winter in calves, weaners and introduced stock.

Symptoms include reduced weight gains, weight loss, bottlejaw, scouring (stomach fluke) and sometimes death.

Control

A diagnosis of liver or stomach fluke should be made before treatment. Infection can be prevented by denying stock access to 'flukey' habitats with fencing and reduction in potential fluke habitats with drainage and re-vegetation.

Drench in March–May and September to control liver fluke. On high-risk properties a third treatment may be required in December. Control stomach fluke with a single treatment in August – see your vet for details.

Central Victoria and Tasmania

Geography

- Moist, temperate climate
- Uniform rainfall with long, warm summers and cool to cold winters
- Annual rainfall between 550 and 1,400mm
- Most areas have rainfall between 500 and 700mm

Production system

- Breeding and finishing region with calves born in autumn and spring
- Most cattle sold at 16–24 months to the domestic supermarket trade or to feedlots
- Most properties graze both sheep and cattle; in the flatter, western areas of Victoria more cropping occurs
- Cattle are mainly British breeds and their crosses

Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful cattle parasite in this region.*
- *To control* Ostertagia, *drench spring calving herds at weaning and again in July. Rotate to 'worm-safe' pasture after the July drench.*
- *Routine drenching of mature beef cattle is not required.*
- *Drench cattle grazing 'flukey' pastures in May/June and September with a third drench in December on high-risk properties.*
- *Lice are commonly treated but in most cases this may not be indicated. Infestations usually resolve with warmer temperatures and improved feed in spring.*

Significant parasites

- Small brown stomach worm *(Ostertagia ostertagi)*
- Liver fluke *(Fasciola hepatica)*

Other parasites

- Small intestinal worm *(Cooperia oncophora)* in early weaned calves
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

- Grazing yearlings on 'worm-safe' pasture during spring improves weight gains
- Worm-safe pastures can be prepared by grazing paddocks with sheep or cattle older than 18 months from the previous summer
- Drench yearlings in December if they do not graze worm-safe pasture during spring

Economics

- Annual cost of strategic *Ostertagia* control in a 100-cow, spring-calving herd is $1,240
- Yearlings or sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- The combination of a late July drench for weaners with a move to worm-safe pasture can increase weight gain by 30–60kg per head
- Drenching and paddock rotations to control *Ostertagia* are highly likely to produce positive returns

Calendar for worm and fluke control

Autumn calving herds

Age group	Dec–Feb	Mar–May	Jul	Sep
Weaners	✓ Weaning	✓	✓	(✓) May be required if previous drench was not an ML
Yearlings/1st calvers	✓	✓	(✓)	
2nd calvers	(✓)	(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls	✓			
Liver fluke control				
All weaned cattle	(Fi)	Fi		F

✓ Strategic worm treatment given each year
(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a change to 'low-risk' pastures, especially for young stock.
Fi Both adult and immature fluke present – select a drench that kills all fluke stages
(Fi) Adult and immature fluke present. This drench may not be needed on properties with a low fluke risk.
F Only adult fluke present. Use a drench other than triclabendazole to help slow the development of resistance.
ML Macrocyclic lactone

Calendar for worm and fluke control

Spring calving herds

Age group	Mar–May	Jul	Sep	Dec
Weaners	✓ Weaning	✓	(✓) May be required if previous drench was not an ML	(✓) May be required if worm-safe pastures were not used
Yearlings/1st calvers	✓	(✓) Pre-calving		(✓)
2nd calvers		(✓) Pre-calving		
Adult cows	Adult cattle have strong resistance to *Ostertagia*. Individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls				✓ Pre-joining
Liver fluke control				
All weaned cattle	Fi		F	(Fi)

See over page for ✓, (✓), (Fi), F key

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in this region is the small brown stomach worm.

It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gains) in weaners and yearlings occur on many properties each year, particularly in the wetter, eastern areas.

Excessive worm burdens may be picked up from pastures contaminated by weaners in autumn and winter and usually occur in late winter and early spring after weaning.

Adult cattle develop a strong resistance to *Ostertagia*. Treatment of individual cows is occasionally required when symptoms (scouring) appear.

Seasonal trends

Numbers of infective larvae on pasture follow a reliable seasonal pattern (see figure 2 of the 'Small brown stomach worm' factsheet).

Larval numbers on pasture are very low over summer due to the hot, dry conditions. A small number of worm eggs and larvae survive in the dung pats between November and March to be released by the 'melting' effect of autumn rains.

During spring, an increasing percentage of the *Ostertagia* larvae picked up by grazing cattle become 'inhibited' in their growth in the lining of the stomach. These inhibited larvae resume their development in autumn and by mid-winter few remain. Inhibited larvae develop into adult, egg-laying worms which generate the autumn rise in pasture larval numbers.

After the autumn rise, cold winter temperatures limit further increases in larval numbers on pasture until the warmer temperatures in late winter and early spring give rise to a rapid increase in larval numbers. This continues throughout the spring until larval numbers begin to decline with the onset of hot, dry conditions in late spring.

Control

In order to maximise weight gains in weaners and yearlings, producers must reduce the exposure of young cattle to high levels of infective larvae on pasture during late winter and early spring. Autumn born yearlings and weaners should be drenched in March–May. In late July, a second drench should be combined with a move to a 'worm-safe' pasture. Worm-safe pasture is best prepared by grazing with sheep or cattle older than 18 months from the previous summer.

ML drenches are used by many producers for *Ostertagia* control, but oral 'white' (BZ) drenches at one-third the cost provide the same effective control.

LIVER FLUKE *(Fasciola hepatica)*

Liver fluke is present across most of the region but its lifecycle's requirement for wet, marshy areas means its impact varies between properties and even between paddocks.

Clinical disease is most common in weaned cattle less than three years of age in the late autumn and winter. During dry summers stock pick up fluke as they graze 'flukey' areas such as swamps, springs and creeks in search of green feed. The risk increases until autumn rains generate fresh green feed and stock cease grazing in 'flukey' areas. Symptoms include reduced weight gain, weight loss, bottlejaw, possibly scouring and sometimes death.

Control

Before undertaking treatment, the presence of liver fluke on the property should be determined in consultation with a veterinarian.

Denying stock access to fluke habitats by fencing can prevent liver fluke infection. Fluke habitat can also be reduced with drainage, re-vegetation and fencing of creeks and soaks.

Where cattle graze fluke habitats, two drench treatments are usually required. The first is given in May to eliminate fluke that have been picked up during the summer and autumn. The second treatment in September is designed to remove adult fluke that can contaminate the pasture in spring. On high-risk properties an additional treatment in December may be required to remove high fluke burdens acquired during the spring.

LICE

Although lice are common in the region, trials indicate that light infestations of lice do not reduce weight gains but heavy infestations can. Losses may also result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and then decline with increasing temperatures in spring and summer. Heavy infestations are usually seen in cattle in poor body condition. In most cases the lice are a consequence, and not the cause, of poor nutritional conditions.

Control

Lice problems are usually resolved by increasing feed availability and the rise in spring temperatures. Where cattle are suffering or the rubbing is resulting in hair loss or skin damage, treatment may be required.

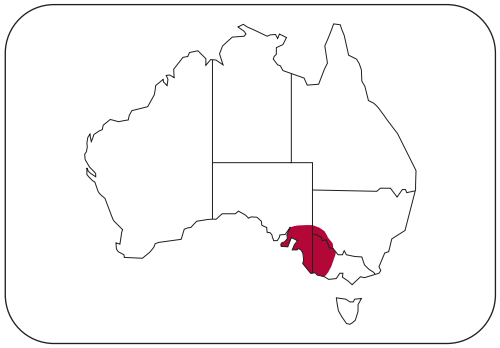
Upon diagnosing an outbreak of lice producers should look for, and attempt to remedy, the underlying cause of the stress.

Lice are seldom a problem in herds using ML drenches as part of their *Ostertagia* control program.

Where lice are an on-going problem a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use an ML drench to control lice. This is costly and can increase the risk of the development of resistant parasites. Specific lice control products can be more effective than MLs and integrated pest management (IPM) principles indicate it is preferable to use a narrow spectrum or specific treatment for each pest.

Western Victoria and South Australia



Summary

- *The small brown stomach worm* (Ostertagia) *is the most harmful parasite of cattle in this region.*
- Ostertagia *control in set-stocked, autumn born calves requires drenching at weaning (December/January), March/April and again in December.*
- *An alternate program involves a six-monthly grazing rotation (January and July) between weaners/yearlings and sheep. Cattle are drenched before rotating to new pasture.*
- *Fluke control requires drenching of at-risk animals in March–May and September with a third drench in December on high-risk properties.*

Geography

- The southwestern area of Victoria and the adjacent area of South Australia have a temperate climate with a long, warm, dry summer and cool, wet winter.
- Most areas have annual rainfall between 400 and 800mm

Production system

- Breeding and finishing area with calving in both autumn and spring
- Few animals sold as weaners; most sold to the domestic supermarket trade or to feedlots at 16–24 months
- Most properties run both sheep and cattle; cropping increases in the flatter, western areas
- Cattle almost exclusively British breeds
- Pastures are a combination of native and naturalised grasses and introduced Mediterranean grasses and legumes

Significant parasites

- Small brown stomach worm (*Ostertagia ostertagi*)
- Liver fluke *(Fasciola hepatica)*

Other parasites

- Stomach hair worm *(Trichostrongylus axei)*
- Small intestinal worm *(Cooperia oncophora)* in early weaned calves
- Biting lice *(Bovicola bovis)* and sucking lice (*Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

- A 'worm-safe' paddock should be prepared for grazing calves after the weaning drench. Worm-safe paddocks can be prepared by grazing with sheep or cattle older than 18 months for the previous six months.
- A second paddock, prepared in the same way should be available for weaners/yearlings after the July drench.
- The weaning drench in autumn born calves can be combined with a move to crop stubble.

Economics

- Annual cost of strategic *Ostertagia* control in a 100-cow, spring calving herd is $1,240
- Yearlings or sale stock must gain an extra 8.2kg in weight to breakeven on drench costs
- Set-stocked weaners drenched in January and April may gain an extra 30–50kg in body weight

Calendar for worm control

Autumn calving herds

Class of cattle	Dec–Jan	Mar–Apr	Jul	Dec
Autumn born calves (set-stocked)	✓ Weaning	✓		✓
Autumn born calves (sheep/cattle rotations)	✓ Move to 'safe' pasture		✓ Move to 'safe' pasture	
1st/2nd calvers	✓	(✓) Pre-calving		
Adults	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated			
Bulls	✓ Pre-joining	(✓)		

✓ Strategic worm treatment given each year

(✓) Not a routine treatment. Indicators for treatment include scouring, sudden loss of condition and a condition score of 2 or less, especially if feed availability is less than 1,000kg DM/ha. Treatment will be more effective if combined with a change to 'low-risk' pastures, especially for young stock.

Fi Both adult and immature fluke present – select a drench that kills all fluke stages

(Fi) Adult and immature fluke present. This drench may not be needed on properties with a low fluke risk.

F Only adult fluke present. Use a drench other than triclabendazole to help slow the development of resistance.

Calendar for worm control

Spring calving herds

Class of cattle	Mar–Apr	Jul	Dec
Weaners	✓ Weaning	✓	✓
1st calf heifers	(✓)		✓
2nd calvers	(✓)		
Adult cows	Adult cattle have strong resistance to *Ostertagia* – individual cows showing signs of internal parasitism (diarrhoea, weight loss and ill thrift) should be treated		
Bulls	(✓)		✓

Calendar for liver fluke control

	Mar–May	Sep	Dec
All weaned cattle	Fi	F	(Fi)

See over page for ✓, (✓), Fi, F, (Fi) key

SMALL BROWN STOMACH WORM *(Ostertagia ostertagi)*

The most important parasite in this region is the small brown stomach worm. It is present in all herds and dramatically reduces growth rates.

Actual losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are uncommon, but production losses (reduced weight gains) in weaners and yearlings occur on many properties.

Excessive worm burdens picked up directly from pasture are usually seen in late autumn and winter after weaning. Disease is more likely in seasons when the autumn break is followed by a prolonged, wet autumn and winter.

Adult cattle develop a strong resistance to *Ostertagia*. Treatment of individual cows is occasionally required when symptoms appear.

Seasonal trends

The numbers of infective larvae on pasture follow a reliable seasonal pattern (see Figure 2 of the 'Small brown stomach worm' factsheet).

Few larvae survive the hot, dry conditions on pasture during summer. Following autumn rain, the larvae and eggs that did survive the summer inside dung pats combine with freshly deposited eggs to produce a rapid rise in larvae numbers in late autumn, peaking in winter. From August onwards, larvae numbers decline and become negligible by November.

During spring, an increasing percentage of the *Ostertagia* larvae picked up by grazing cattle become 'inhibited' in their growth in the stomach lining. Numbers peak during mid-summer. Inhibited larvae resume their development in autumn and by mid-winter few remain.

Disease caused by inhibited larvae resuming development *en masse* is most common in the first autumn after weaning for spring born calves and in the second autumn after weaning for autumn born calves. Autumn calving heifers are highly susceptible to inhibited larvae resuming development around the time of calving.

Control

Strategic drenching programs in this region are designed to prevent young cattle contaminating pasture during autumn. There are separate programs for young cattle which are set-stocked and those which are rotationally grazed with sheep.

Set-stocked, autumn born calves should be drenched at weaning (December–January) with a macrocyclic lactone (ML) and then again in March or April. The weaning drench removes the inhibited larvae which survive over summer inside weaners. The second drench removes the worm burden established from the small number of larvae which survive the summer in dung pats. The two drenches significantly reduce *Ostertagia* egg counts, but continuous low level contamination of winter and spring pastures results in a worm build-up by late spring, especially of inhibited larvae. Therefore, a December drench is advisable.

Spring born calves should be drenched at weaning (March– April) and again in July. The July treatment is administered irrespective of the time of weaning.

Where sheep are available to rotate with cattle, drench weaners in January and then move to stubble or a paddock that has been grazed by sheep for the previous six months. Administer a second drench in July and move weaners to a new worm-safe pasture. A final drench is given in December to remove inhibited larvae.

ML drenches are often used for *Ostertagia* control, however oral 'white' (BZ) drenches at one-third the cost can provide effective control.

LIVER FLUKE *(Fasciola hepatica)*

Liver fluke are present in the wetter parts of the region and irrigation areas of the lower Murray. The requirement of the fluke for wet, marshy areas means that its impact will vary between properties and even between paddocks.

Clinical disease is most common in weaned cattle less than three years of age in late autumn and winter. During dry summers, stock pick up fluke as they graze 'flukey' areas such as swamps, springs and creeks in search of green feed. The risk builds until the autumn rains produce fresh green feed and stock cease grazing 'flukey' areas.

Symptoms include reduced weight gain, weight loss, bottlejaw, scouring and sometimes death.

Control

Before any treatment is undertaken the presence of liver fluke on a property should be determined in consultation with a veterinarian.

Denying stock access to fluke habitats by fencing can prevent liver fluke infection. Fluke habitat can also be reduced with drainage, fencing of creeks and soaks and re-vegetation.

Where cattle graze fluke habitats, two drenches are usually required. The first is given in March–May to eliminate fluke picked up during the summer and autumn and should be effective against immature fluke. The second treatment in September is designed to remove adult fluke that can contaminate the pasture in spring. On very high-risk properties a third treatment in December may be required to remove high fluke burdens acquired during the spring. Sheep should also be included in any control program.

LICE

Although lice are common in the region, trials indicate that light infestations of lice do not reduce weight gains but heavy infestations can. Losses may also result from poor appearance at sale and damage to fencing and hides from rubbing.

Seasonal trends

Lice numbers increase from late autumn through to early spring and then decline with increasing temperatures in spring and summer. Heavy infestations are usually seen in cattle in poor body condition. Usually lice are a consequence, not the cause, of poor nutritional conditions.

Control

Lice problems are usually resolved by increasing feed availability and the rise in spring temperatures. Where cattle are suffering or rubbing is resulting in hair loss or skin damage, treatment may be required.

Upon diagnosing an outbreak of lice, producers should look for, and attempt to remedy, the underlying cause of the stress.

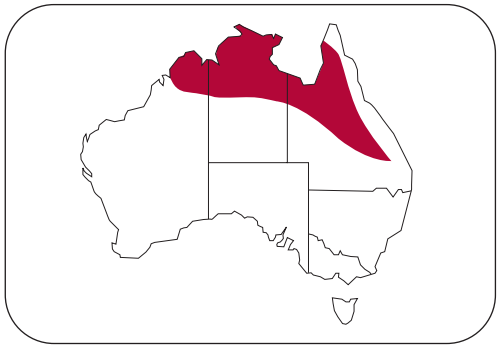
Lice are seldom a problem in herds using ML drenches as part of *Ostertagia* control.

Where lice are an on-going problem a single treatment in late autumn will usually provide effective control.

Many producers are tempted to use an ML drench to control lice. This is costly and can increase the risk of the development of resistant parasites.

Specific lice control products can be more effective than MLs and integrated pest management (IPM) principles indicate it is preferable to use a narrow spectrum or specific treatment for each pest.

Northern Australia



Geography

- Northern area is tropical savannah with a hot, moist climate
- A marked dry season occurs in winter (April–October)
- South of this is a zone of hot grassland with a dry winter
- Annual rainfall ranges from 400–1,400mm

Production system

- Extensive grazing systems with low stocking rates and large properties
- Primarily a breeding area with calves born during spring
- Most cattle are only mustered once at the end of the wet season (April or May) for weaning and sale
- Cattle are mainly *Bos indicus* and their crosses, with most sold to the live feeder market of Asia and Australia

Summary

- *Buffalo fly is widespread but should only be treated when there are at least 200 flies per animal.*
- *In cattle tick areas, cattle with at least five-eighths* Bos indicus *blood should be used to reduce the need for tick treatments.*
- *Vaccinate all cattle against tick fever at three to nine months of age.*
- *Blacks scours* (Coccidiosis) *is common in young cattle around weaning.*

Major parasites

- Buffalo fly *(Haematobia irritans exigua)* in the Darwin, Katherine and Gulf districts of NT and Qld with heaviest infestations in the wet season
- Cattle tick *(Boophilus microplus)* and tick fever *(Anaplasma and Babesia)*
- Black scours *(Coccidiosis)* around weaning time

Other parasites

- Barber's pole worm *(Haemonchus placei)*
- Nodule worm *(Oesophagostomum radiatum)*
- Small intestinal worm *(Cooperia punctata* and *C. pectinata)*
- Biting lice *(Bovicola bovis)* and sucking lice *(Linognathus vituli, Haematopinus eurysternus, Solenopotes capillatus)*

Grazing management

- Vaccinate cattle from southern areas with few or no cattle ticks, prior to moving to tick endemic areas
- Young cattle held in yards or concentrated around watering or feeding points should receive preventative treatment against *Coccidiosis*
- Incidence of roundworms is low and specific grazing strategies are seldom required or practical

Economics

- Vaccination against tick fever in tick affected areas can produce excellent returns
- Cattle which are five-eighths or more *Bos indicus* are largely resistant to cattle tick
- Treatment of cattle with less than 200 buffalo flies per animal is unlikely to be cost effective
- Steers protected from buffalo fly can increase weight gains by 33kg

Calendar for fly, tick and fluke control

Spring calving herds

Time of year	Parasite	Control and treatment		
Onset of wet season	Buffalo fly	Treat only when there are more than 200 flies per animal (100 each side)	Chemical options – Back rubbers are useful in extensive areas and in the wet season where mustering is impossible – Back rubbers will be most effective if begun early in the season	Non-chemical options – Purchase the correct dung beetles and encourage their proliferation to help reduce the breeding environment for flies – Cull hypersensitive animals – Use fly traps where feasible
Wet season	Ticks	Utilise the innate resistance of *Bos indicus* breeds and their crosses – see DPI Notes at http://www.dpi.qld.gov.au/thematiclists/1175.html All cattle should be vaccinated against tick fever between three and nine months of age		
End of wet season (weaning time)	Black scours (*Coccidiosis*)	Consider monensin medicated feed where *Coccidia* are diagnosed as a problem		

CATTLE TICK AND TICK FEVER

Cattle tick is endemic from north-western Queensland to the Northern Territory and west to the Kimberly region of WA.

In endemic areas the innate resistance of *Bos indicus* cattle largely removes the need for routine treatments. Ticks still pose a problem however, because of their ability to spread the tick fever parasites *Babesia* and *Anaplasma*. Cattle with greater than five-eighths *Bos indicus* blood are more resistant to *Babesia* but are still susceptible to *Anaplasma marginale*. If treatments are required a number of options are available.

Ticks are most active from December to June, spending their parasitic stage (about 21 days) on one host. Adult females feed for about a week then drop onto pasture to lay eggs and subsequently die. Larvae can survive in the pasture for up to two months during summer and six to seven months in winter. Egg numbers decline during winter and the wet season.

BLACK SCOURS *(Coccidia)*

Coccidia are microscopic organisms which live in the intestine of young cattle. Severe infection produces profuse dark watery diarrhoea. Infected animals become dehydrated and some may die. Recovered animals often have a long period of low food consumption and poor weight gain. Disease is most common in young cattle around the time of weaning or during prolonged yarding.

Lifecycle

Coccidia have lifecycle stages in cattle and on the pasture. In cattle, *coccidia* breed and multiply in the wall of the small and large intestine. Eggs (oocysts) are excreted in the faeces. They become infective (sporozoites) and after ingestion the sporozoites penetrate the gut wall and the lifecycle is complete.

Signs

- Sudden onset of severe, foul smelling diarrhoea which may be blood-stained – either dark, tarry stain or fresh, red clots – and may also contain shreds of gut lining
- Straining
- Anaemia
- Decreased appetite
- Dehydration and recumbency
- Death

Epidemiology

The parasite lives and proliferates in the lining of the intestines. Almost every animal becomes infected with *coccidia* during their life, usually as a calf or weaner. In most cases the infection passes uneventfully and the animal becomes immune. In some cattle the infection can become overwhelming, particularly when the animal is experiencing some other form of stress, such as weaning, poor nutrition or close confinement.

During weaning or confinement, yards or areas around watering holes become rapidly contaminated with faecal material from infected animals. The parasite then spreads through young, susceptible cattle. The sporozoites are tough and survive for long periods in the soil. If a set of weaning yards become infected producers should consider moving future weaning to new yards.

After infection, cattle develop strong immunity to coccidiosis. A small number of animals may become permanent carriers, shedding small numbers of oocysts in their faeces.

Risk factors

- Young animals (calves and weaners)
- Low body weight at weaning
- Confinement in small areas
- Feed or watering points contaminated with faecal material
- Stress such as weaning, cold weather or poor nutrition

Control

Where early weaning occurs, or weaners are held in yards for more than a week, preventative measures should be used. Coccidiosis can be prevented by feeding a medicated ration or supplement containing monensin. Monensin is included in the diet at the rate of 10–20mg per head per day.

Infected animals should be isolated and overcrowding eased. Electrolytes can be added to the water and water troughs should be raised to prevent faecal contamination.

Once a calf has severe scours, treatment is difficult and consists largely of supportive treatment to correct dehydration. Electrolyte solutions should be administered. Euthanasia should be considered for animals that have become recumbent.

WORMS

There are few roundworms in this region and clinical disease is extremely rare. Despite this, it is not uncommon for producers to drench at weaning, although this is not routinely recommended.

BUFFALO FLY *(Haematobia irritans exigua)*

Buffalo fly is a blood-sucking parasite of cattle in warm, moist areas of northern Australia.

Lifecycle

Adult flies live on the cattle. Adult females lay eggs in cattle dung. Larvae hatch within 24 hours and feed in the dung for 9–40 days as they mature to adulthood. In hot, humid conditions the fly lifecycle takes less than two weeks.

Effect on cattle

Blood sucking by flies causes severe skin irritation. Cattle rub vigorously, disrupting grazing time and damaging the hide. Some cattle are allergic to fly bites and rub excessively, causing severe ulcers.

Studies in Queensland showed steers protected from buffalo fly gained an extra 14% body weight over a 13-month period. In another study cattle protected from flies gained an extra 33kg over a 21-week period.

If buffalo fly is not effectively treated it can cost up to $30 per head in lost production.

Control

Cattle can tolerate small numbers of flies without losing production. Treatment is only required when there are 200 flies per animal or when susceptible animals, such as bulls, show ‘fly worry’.

A range of chemical and non-chemical treatments are available. Prior to the use of chemical options all non-chemical options should be explored.

Non-chemical options

- Cull hypersensitive animals
- Install buffalo fly traps
- Introduce dung beetles to break down dung pats and reduce fly breeding habitat.

Chemical control

A range of chemical options is available (see the ‘Buffalo fly’ factsheet).

Some chemicals adversely affect dung beetles. This can be minimised by the use of insecticidal ear tags, treating only when necessary, avoiding SPs during spring when dung beetles are emerging and using ML pour-ons in autumn and only when control of other parasites is required.

Principles of parasite control

Parasites are a natural part of the ecology in which cattle evolved. Parasites need cattle for their survival, so most successful parasites do not frequently kill their host. In an undisturbed environment there is usually equilibrium between hosts and parasites and the incidence of disease due to parasite infestation is low. It is often the imposition of human management, production requirements or environmental manipulation that alters the equilibrium and enables parasites to flourish.

Successful and sustainable parasite control can only be achieved when the impact of management on the incidence of parasitism is recognised. Parasites are not the sole cause of the problem. Relying simply on chemical control measures may only produce short-term responses and will undoubtedly prove unsustainable.

Integrated parasite management

The equilibrium between parasites and cattle is a complex interaction of many factors. The factors that influence the incidence of parasitism are often linked together in a 'web of causation'. An awareness of these interactions allows producers to modify as many factors as practical, in order to shift the equilibrium towards the cattle. In other fields this is known as integrated pest management (IPM).

The necessity for IPM has often been driven by a need to reduce reliance on chemicals due to the development of resistance in pests. The emergence of chemical resistance is increasingly common in cattle parasites. Producers that adopt an IPM strategy will achieve maximum production even in the absence of chemical resistance.

Planning

A good parasite control program requires planning and managerial skill. It is increasingly recognised that profitability differences between farms are often due to managerial skill rather than to technical knowledge or hard work. The same is true for parasite control and success requires planning. There is probably no greater profit booster than a day in the office planning.

Prevention not cure

The traditional approach to parasite control has been to wait until a problem occurs before treating stock. By the time symptoms or 'clinical' disease are seen in a few animals, substantial production losses may already have occurred in many more animals within the herd. These invisible losses are referred to as 'sub-clinical' and include reductions in weight gain, lowered fertility and reduced milk yields. In many cases sub-clinical disease can occur in the absence of clinically affected animals. As sub-clinical disease usually affects many animals, losses are often greater than those resulting from clinically affected animals. In order to avoid sub-clinical disease a preventative approach is required.

Chemicals are only one string in the bow

Cost effective and sustainable parasite management involves much more than simply applying chemicals at the correct time. Relying on chemicals is expensive, intensifies selection pressure for the development of parasite resistance and increases the quantity of chemicals in the environment. Whenever a chemical treatment is applied, effort should be made to simultaneously utilise other parasite control techniques such as 'worm-safe' pasture.

Protect the susceptible

Within a herd, the susceptibility of each age group and sex of cattle to parasites is not equal. An understanding of the susceptibility of each class enables efforts to be directed towards the prevention of problems in high-risk groups.

Young

When a parasite attacks its host, the immune system of the animal senses the presence of the parasite and mounts a protective response. This response involves antibody proteins and white blood cells that attack the parasite. The effectiveness of the immune response at eliminating the parasite develops and strengthens with age. Young cattle are more susceptible than adults to most parasites. Cattle under two years of age should be given special attention in parasite prevention programs.

Stressed

The ability of cattle to handle parasites also depends on their state of health. If they are in sub-optimal health the immune response is less effective. The most common stress, which increases cattle's susceptibility to parasites, is poor nutrition during unfavourable seasonal conditions. Cattle on a low plane of nutrition should be monitored carefully for parasites. Other stresses that increase susceptibility include calving and lactation, weaning, droving or trucking, a new environment, mixing of mobs and cold weather.

Naive

An animal's immune response is unique to every parasite. If cattle are moved to a new environment that contains a parasite to which they have not been exposed, they will be susceptible until their immune system has responded. This can take several months. Until this occurs cattle are particularly vulnerable to parasites and careful monitoring is required.

Breeds

There are few differences between breeds of cattle in their susceptibility to parasites. There are however marked differences in the ability of some breeds to handle cattle tick. The *Bos indicus* breeds (eg Brahman) are less susceptible to cattle tick than the *Bos taurus* breeds (eg Angus, Hereford, Shorthorn). The use of *Bos indicus* breeds in tick endemic areas has dramatically reduced the need for tick treatments. The same applies to tick fevers although *Bos indicus* are susceptible to *Anaplasma*.

Preventing parasite challenge

Mounting an immune response to parasites is a biological effort for cattle. The proteins and cells required to fight parasites must be diverted away from other body functions such as growth and fattening. Maximum production will be achieved when parasite challenge is reduced. Even when their immune response is strong and effective, cattle with no parasite challenge will grow faster.

Decreasing the exposure of cattle to parasite larvae can reduce parasite challenge. This can be achieved by paddock rotation and provision of paddocks with low parasite levels, eg 'worm-safe' and 'tick-safe' paddocks.

Chemical resistance management

As long as chemicals are used to control parasites there is the potential to select for resistance in the target organism. The most severe problems are seen in ticks and buffalo fly. No resistance has been confirmed in worms in cattle although it probably exists to some extent based on experience in New Zealand. Resistance can probably be delayed by reducing the frequency of chemical applications and ensuring the correct dose is administered by strict adherence to manufacturers' instructions.

Buffalo fly

Buffalo fly *(Haematobia irritans exigua)* is a small blood-sucking parasite of cattle found in warm, moist areas of northern Australia (See Figure 1).

Buffalo fly was rated by cattle producers, in a 1990 Queensland survey, as the most important animal health issue affecting beef cattle profitability. Producers currently spend $4–6 million annually on chemical control of buffalo fly and the total cost of the pest to the cattle industry is estimated to be $20–30 million each year.

Lifecycle

Adult flies live on cattle and feed 10–40 times a day. Adult females lay eggs in cattle dung. Larvae hatch within 24 hours and feed in the dung for 9–40 days as they mature to adulthood. In hot, humid conditions the whole fly lifecycle may take less than two weeks (See Figure 2).

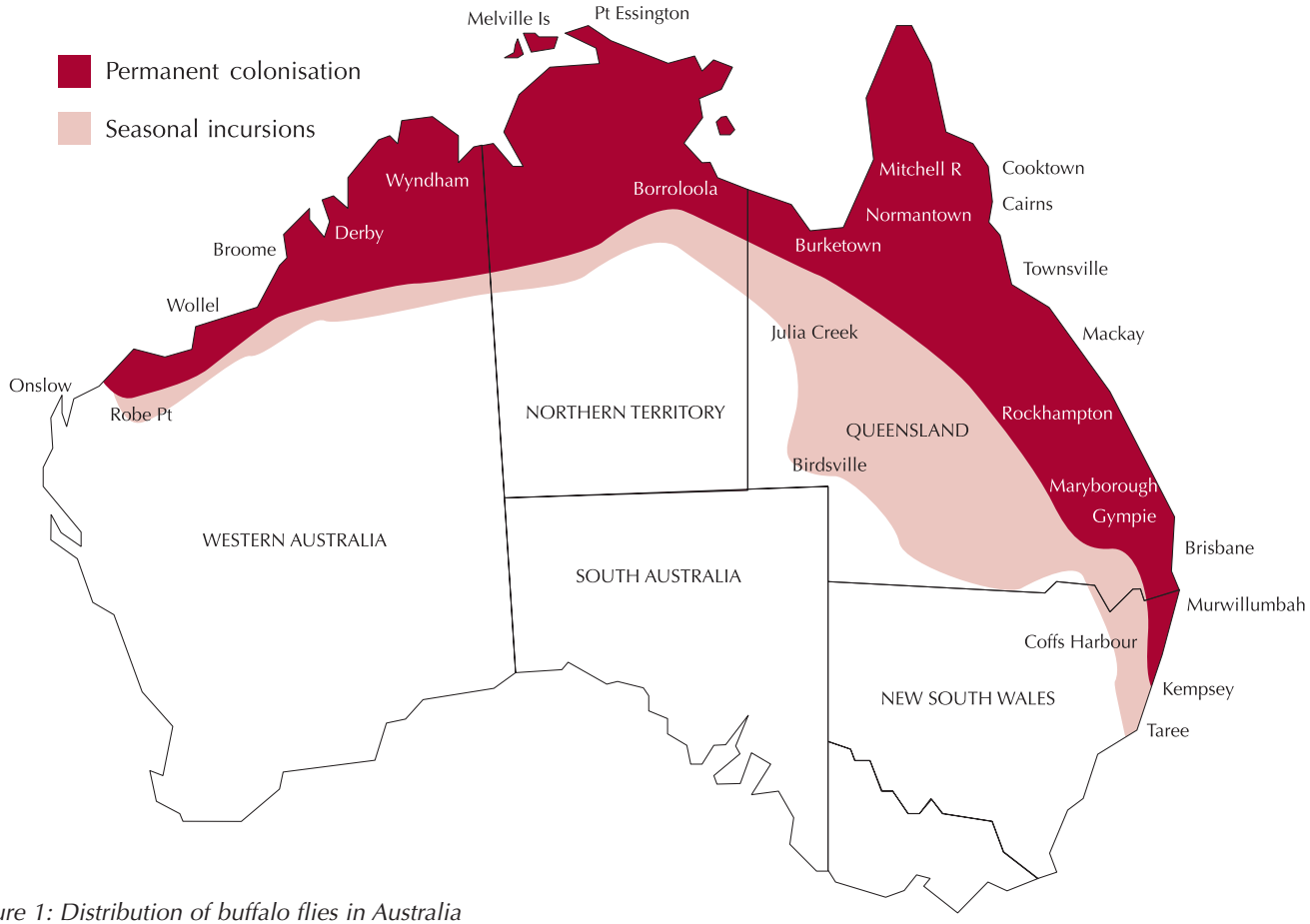


Figure 1: Distribution of buffalo flies in Australia

Effect on cattle

Blood sucking by flies results in severe skin irritation, causing cattle to rub vigorously, which disrupts grazing and damages hides. Some cattle are allergic to buffalo fly bites and rub excessively causing severe ulcers. Bulls, older cattle and those in poor condition usually carry the heaviest fly burdens. Dark-coated cattle attract more flies.

Studies in Queensland show steers protected from buffalo fly may gain an extra 14% in body weight over a 13-month period. In another study, cattle protected from flies gained an extra 33kg over a 21-week period.

Where buffalo fly is not effectively treated it may cost producers up to $30 per head in lost production.

Control of buffalo fly

The presence of buffalo fly should not mean treatment is immediately instituted. Cattle can tolerate small numbers of flies without losing production. Treatment is required when there are more than 200 flies per animal (100 on each side) or when susceptible animals such as bulls show 'fly worry'.

There are a range of treatments avaliable for the control and prevention of buffalo fly. However, prior to the use of chemicals, all the non-chemical options should be explored.

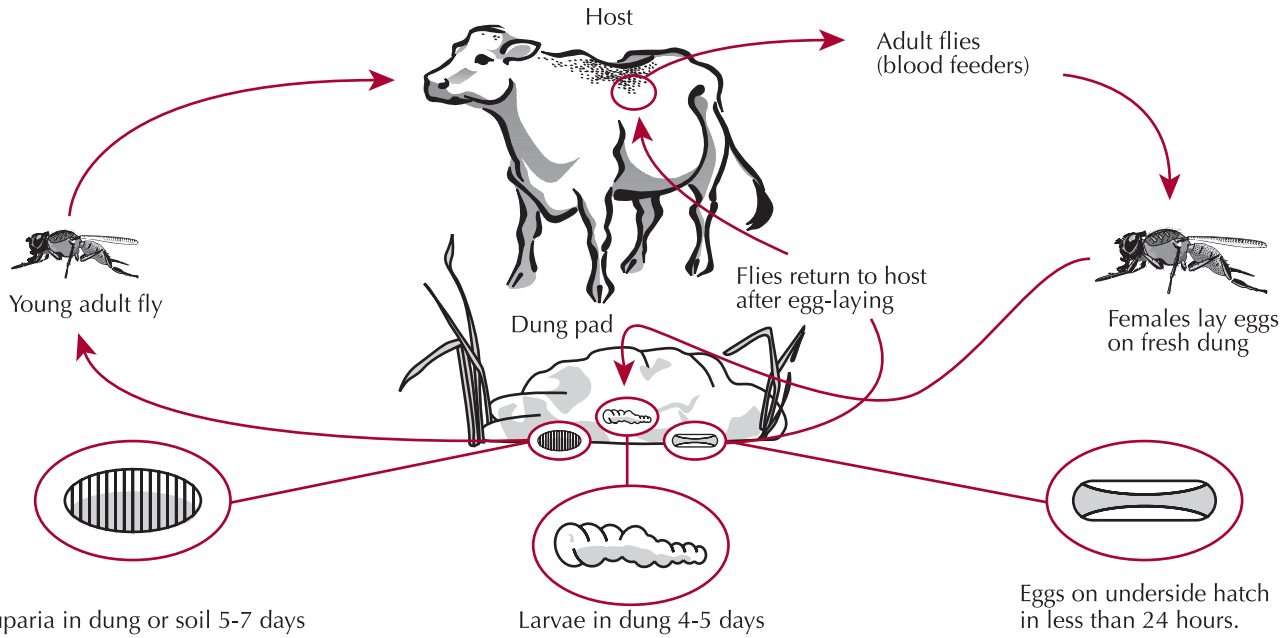


Figure 2: Lifecycle of the buffalo fly

Non-chemical options

Cull allergic animals

A small number of cattle become allergic to fly saliva and react excessively. These cattle show irritation and skin sores even when fly numbers are low. These 'hypersensitive' animals will never return to normal and should be culled.

Buffalo fly traps

Two types of buffalo fly trap are available. The tunnel trap is a short darkened tunnel through which cattle pass regularly. Due to changes in the light level on entering the tunnel, flies leave the cattle and are caught in cages attached to the tunnel sides. The trap is simple to build and can reduce fly numbers on cattle by up to 75%.

The cost of purchasing a tunnel trap varies from $1,000 to $1,500 depending on materials. This can be reduced if built on-farm. Savings in labour and chemical expenses should make the trap economically worthwhile over a five-year lifespan, especially for herds greater than 50 head. For more information and designs see the Queensland Department of Primary Industries website, www.dpi.qld.gov.au/beef/11925.html

The buffalo fly brush trap consists of a clear plastic tent. Flies are brushed off as cattle move through the tent, becoming trapped inside a solar heated dome where they quickly die of dehydration. These traps can remove up to 90% of flies each time cattle pass through. Provided cattle walk through the trap every second day, sufficient fly control is often achieved without the need for insecticides.

Brush traps cost around $3,800 to install. They are available through rural merchandising stores or from Range Motor Trimming on (07) 5499 9066.

Dung beetles

Dung beetles break down dung pats and reduce the breeding habitat for buffalo flies. Dung beetles are climate specific and different species are required in different climatic regions. In many areas the appropriate species may not be present. Where this is the case they should be introduced. Dung beetles can be purchased from John Feehan on (02) 6248 0376.

Some chemical treatments used on cattle adversely affect the dung beetle population. The impact can be minimised by:

- Using methods of fly control which do not affect beetles, eg insecticidal ear tags;
- Reducing chemical usage by treating only when necessary;
- Avoiding the use of synthetic pyrethroids during spring when beetles emerge from their pupae; and
- Only using macrocyclic lactone (ML) pour-ons to treat buffalo fly when simultaneous control of other parasites is required.

Buffalo fly (cont...)

Spring	Summer	Autumn	Winter
BACK RUBBERS or DUST BAGS or FLY TRAPS			
OP SPRAY (if flies are a problem early in the season)	EAR TAGS for 10 or 16 weeks when fly numbers exceed acceptable levels (Use OP tags for 2 years – then a SP tag for 1 year)	OP or SP SPRAY* or ML POUR-ON (if flies remain a problem after tag removal) * Use OP spray after SP tags or SP spray after OP tags	

Table 1: Chemical control options

Chemical control

A suggested program for the use of chemical treatments is shown in Table 1. A range of chemical options is available to assist in the control of buffalo flies (see Table 2).

In extensive areas the only chemical treatments that will be practical are self-administered or have long periods of activity. The chemical treatments meeting these criteria are ear tags, rubbers and dust bags.

Ear tags

Ear tags slowly release organophosphate (OP) or synthetic pyrethroid (SP) insecticides for a period of 10–16 weeks. Cattle grooming and interaction deposits chemical onto the shoulders, back and flanks of tagged animals. All cattle in a herd should be tagged and the tags must be removed at around 10–16 weeks depending on the manufacturer's recommendations.

Sprays

OP and SP chemicals are also available as backline or full body sprays. Cattle should be treated in a race rather than a holding yard to ensure correct application. Incorrect application increases the risk of flies developing resistance to the chemical. The period of protection from sprays is relatively short. A single spray (eg at weaning) will only have a temporary effect and is unlikely to improve overall fly control. Spray misting over a yard is not effective.

Pour-ons

OP, SP and ML chemicals are all available in pour-on formulations for the control of buffalo fly. Pour-ons are an expensive treatment if used for fly control alone. ML products also control worms, ticks and lice. Unless control of these parasites is required simultaneously, use of MLs for buffalo fly control should be avoided.

Plunge dips

The use of plunge dips for fly control is now declining.

Back rubbers, side rubbers and rubbing posts

Rubbers consist of absorbent material soaked in a mixture of oil and insecticide fed from a reservoir. As cattle rub against them to relieve irritation, the flies are dislodged. Flies returning to the cattle are killed as they come into contact with the oil and insecticide. Cattle quickly learn the relief provided by using rubbers.

Rubbers should be placed in areas where cattle congregate such as watering points, camps or supplementary feeding points.

Dust bags

Dust bags contain carbamate insecticide and rely on the regular passage of cattle under the bag. Bags are placed at cattle gathering points such as gateways, watering points, camps or under shade trees. Cattle learn that rubbing against the bag reduces fly numbers. Fly control may not be apparent for 1–2 weeks after cattle learn to use the bags, as it is not until this time that effective concentrations of insecticide accumulate on the coat.

CHEMICAL GROUP	PRODUCT NAME	MEAT WITHHOLDING PERIOD (DAYS)	EXPORT SLAUGHTER INTERVAL (DAYS)	INSECTICIDAL ACTIVITY IN DUNG
SP (SYNTHETIC PYRETHROID)				
Ear tags#	Python	0	0	Probably not
Sprays	Cypafly+	3	3*	Yes
	Sumifly	0	0	Yes
	Supershield (contains natural pyrethrins)	0	Not determined	No information
Pour-ons	Coopafly	0	21	Yes
	Demize	14	28	No information
	Easy Dose	0	21	Yes
	Arrest	0	21	Yes
	Y-Tex Brute	7	Not determined	No information
OP (ORGANOPHOSPHATE)				
Ear tags#	Optimizer	0	0	Probably not
	Spike	0	0	Probably not
	Warrior	0	0	Probably not
	Patriot	0	0	Probably not
Sprays	Nucidol 200 EC	3	3	No information
	Supona BF+	0	0	No information
	Di-Jet	3	3	No information
Back rubbers	Di-Jet	3	10	No information
	Nucidol 200 EC	3	10	No information
	Supona BF+	0	10	No information
SP/OP COMBINATIONS				
Sprays	Barricade S+	8	21	Yes
	Blockade S Dip & Spray+	8	21	Yes
	Tixafly+	0	21	Yes
ML (MACROCYCLIC LACTONE)				
Pour-ons	Baymec Pour-on+	42	42	Yes
	Dectomax Pour-on+	42	42	Yes
	Eprinex Pour-on	0	0	Yes
	Ivomec Pour-on+	42	42	Yes
	Paramax Pour-on	28	42	Yes
	Virbamec Pour-on	35	42	Yes
	Virbamec LV Pour-on	42	42	Yes
	Genesis Pour-on	21	21	Yes
	Dairymec Pour-on	42	42	Yes
	Beefmec Pour-on	42	42	Yes
	Virbamax Pour-on	42	42	Yes
	Ecomectin Pour-on+	42	Not determined	Yes
	Noromectin Pour-on	42	Not determined	Yes
	Paramectin Pour-on	35	42	Yes
	Imax CD Pour-on	21	Not determined	Yes
CARBAMATE				
Dust bags	Ficam Gold	0	0	No information

Adapted from Wardhaugh KG (CSIRO Contracted Report No.56). The significance on dung beetle populations of chemical residues in manure varies, depending on the time and frequency of treatment and the percentage of the herd treated. For a comprehensive list of the latest treatments, go to www.apvma.gov.au

 # Remove ear tags before slaughter to prevent possible contamination.
+ Do not use in lactating dairy cows.
** The ESI is based on the correct re-treatment interval being applied.*

Table 2: Chemical treatments

Liver fluke

Effective drenching and controlled grazing can reduce the risk of liver fluke *(Fasciola hepatica)* in livestock. Over six million Australian cattle graze pastures at risk of fluke infection and fluke treatments cost producers $10 million annually.

Liver fluke can infect cattle, sheep, horses, pigs, goats, native grazing animals such as kangaroos and wombats and introduced species such as rabbits. Even humans can be infected when eating unwashed watercress from fluke-infected areas.

The lifecycle

The adult fluke is about 30–40mm in size and lives in the bile ducts of the liver where they can survive for many years. Adult female flukes can produce up to 50,000 eggs per day. The eggs pass in the bile into the intestinal tract and then in the faeces onto pasture. Eggs hatch if the temperature is more than 10°C and there is sufficient moisture. In summer, fluke eggs hatch within about 21 days, while in spring and autumn they may take up to 90 days.

Following hatching, a *miracidium* emerges from the egg. This stage in the fluke lifecycle must locate a host snail in a moist environment within three hours before it runs out of energy and dies. The miracidium bores into the host snail and undergoes several developmental stages before emerging as a *cercaria*. Up to 600 cercaria can emerge from a single snail infected by one miracidium. On pasture, cercaria form cysts and become the infective stage called *metacercaria*. These cysts are very hardy and can survive for months and even years on the pasture. When grazing livestock ingest metacercaria, they break open in the intestinal tract to release immature fluke, which burrow through the intestinal wall and migrate to the liver. These young fluke are only 1–2 mm long but can cause considerable damage as they burrow through the liver tissue. After 8–10 weeks adult fluke enter the bile ducts and begin their egg laying.

The snail

The most important host snail for the liver fluke is *Pseudosuccinea (Lymnaea) tomentosa*. This snail can be identified by the characteristic direction of the twist in the shell. The snail is hardy and can survive long, dry periods by burying itself in mud. The ideal snail habitats include slow moving shallow watercourses, wet marshy areas and around springs, irrigation channels and seeps. These types of area are common where annual rainfall is more than 600mm or under irrigation. The snails are prolific breeders and one snail can produce 3,000 eggs a month. They can complete their life cycle in as little as one month.

Prevalence

Liver fluke is present in all states but most at-risk stock are present in south-eastern Australia where there is a suitable habitat for the host snails. These include the tablelands, coastal margins and irrigation areas of NSW and Victoria.

Liver fluke are not present on all properties. An accurate way to determine if liver fluke are present is to take blood samples from adult animals born on the property that have grazed at-risk areas. Faecal samples are less reliable. On dairy farms milk can be tested to check for the parasite.

The disease

Liver fluke produce both acute (sudden onset) and chronic (long-term) disease. The acute disease occurs when large numbers of immature fluke migrate through the liver and is usually seen in autumn. As the fluke burrow through the liver tissue they cause hemorrhage and damage to the liver structure, resulting in illness and death. Acute disease is often seen in sheep.

Chronic disease is the most common form seen in cattle and the main effects are low weight gain in young cattle, decreased milk production and condemnation of infected livers at slaughter. Cattle with heavy infections have pale mucous membranes (lips, eyelids) and some develop swelling under the jaw (sub-mandibular oedema or 'bottle jaw'). These signs are mostly seen in late autumn, winter and spring.

Research has shown that liver fluke can reduce cattle weight gains by 0.7–1.2kg per week depending on the size of the fluke burden. Animals suffering from reduced weight gain will not catch up to other cattle unless treated. The effect of liver fluke on performance is more severe during periods of low nutrition.

Liver fluke - 'bottle jaw' in long-standing infection

Control

The parasite has two stages:

1. The pasture phase
2. The host stage in sheep and cattle

Successful fluke management requires control of both stages.

Host stage

Control of fluke within cattle requires the use of chemical drenches. The timing and frequency of drenching will vary between locations and seasons. In most situations, two drenches in May–June and September will provide adequate control. On properties with a severe fluke risk, a third drench during December–February may be needed.

Producers can reduce the number of fluke-infected cattle by:

- Fencing 'flukey' areas;
- Grazing a single mob on at-risk pastures to reduce the number of animals exposed to the parasite; and
- Treating cattle 6–8 weeks after introduction to at-risk areas to ensure the fluke lifecycle is not completed.

Pasture phase

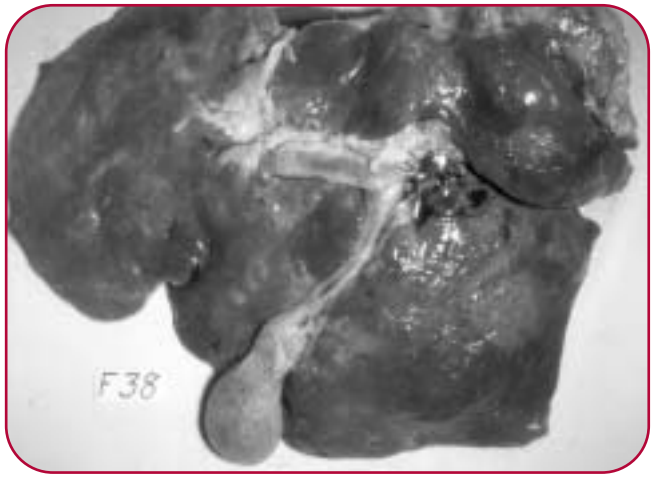
Any method that reduces the number of host snails or prevents stock from grazing in fluke habitats will aid in control. Theoretically snails could be poisoned, but killing all snails is virtually impossible and the environmental consequence of using a molluscicide is unacceptable.

Strategies that can be used to reduce the habitat of the fluke snail include fencing off areas that contain the snail and providing alternate water supplies such as troughs.

Fluke drenches

Fluke drenches vary in the stage of the fluke lifecycle that they control. The three most widely used drenches contain triclabendazole, nitroxynil or clorsulon, however only triclabendazole will kill all stages of the liver fluke. Triclabendazole should be used whenever immature fluke are present (all times of the year except late winter and early spring). Most fluke programs recommend a drench in late winter/early spring. At this time only adult fluke will be present and it is advisable to use a chemical other than triclabendazole at this time to reduce selection pressure on the parasites for resistance to this drug.

Unaffected producers should be vigilant in keeping their land free of fluke, as there is a native snail that can provide a suitable host on many properties. Introduced cattle should be treated with a triclabendazole drench on arrival.



Subacute liver fluke infection showing enlarged bile ducts, distended gall bladder and discoloured and uneven surface of the liver

Severe and long-standing liver fluke infection with very little normal liver remaining

Lice

Lice are one of the most commonly treated parasites of cattle in Australia. However, the direct impact of lice on cattle weight gains is limited. Lice are 'opportunistic' and heavy infestations usually occur in cattle already stressed from poor seasonal conditions. In many cases treatment is not necessary and the lice will resolve naturally as seasonal conditions improve.

Diagnosing lice

Cattle lice are small, wingless insects, 2–5 mm in length and white to grey and bluish-black in colour. The first sign of lice usually noticed by producers is the rubbing of cattle against posts and trees. Rubbing results in hair loss, particularly on the sides of the neck and at the base of the tail.

When the longer hair around the head, neck and tail is parted, lice can be seen moving away from the light. Treatment is recommended when more than two lice per square centimetre are present. It is not important to identify the lice species present, as lice control chemicals are usually effective against all species.

Lifecycle

The entire lice lifecycle occurs on the cattle and lice will die within a week when dislodged from an animal. Adult females lay eggs that are 'glued' to the hair shafts. These eggs hatch and the resulting nymphs pass through three intermediate or nymphal stages (moults) to become adults. The complete cycle from egg laying to maturity takes between three and six weeks. Biting lice reproduce more rapidly than sucking lice.

Types of lice

The four most important lice species that occur on cattle are the biting louse *(Bovicola bovis)*, the short-nosed sucking louse *(Haematopinus eurysternus)* and the long-nosed sucking louse *(Linognathus vituli)* and the small blue sucking louse *(Solenopotes capillatus)*.

Sucking lice cause more discomfort to the cattle. They feed by piercing the skin with their mouthparts and sucking blood from capillaries and blood serum that exudes from the damaged skin surface. Biting lice feed on debris on the skin surface. Feeding irritates the skin and cattle attempt to relieve the itchiness by rubbing. Rubbing causes hair loss, scaly skin and raw areas.

Seasonal trends

Heaviest lice infestations are seen in winter through to early spring. During this period cooler temperatures and thicker hair coats on cattle provide a more suitable environment for lice. Hot temperatures during summer reduce lice populations to low levels.

Cattle in poor condition and on low-quality feed are more likely to have larger lice burdens and the lice are likely to persist for longer periods. Healthy cattle appear to develop some resistance, which controls lice burdens. Excessive lice infestations could indicate underlying stress, requiring further investigation.

Spread

Spread of lice between cattle requires close contact. Cattle lice are specific to cattle and lice transfer by other species such as sheep or goats is extremely unlikely. Lice are present in many cattle herds but numbers are naturally kept in check by the immune system of the cattle, seasonal changes in temperature and chemical applications.

Introduced cattle are often blamed for lice outbreaks. Typically, the outbreak is due to a rise in numbers of an already present lice population. If one or two lousy cattle are introduced it will more than likely be several years until a widespread herd infestation is noticed.

In herds where lice are not present, treatment and confinement of introduced stock is advisable. Three weeks quarantine with two treatments 14–16 days apart will ensure lice are not introduced to the herd.

Economics

Lice infestations can contribute to low weight gains or loss of condition in stressed cattle on low levels of nutrition, especially during the winter.

Under conditions of adequate nutrition, lice have little or no effect on weight gain. This was demonstrated in Victorian trials in young cattle infected with sucking lice and in New Zealand trials where mixed infections of biting and sucking lice had no effect on the growth rate of cattle aged between two and twelve months.

Although weight gains are seldom affected, the indirect effects of rubbing are more likely to have an economic impact. Areas of hair loss and scruffy appearance may reduce sale price. Damage to the hide can also de-value leather. The other indirect cost is damage to fences, posts, yards and trees due to rubbing.

Treatment

On some properties, routine treatment for lice may not be warranted.

Treatment may be required where an impending sale requires improved coat condition or when cattle rubbing damages farm infrastructure. Cattle experiencing serious discomfort as a result of lice must be treated to ensure animal welfare standards are maintained. Cattle with heavy infestations of sucking lice should be treated to avoid anaemia.

The common situation where lice numbers increase during late winter and early spring does not require treatment unless any of the criteria above become apparent. Improving nutrition and warmer weather in spring will usually result in a natural resolution of the infestation. As infestations usually occur during times when cattle are stressed, the underlying cause of the stress should be treated where possible. More often than not the stress will be poor nutrition.

In herds with on-going lice problems, a single chemical treatment in late autumn or early winter should achieve adequate control. As lice spread through close physical contact, treatment of the entire herd is essential.

A range of chemicals is available for the treatment of lice. Pour-on formulations dominate the market. The chemical classes include organophosphates, synthetic pyrethroids, insect growth regulators and macrocyclic lactones.

The concentration of pour-on insecticides at sites remote from the backline of cattle may be insufficient to kill all lice. Where heavy infestations are treated, two applications 14–16 days apart should be given.

The widespread use of macrocyclic lactone (ML) pour-on products has greatly reduced the incidence of lice infestation. Although the principal purpose of these products is control of roundworms, they are also effective against lice. In most regions the use of MLs in roundworm control programs will usually keep lice infestation under control.

Where lice are an on-going problem and MLs are not frequently used, a single autumn treatment with any of the lice-specific products should be sufficient to achieve satisfactory control. Lice control products are as effective as ML pour-ons in controlling lice and may be considerably cheaper.

Many producers are tempted to use an ML product to control lice due to the additional control of a wide range of cattle parasites achieved by these chemicals. However, if the treatment of other parasites is not specifically indicated, the 'just-in-case' use of chemicals is not warranted and expensive.

Black scours *(coccidia)*

Coccidiosis is a disease caused by a microscopic protozoal organism *(Eimeria)* that lives in the small and large intestine of young cattle. Coccidiosis is most common in calves three weeks to six months of age. It occurs in all areas of Australia but is more common in warm, wet areas. The most damaging coccidia organisms in cattle are *Eimeria zuernii and Eimeria bovis*.

Severe infection produces profuse, dark, watery diarrhoea, resulting in dirty tails and hindquarters. Infected animals dehydrate and some become recumbent and may die. Recovered animals often have a long period of low food consumption and poor weight gain.

Lifecycle

The lifecycle of coccidia is complex with asexual and sexual stages within cattle and an asexual stage on the pasture. In cattle the protozoa breed and multiply in the wall of the small and large intestine. The sexual stage within cattle produces *oocysts* that are passed in the faeces. Oocysts are non-infective to a new cattle host until they 'sporulate' or divide into infective organisms known as *sporozoites*. Upon ingestion, sporozoites penetrate the gut wall and complete the lifecycle.

Disease (coccidiosis)

Multiplication and development of *Eimeria* in the intestinal wall damages the lining of the gut. The intestinal wall becomes swollen and sections of gut lining fall off, leading to bleeding. The first sign of the disease is a profuse, watery diarrhoea that contains blood, clots and shreds of intestinal lining. Faeces often cover the hind legs and the tail. Affected animals become depressed, dehydrated and weak.

Signs

- Sudden onset of severe, foul-smelling diarrhoea which may be blood-stained – either a dark, tarry stain or fresh, red clots – and may contain shreds of gut lining
- Straining
- Anaemia and dehydration
- Decreased appetite
- Usually seen in weaners less than 250kg
- Inability to rise
- Death

Prevalence

Eimeria are most common in beef calves grazing in the wet tropical and subtropical environments of eastern Queensland and the north coast of NSW. They can also be found in the higher rainfall areas of coastal and tableland NSW, southern Victoria, south-eastern South Australia and south-western Western Australia.

In tropical and subtropical areas, coccidiosis is most commonly seen at weaning, whereas in temperate regions younger calves are usually affected.

Epidemiology

The parasite lives and multiplies in the lining of the intestines. Almost every animal becomes infected with *Eimeria* during their lifetime, usually as a calf or weaner. In most cases the infection passes uneventfully and the animal becomes immune. In some animals the infection can be overwhelming, usually when the animal is experiencing some form of stress such as weaning, poor nutrition, close confinement, transportation or the sudden onset of cold, wet weather.

Following infection cattle develop strong immunity to coccidiosis. A small number of recovered cattle become permanent carriers. These animals shed small numbers of oocysts, which serve as an on-going source of infection for the next generation of calves.

During weaning or confinement, oocysts shed in the faeces of some calves contaminate yards or areas around watering holes. As a result of high stocking rates in cattle yards the concentration of oocysts is higher than normally occurs in the paddock. The combination of a heavily contaminated environment and stressed calves can result in outbreaks. The parasite then spreads rapidly through the young susceptible animals.

Oocysts passed in faeces are tough and survive for long periods in the soil. If a set of weaning yards becomes infected producers should consider moving future weaning to new yards.

Prevention

Eimeria cause few problems in unstressed grazing cattle. It is the management imposed upon cattle that brings together risk factors for the disease. In most cases coccidiosis can be prevented by reducing faecal contamination of the environment and minimising stress. Risk factors should be minimised where possible and in some cases preventative drugs may be required.

Risk factors for coccidiosis

- Young animals (calves and weaners)
- Low body weights at weaning
- Confinement to small areas
- Feed or watering points contaminated with faeces
- Stress such as weaning, cold weather or poor nutrition

Properties in tropical and subtropical areas that have experienced coccidiosis problems, should consider feeding a ration or supplement medicated with an anti-coccidial drug (a *coccidiostat)* when weaners are held in yards or confined to damp areas for more than a week.

In temperate areas, precautionary coccidiostats are not routinely required and avoidance of overcrowding of young calves in damp areas will usually be sufficient to prevent the disease.

Treatment

Calves affected with coccidiosis shed large numbers of oocysts in their faeces. These sporulate on the pasture and contaminate the area for several months. By the time a diagnosis of coccidiosis is made the environment is heavily contaminated. Unaffected calves should be moved to a fresh environment and consideration given to the provision of coccidiostats in the ration or supplement.

All calves with diarrhoea should be isolated in an area where contamination can be managed and treated. Contaminated paddocks should be grazed by adult cattle or sheep for the next couple of months.

The principle reason for death from coccidiosis is dehydration. The first priority when treating sick calves is to restore fluids lost in diarrhoea, and oral electrolyte solutions should be administered. Most calves will have lost around 10% of their body weight in fluid by the time treatment is required. Large quantities of fluids may be needed to replace the initial and ongoing losses resulting from the diarrhoea. For example, a 50kg calf will need five litres of fluids to replace its initial fluid deficit, plus two litres a day to maintain normal requirements and an extra two litres a day to replace ongoing fluid loss in diarrhoea. During the first day the calf could require up to nine litres of fluid. No more than two litres of fluid should be administered at a time, with the dose repeated at two-hourly intervals.

Treatment may be required for three to four days.

Most calves respond to fluid therapy alone. Anti-protozoal drugs can be prescribed by a veterinarian. Given alone without fluid replacement, these drugs have limited impact.

Attention should be given to the environment of sick and unaffected animals. Crowding should be eased. This should include removal of hay racks and rollers that encourage close contact. Drinking troughs should be raised to reduce the risk of faecal contamination.

Hereford calf suffering acute coccidiosis
Dr Keith H Walker, NSW Department of Primary Industries

Cattle tick

The Australian cattle tick (*Boophilus microplus)* is a parasite of cattle, particularly European breeds. Although called the cattle tick, other hosts include horses, sheep, deer, buffalo and goats. Cattle ticks impact around one third of all Australian cattle and can be a severe limitation to cattle production in infested areas. It is estimated that ticks cost the Australian cattle industry in excess of $150 million annually.

The cattle tick has a significant secondary impact by spreading tick fever. Cattle tick is the only natural mechanism for the spread of the blood parasites *(Anaplasma marginale, Babesia bovis and Babesia bigemina)* that cause this disease. Tick fever is a significant cause of lost production and death in cattle in areas where ticks are present.

Prevalence

Cattle tick is a regulated parasite and control programs monitor and enforce the status of tick free areas. In the tick infected areas eradication is considered impossible or cost prohibitive and within these 'endemic' areas producers undertake the management of ticks on an individual basis.

Endemic areas include the northern regions of Queensland, the Northern Territory and Western Australia. In Queensland, cattle tick occurs in all the eastern, tropical and subtropical, coastal regions and in parts of the drier areas to the west of the Great Dividing Range. In endemic areas the highest number of ticks occurs in late spring and early summer.

Sporadic occurrences do occur in tick free areas and management and eradication on infected properties is prescribed and regulated by the appropriate statutory authority.

Lifecycle

The lifecycle of the cattle tick comprises a free-living, non-parasitic stage on the pasture and a parasitic stage on the host.

Once an adult female tick feeding on cattle has engorged on blood and been fertilised by a male tick, she drops onto the pasture and moves to a shaded area. If the temperature is above 15°C the female produces between 2,000 and 5,000 eggs in the seven days before she dies. If temperatures are greater than 21°C and humidity higher than 70°C eggs hatch in as little as 14 days. At temperatures between 15°C and 20°C hatching may take up to four months. Hatching ceases below 15°C.

The resultant larvae or 'seed ticks' climb grasses, tree stumps and posts and wait for a passing host to brush past. Seed ticks can survive for up to four months in winter waiting for a host, but only for three weeks in hot, summer weather.

On cattle, seed ticks pierce the skin and suck on white blood cells. In 4–13 days they shed their skin and a nymph emerges. These nymphs undergo a further moult to become an adult tick around 14–15 days after the seed tick attached to the host. The female tick feeds for 19–36 days before dropping to the ground.

Under ideal conditions the shortest inter-generation interval is 6 weeks, more typically 9 weeks, and 15 weeks in cool weather.

Symptoms

Heavy tick infestations result in anaemia, licking and rubbing at bite sites (tick worry), tick sores, ulceration, lack of energy, rapid weight loss and death. Ticks can also transmit tick fevers.

On close examination ticks can be seen, particularly on the neck, brisket and flank and between the hind legs.

Each engorged female adult tick feeding on a cow can reduce milk yield by 9mL and weight gain by 0.6g per day.

Diagnosis

Diagnosis of cattle tick is achieved by observing and correctly identifying the ticks on cattle. Identification is easiest for semi-engorged females about 5–7mm in length. Cattle ticks must be differentiated from the two other ticks commonly found on cattle – the bush tick *(Haemaphysalis spp.)* and the paralysis tick *(Ixodes holocyclus)*.

The distinguishing features of the cattle tick are pale whitish legs, short mouthparts and the presence of eyes. The bush tick has brown legs and no eyes and the paralysis tick has long mouthparts and no eyes.

Treatment and control

Integrated control of ticks combines the use of tick resistant cattle, chemical treatments, tick vaccines and tick-safe pasture.

In endemic areas the mere presence of ticks should not be the trigger to treat with chemicals. Cattle can tolerate low burdens of ticks without losing production. Treatment is recommended when there are more than 30 ticks on one side of an animal.

Resistant cattle

Zebu *(Bos indicus)* cattle and their crosses usually have lower tick burdens and require fewer treatments than European and British breeds of cattle *(Bos taurus)*. In most of the endemic areas the use of *Bos indicus* breeds has removed the need for routine tick treatments.

First-crosses between *Bos indicus* and *Bos taurus* have an intermediate level of tick resistance. The more *Bos indicus* within a breed or cross, the greater the resistance.

There can be large differences in tick susceptibility between individual cattle within a breed. Breeding for increased tick resistance can produce improvements in any breed.

Chemical treatments

A range of chemical treatments is available. Products may contain active ingredients from a range of drug classes including synthetic pyrethroids, insect growth regulators, organophosphates, amidines and macrocyclic lactones.

Chemical treatments should be used in combination with tick-safe pasture and monitoring of tick burdens.

Plunge dipping is inexpensive and has the advantage of killing ticks almost instantly. However it is labour intensive and there is a high risk of chemical exposure to the operator. The use of plunge dips has declined since pour-on treatments became available.

A range of pour-on products is available. They are easy to apply.

Resistance to chemicals

The cattle tick has developed resistance to all the chemical groups used to control it with the exception of the macrocyclic lactones and insect growth regulations. The extent of resistance depends on the extent to which the chemical has been used either on that farm or within contact of those cattle. Resistance to a chemical group should be suspected when less than 97% of ticks on treated cattle die. To ensure chemicals remain effective for as long as possible producers should adopt the following procedures:

- Treat cattle only when necessary (when tick counts exceed the 30-a-side threshold)
- Follow manufacturers' instructions strictly to ensure correct dose is applied
- Utilise the innate tick resistance of *Bos indicus* breeds to reduce the frequency of treatments
- Utilise tick-safe pasture
- Rotate between chemical classes on an annual basis
- Treat for buffalo fly and cattle tick concurrently.

Vaccination

A vaccine against cattle tick (TickGARD Plus) is available. It kills ticks slowly as they engorge on blood. The vaccine must be given every 10–12 weeks throughout the year. This requirement makes its use more practical in frequently handled cattle. Because of the strong natural tick immunity of *Bos indicus* breeds, the vaccine is likely to be more beneficial in *Bos taurus* breeds and their crosses.

Tick-safe pasture

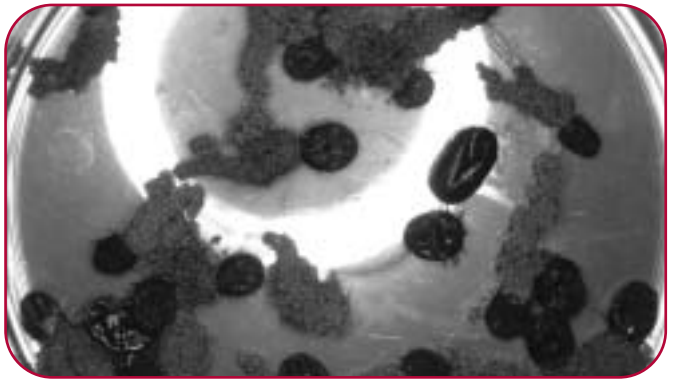
Unless seed ticks attach to a new host they perish. The period during which they can survive while waiting for a host varies with the season and climate. Seed ticks die most rapidly in hot, dry conditions. By strategic spelling of areas with low levels of seed tick, pasture contamination can be reduced. These tick-safe pastures should be combined with chemical treatments to reduce tick burdens and the need for repeat chemical treatments.

Seed ticks can survive on pasture for a maximum of seven months. On the majority of farms this period of spelling is uneconomical. Fortunately, in most locations a four-month rotation has proven to be sufficient to reduce seed tick populations to low levels *(Table 1).*

Region	Rotational strategy
Central Queensland	Two-paddock rotation with spelling period of 3–4 months in summer and 4–5 months in winter.
Southern Queensland	Treat European cattle in May. Two-paddock management system with paddock moves in May, September and January.
Monsoonal Australia and north coastal Queensland	Paddock rotations difficult as the rapid growth of pasture in unstocked paddocks is unlikely to be utilised.
Dry tropical Queensland	Two-paddock rotation at intervals of 8–10 weeks in summer and early autumn. Paddock moves in April, June, September, November and February.

Table 1: Recommended rotations to provide tick-safe pasture

Adapted from Parasites of Cattle (1995), M.G.Smeal



Adult ticks laying eggs

Small brown stomach worm

The cooler temperatures and high rainfall in the temperate areas of southern Australia provide a suitable environment for many of the gut parasites of sheep and cattle.

The most important parasite of cattle in these regions is the small brown stomach worm *(Ostertagia ostertagi)*. It is present in all herds and can dramatically reduce growth rates. Acute losses from heavy *Ostertagia* burdens (scouring, weight loss and death) are rare, but production losses (reduced weight gain in weaners and yearlings) occur on many properties each year.

Lifecycle

The lifecycle of *Ostertagia* is direct and involves adult worms, which live in the stomach of cattle, and free-living larvae, which live on the pasture.

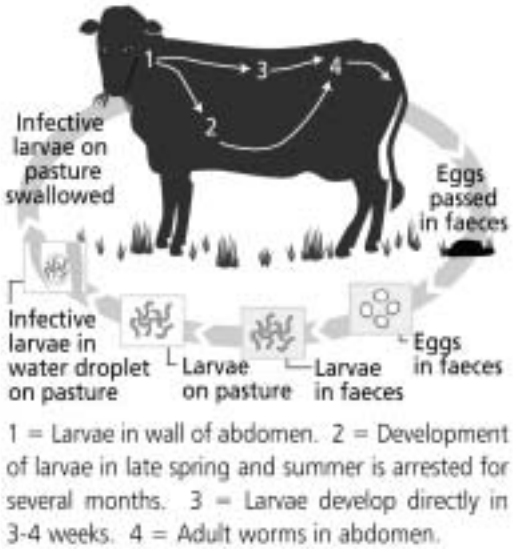


Figure 1: Worm lifecycle (Ostertagia)

Adult *Ostertagia* are hair-like parasites 7–9mm in length that reside in the abomasum (fourth stomach). After mating, adult females lay eggs that are passed in the faeces. These eggs are tiny and can only be seen under a microscope. The eggs hatch within the dung pat to produce early-stage larvae if the temperature is between 10°C and 35°C and there is sufficient moisture. These young larvae feed on bacteria in the dung and grow to become infective-stage larvae within a fortnight. During rainfall, infective larvae migrate from the dung onto adjacent pasture where they are ingested by cattle.

Once infective larvae are ingested they enter the fourth stomach and burrow into the stomach wall lining. There they undergo one of two fates – either they continue their development, emerging from the stomach lining around 10 days later to mature to adult worms, or their development may be halted within the stomach wall. The whole lifecycle can take as little as 21–28 days under ideal conditions (See Figure 1).

Inhibited larvae

As temperature and day length increase during spring, conditions on the pasture become less favourable for survival of free-living larval stages. Rather than developing directly into adults whose eggs have little chance of surviving the hostile conditions on pasture over summer, an increasing number of larvae halt their development in the stomach lining. These larvae are known as 'inhibited' larvae.

In the following autumn when pasture conditions are again suitable for egg hatching and larval survival, the inhibited larvae resume their development. *Ostertagia* infestations derived from inhibited larvae are known as Type 2 infections.

Seasonal parasite numbers are shown in Figure 2.

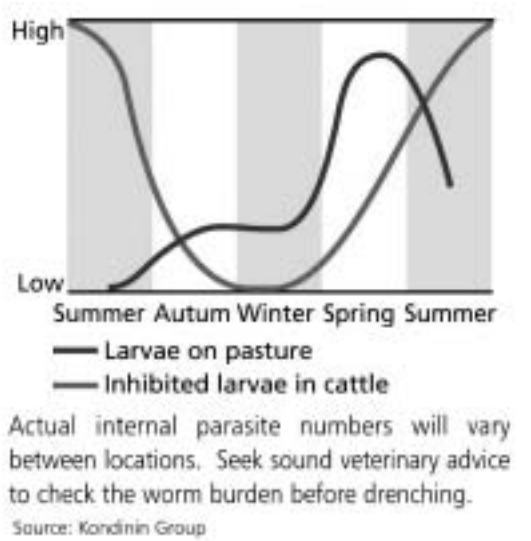


Figure 2: Seasonal parasite numbers

Epidemiology

The number of *Ostertagia* that establish in an animal is a combination of the number of infective larvae ingested while grazing and the susceptibility of the cattle host.

Larvae that are not eaten off the pasture die. The duration of their survival on pasture depends on climatic conditions and can be many months when conditions are cool and moist. In hot, dry weather however, larvae that migrate out of the dung pat will only survive for a short period.

During hot summer conditions few larvae survive on pasture and cattle acquire few worms when grazing. However, in all but the hottest climates some larvae will survive over summer within dung pats, migrating from the dung in the following autumn when the pat 'melts' in the rain.

Disease

When *Ostertagia* larvae emerge from the stomach wall to become adult worms they cause damage to the stomach lining which leads to loss of body tissue proteins.

Disease caused by the small brown stomach worm is known as 'ostertagiasis'. Sub-clinical losses due to ostertagiasis can be enormous. Lost weight gains are invisible and by the time symptoms appear considerable productivity will already have been lost.

Type 1

Type 1 infections are the result of ingested larvae developing directly into adult worms. This form of the disease is most common in weaners, 6–12 months of age, and yearling cattle in their second spring. Heavy infections usually occur in late winter and early spring due to grazing of heavily contaminated pastures during the preceding autumn and early winter.

Large worm burdens cause severe inflammation of the stomach lining, loss of appetite, profuse watery diarrhoea, protein deficiency and rapid weight loss.

Pre-type 2

Pre-type 2 infection is usually seen during spring and summer. Large numbers of larvae become inhibited following ingestion from pasture during spring. There are no overt symptoms of this disease but affected cattle have reduced weight gains. The inhibited larvae resume their development 4–6 months later during the following late summer and autumn.

Type 2

Type 2 infection occurs when large numbers of inhibited larvae resume their development and emerge from the stomach wall *en masse*.

Outbreaks are characterised by large numbers of infected animals, weight loss, diarrhoea and death. Type 2 disease is usually seen during late summer, autumn and early winter in 18-month-old steers, autumn calving heifers and second calving cows. Type 2 disease has become less common following the introduction of drenches which are effective against inhibited larvae.

Seasonal trends

The number of infective larvae on pasture follows a reliable seasonal pattern within a district. More specific details can be found in each regional section.

Control programs are designed to eliminate the source of the pasture contamination that gives rise to peak pasture larvae levels and to prepare worm-safe paddocks for weaners to graze during the peak period.

The mechanics of this are dealt with in each regional section.

Immunity to Ostertagia

By 18 months of age most cattle develop a strong immunity to *Ostertagia*. Cattle most at risk are those between weaning and 18 months of age.

Adult cattle have a strong resistance to the parasite and routine drenching is not required. Immunity in adult cows and bulls can sometimes breakdown during times of stress, drought, joining, cold winters or in very old cows. Only those cows showing symptoms (scouring) need to be drenched.

Control

Maximising weight gains involves reducing the exposure of weaners and yearlings to high levels of infective larvae on pasture during late winter and early spring. Control programs vary between regions (see regional sections) but for most of south-eastern Australia the program is similar.

Young cattle should be drenched at weaning and again in April. For spring born calves the weaning drench and April drench may be the same. In late July, a second drench should be combined with a move to a worm-safe pasture. The pasture is best prepared by grazing from the previous summer with sheep or cattle older than 18 months.

Macrocyclic lactone (ML) drenches are used by many producers for *Ostertagia* control, but oral benzimidazole (BZ) drenches (eg Systamex, Valbazen, Panacur) provide similar effective control and are much cheaper.

Economics

Extensive trials across Australia and particularly in NSW have demonstrated the cost effectiveness of *Ostertagia* control programs. When strategic drenching is combined with worm-safe pasture, weight gains in the first spring after weaning may improve by up to 60kg per head. Recent estimates on the net financial benefit of *Ostertagia* control in growing cattle suggest gains of $3,500–$8,000 for a 100-cow herd depending on the location and severity of the problem.

Tick fever

Tick fever is a blood disease of cattle caused by organisms spread by cattle ticks. The most important parasites that cause tick fever are *Babesia bovis, Babesia bigemina and Anaplasma marginale*. Tick fever occurs wherever there is cattle tick *(Boophilus microplus)*.

Lifecycle

When cattle ticks feed on an animal infected with tick fever, they ingest blood cells infected with the organisms. *Babesia* parasites are passed by female ticks into their eggs and subsequently into immature 'seed' ticks (larval ticks). Seed ticks or adult ticks feeding on new hosts spread the infection. The infective stage spread by feeding ticks is known as a *merozoite*, which invade the cattle's red blood cells and multiply. Mature *Babesia* parasites are released when blood cells rupture. These adults then invade other red blood cells. Up to 20% of the animal's red cells may be infected.

Anaplasma marginale does not pass through the eggs to larval stages of the tick. The parasite reaches a new host when ticks transfer between hosts with the male tick being the most important vector as it is generally more mobile. *Anaplasma* can spread to the calves of cows infected during the last six months of pregnancy. *Anaplasma* may also be spread in infected blood at dehorning, castration and vaccination.

Disease

Once infected ticks attach to an animal it takes some time before significant numbers of organisms appear in the blood (6–12 days for *Babesia bovis*, 12–18 days for *Babesia bigemina* and 21–47 days for *Anaplasma marginale*). All ages of cattle can be infected, however disease is most severe in cattle over 12 months of age. Symptoms are primarily caused by the rupture of red blood cells. Affected cattle may develop a high fever, anaemia, weakness, jaundice, red urine, reduced appetite, recumbency and death.

Breed susceptibility

Zebu cattle *(Bos indicus)* and their crosses are more resistant to *Babesia* parasites than *Bos taurus* breeds. *Bos indicus* are still highly susceptible to *Anaplasma*. Studies by Meat & Livestock Australia have demonstrated the cost benefit of vaccinating all cattle, regardless of breed, with the triple antigen vaccine that protects against both strains of *Babesia* and *Anaplasma*.

Prevention

Infection in young animals usually passes without the occurrence of severe disease. These animals become immune to the strain of organism that infected them, however they remain susceptible to the other strains. It was once thought that in areas where cattle ticks are naturally occurring a sufficient proportion of cattle were infected as calves to provide adequate protection. This has since been disproven and trials have indicated that it is cost effective to vaccinate all breeds of cattle in any area where cattle tick is present (see Table 1).

Parasite	Breed		
	Bos indicus	50% crossbred	*Bos taurus*
Anaplasma marginale	$22	$40	$53
Babesia bovis	$1	$5	$55
Babesia bigemina	$1	$2	$44

Table 1: Maximum estimated return for each dollar spent on weaner vaccination for tick fever

Eight weeks after a single dose of the vaccine, cattle develop a lifelong immunity. All cattle in tick endemic areas should be vaccinated once, between three and nine months of age. The vaccine is a live vaccine and a small number of animals may show signs of the disease. These animals should be treated with the drug, Imizol.

Two vaccines are available – a chilled 2-in-1 (bivalent) vaccine and a frozen 3-in-1 (trivalent) vaccine. The trivalent vaccine protects against all three strains of tick fever, whilst the bivalent does not provide protection against *Babesia bigemina*. Only producers with pure *Bos indicus* breeds should consider the use of the bivalent vaccine. Despite the strong resistance of *Bos indicus* cattle to *Babesia bigemina* the economic returns following vaccination against this organism are still positive and most producers will benefit from use of the trivalent vaccine. Before considering the use of bivalent vaccine producers should discuss this option with their veterinarian.

Treatment

The only drug available to treat tick fever is imidocarb (Imizol). It is a highly effective treatment and has a residual activity of around four weeks if used at the higher dose. Specific advice should be sought from your veterinarian on the use of this product as it can interfere with vaccine responses.

Selecting a worm drench

Producers are faced with a large array of drenching products. Fortunately, within a few limited boundaries, the choice of drench is not that critical. How and when the drench is used will have a much greater impact than the actual brand selected. Many products are similar, containing the same active ingredient from the same class of drench. An understanding of the major drench classes and the actives within each class will help to simplify the decision.

Registration

Any drench that is registered for the control and treatment of internal parasites has been required to demonstrate its efficacy and safety to the Australian Pesticides and Veterinary Medicines Authority (APVMA). This does not mean that it is a suitable product for your specific application. It simply confirms the product will fulfill its label claims. Some registered products cannot be considered 'good' products, as they have been superceded by far superior chemicals.

Generics

There are often large differences in the price of drenches. A common reason for the price differential is patents. Once a chemical's patent has expired several manufacturers can produce it and the price usually falls as a result. Products with the same active ingredient, marketed by companies other than the original patent holder, are known as 'generics'.

The important parasites

The most significant roundworm in temperate Australia is the small brown stomach worm *(Ostertagia ostertagi)*. Its lifecycle is direct but it also has the ability to halt its development during late spring and early summer when its lifecycle is unlikely to be completed on the pasture. The larvae cease development and remain 'inhibited' in small nodules in the stomach wall. They resume development to adult worms in the following autumn.

All drenches with activity against the small brown stomach worm are capable of killing the adult stage. However the ability of the major drench classes to kill inhibited *Ostertagia* larvae varies considerably and should be a major consideration when selecting a product.

Roundworm drenches

The three main classes of drench used to treat cattle roundworms are macrocyclic lactones (ML), benzimidazoles (BZ) and levamisole.

Macrocyclic lactones

Macrocyclic lactones (ML) were developed during the 1970s and 80s and offer exceptional efficacy against a range of internal and external parasites. It is unquestionable that their efficacy and spectrum of parasite control is superior to other classes of drench. What remains less clear is whether this efficacy translates into improved on-farm production.

The ML drenches are expensive but are convenient as all actives within this class are available in pour-on formulations. There are five ML actives available and they are marketed under a range of trade names (see Table 1).

Benzimidazoles

The original benzimidazole (BZ) chemical was thiabendazole. The current third generation BZ products are a marked improvement on their predecessors. Most of the chemical patents in this class have expired and they are available under a range of different trade names (see Table 2).

With the exception of one product (Alternate), BZs must be administered orally. They have high efficacy against adult and immature *Ostertagia*. Fenbendazole and oxfendazole have proven to be more effective against inhibited *Ostertagia* larvae than albendazole, with trials suggesting they can consistently remove 85% of inhibited larvae.

BZ drenches cost around one third the price of MLs. This will usually be more than sufficient to cover the extra labour costs resulting from oral drenching.

Oxfendazole is also available as a pour-on.

Class	Active ingredient	Trade name
Macrocyclic lactones	Eprinomectin	Eprinex Pour-On
	Moxidectin	Cydectin Pour-On and Injection
	Ivermectin	Ivomec Pour-On and Injection Noromectin Pour-On and Injection Ecomectin Pour-On and Injection Baymec Pour-On Virbac Pour-On and Injection Paramax Pour-On Genesis Pour-On and Injection Cevamec Injection Bomectin Injection
	Doramectin	Dectomax Pour-On and Injection
	Abamectin	Avomec Injection Duotin Injection Virbamec Pour-On and Injection Beefmec Pour-On Vetmec Injection Rycomectin Injection Genesis Abamectin Pour-On and Injection Paramectin Pour-On and Injection Grow Force Pour-On Cattlegard Injection

Table 1: Active ingredients and trade names of macrocyclic lactone drenches.

Levamisole

Levamisole is available in pour-on, oral and injectable formulations (see Table 3) but has low efficacy against inhibited *Ostertagia* larvae. Its efficacy against adult worms acquired during autumn and winter by calves less than one year old is high. The efficacy against adult *Ostertagia* burdens derived from inhibited larvae in animals 15–18 months of age varies from 50–80%. Spring born calves (July–October) being weaned in the following autumn (March–May) will not have

inhibited *Ostertagia* larvae and levamisole can be used as a cost effective drench in these cattle.

Persistence of MLs

Some ML drenches have relatively long periods of persistent activity. Doramectin (Dectomax) and moxidectin (Cydectin) have the longest persistence against *Ostertagia* (see Table 4).

Persistent activity is of most value when cattle must be returned to a contaminated environment during autumn, winter or early spring. For producers preparing worm-safe pastures, persistence is of limited value. Persistence if also of little value when drenching in late spring or summer. Persistence is of benefit to producers weaning in autumn where cattle are set-stocked or grazed in short-term rotations.

ML pour-ons versus injections

Pour-on ML formulations contain a higher dose of the active ingredient compared to injectable ML formulations. However the price per dose is usually similar.

Many producers find pour-ons easier to apply than injectable or oral drenches. Pour-ons eliminate the risk of injection site infection and avoid the difficulties associated with sterilising syringes on-farm.

Disadvantages of pour-ons include an increased risk of drench splashing onto operators and the need for safety gear to be worn. Pour-ons also increase the volume of product required. The coat must not be excessively dirty prior to application of pour-ons and may take some time after application to become 'rain fast'.

Use of injectable drenches can reduce the amount of drench required as the higher resolution of the syringe enables doses to be more accurately tailored to the weight of the animal.

Drenches for adult cattle

There is very little evidence to support the routine drenching of all adult cattle. By two years of age most cattle have developed a strong immunity to worms. This occasionally breaks down during times of stress, such as drought or in first and second calving cows. In adult cattle it is only necessary to treat those animals showing signs of parasites, such as scouring. Bulls should be treated for worms and external parasites prior to and after the mating period.

Most producers can immediately improve the cost effectiveness of their drenching program by using less drench on their adult stock and diverting the cost to young cattle between weaning and two years of age.

Class	Active ingredient	Trade name
Benzimidazole	Albendazole	Strategik Nuwhite CC Valbazen WSD Albendazole Kabezen
	Oxfendazole	Oxfen C and LV Parafend Alternate Systamex Worma Drench Bomatak Oxazole
	Fenbendazole	Panacur WSD Fenbendazole Fencare 4Farmers Fenbendazole

Table 2: Active ingredients and trade names of benzimidazole drenches

Class	Active ingredient	Trade name
Levamisole	Levamisole	Citarin Pour-On Virbac Levamisole Pour-On Levipor Pour-On Nilverm Oral, LV, Pour On and Injection Big L Oral Nufarm Levamisole Oral WSD Levamisole Oral and LV Levamisole Gold Oral and LV 4Farmers Levamisole Oral Clear LV Nulev Oral and LV Rycozole Oral and RV

Table 3: Trade names of levamisole drenches

Active ingredient	*Ostertagia spp.*	*Cooperia spp.*
Moxidectin	Up to 42 days	–
Ivermectin	Up to 14 days	Up to 28 days
Doramectin	Up to 35 days	Up to 35 days
Abamectin	Up to 14 days	–
Eprinomectin	Up to 28 days	Up to 28 days

Table 4: Persistent activity of ML pour-ons against Ostertagia and Cooperia parasites

Source: Kondinin Group

Cooperia

The limiting parasite for the ML drenches is *Cooperia*. Marketing of ML drenches has emphasised differences between products in their ability to kill and provide persistent activity against *Cooperia*.

Cooperia are the predominant worm of cattle between two and 12 months of age. From six months of age cattle begin to develop strong resistance to re-infection and by 12 months few *Cooperia* become established.

Cooperia are not considered a serious pathogen in beef cattle in most situations. They are most significant in early-weaned calves or where calves are heavily stocked and may require special attention in these situations. There is little evidence to confirm that differences in the ability of drenches to control *Cooperia* translate to on-farm production gains in traditional beef cattle operations.

Safe pastures

Safe pastures

Cattle treated for parasites and then returned to the same paddock rapidly become re-infested. This adds little to productivity and has limited impact on reducing parasite levels on the pasture. 'Safe' pastures can be used to extend the interval between chemical treatments and to reduce cattle exposure to parasite larvae. Lower parasite levels on pasture result in better weight gain.

Total elimination of all parasites from pasture is not possible. Safe pasture is not parasite free but levels are sufficiently low so production is not limited and disease does not occur. Safe pastures can be utilised by all producers regardless of their property size or enterprise type.

Ways to provide 'safe' pasture

Resting paddocks is only one method of providing safe pasture and may not be physically or economically feasible on many continuously grazed properties. There are many other methods of providing safe pasture such as hay and silage making, grazing with sheep, cropping and fresh pastures (see Table 1).

Although planning and preparing for safe pasture can often be the most difficult component of a parasite control program, the rewards can be as large, or larger, than the impact of chemical drenches.

Short-term rotational grazing (cell grazing)

Cell grazing systems typically involve a three- to five-week spelling rotation. Unfortunately most parasites can survive in the environment for much longer periods. Therefore short-term rotational grazing has little impact on pasture parasite levels.

Management practice	Duration of de-stocking	Residual number of roundworm larvae	Nutritive value	Usefulness for worm control
Short-term rotational grazing	3–5 weeks, April–Sept	Unchanged	Good	Poor
Fodder conservation as silage or hay	4–8 weeks	Reduced	Very good	Good
Cropping cereals	32 weeks or more	Decimated	Poor	Excellent
Cattle/sheep alternation	26 weeks, Jan and July	Reduced	Good sheep/ poor cattle	Very good
Grazing with adult cows/yearlings	26 weeks Nov–Apr	Reduced	Unchanged	Moderate Unreliable

Table 1: Comparison of traditional pasture management practices for roundworm control
Adapted from Mackinnon Project, University of Melbourne

Fodder conservation

Hay or silage production is an effective method of reducing the number of parasites on a pasture. Large numbers of parasites are removed in the hay or silage and the reduction in ground cover exposes the remaining parasites to harsher conditions that hasten their death.

Cropping and freshly sown pasture

Paddocks that have been cropped or freshly sown with perennial pastures typically have very low levels of parasites. Parasite levels are reduced by the long duration without grazing, soil disturbance and the generally unfavourable environment produced by crops.

Grazing with non-susceptible animals

Most parasites can only complete their lifecycle in one species of animal (see Table 2). If paddocks are grazed with another species many parasite lifecycles can be 'broken'. This allows a paddock to be used for grazing while disrupting parasite lifecycles. This kills many parasites, dramatically reducing pasture contamination levels. In effect the paddock is being 'rested', however it can still be used for grazing and economic purposes.

Parasite	Host	Survival time off host
Cattle tick	Cattle	Up to seven months
Bush tick	Cattle, sheep, horses, pigs, dogs, bandicoots, marsupials and humans	Unfed nymphs and adults can survive for up to 12 months
Lice	Cattle	Less than three days
Ostertagia	Cattle	Warm, dry conditions – 90% die in 10 days
Trichostrongylus	Cattle and sheep	
Haemonchus	Cattle	Wet, cold conditions – 90% die in 220 days
Oesophagostomum	Cattle	
Fluke	Cattle, sheep, goats, other ruminants, pigs, kangaroos and humans	Years
Paramphistomes	Cattle	Years

Table 2: Host specificity and length of environmental survival of parasites

Source: Kondinin Group

Sheep and cattle share few parasites and provide a readily available option for preparing safe pasture through cross-grazing. The only well adapted roundworm of both sheep and cattle is *Trichostrongylus axei*. This parasite is not particularly harmful and seldom causes problems in either sheep or cattle.

On 'cattle only' properties, the stronger immunity of adult cattle to roundworms can be used to provide worm-safe pastures for more susceptible weaners.

Resting alone may do little

Roundworm larvae on pastures are rapidly killed by hot, dry conditions. In contrast larvae can survive for long periods when it is cold and wet. At 25°C and 10% humidity, 23% of larvae may die each day, while at 5°C and 90% humidity the daily death rate may be less than 1%. Resting pasture during the cooler months of the year has a much lower impact on parasite levels than resting during hot, dry conditions.

Six months rotation between sheep and cattle

The most commonly available method of providing worm-safe pasture is cross-species grazing with sheep and cattle. Each grazing period should be longer than two months and preferably six. Grazing cattle pastures with sheep from December to June has been shown to significantly reduce contamination with *Ostertagia* and *Cooperia* roundworm larvae. Refer to Figure 1.

When are safe pastures not required?

Safe pastures can be used in the control of most parasites except those species, such as lice, which cannot survive off cattle for any period of time.

Safe pastures also have little role in the control of parasites that can move over large distances, such as the buffalo fly.

Drench and move

When cattle are moved to a safe environment they should be treated with a chemical to avoid rapid contamination of their new environment. Many chemical products do not kill parasites instantly or viable eggs may remain in the intestinal tract for some time. Prior to moving cattle to a safe pasture it may be advisable to move them via a paddock where further parasite contamination does not matter. The dynamics of this will vary between parasites and chemical products. Veterinarians can provide more specific advice.

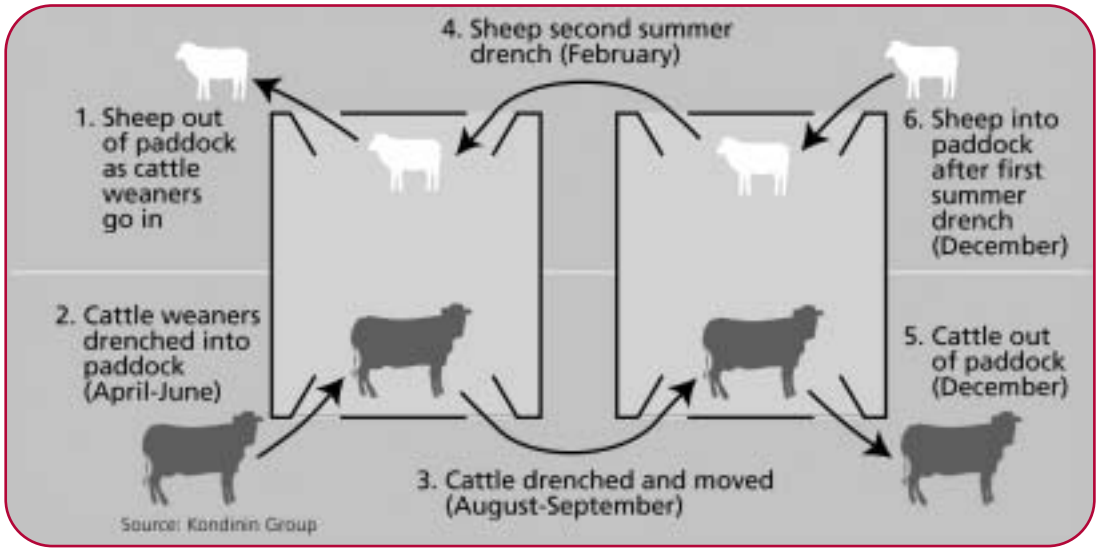


Figure 1: A double-paddock grazing system – an example of a suitable rotational grazing system for western Victoria and the south-west slopes of NSW.

Glossary

Abomasum: the fourth stomach of a ruminant

Anaemia: a low level of red blood cells

Anaplasmosis: a blood disease (tick fever) caused by the rickettsia *Anaplasma marginale*

Anthelmintics: chemicals used to control internal parasites

Autumn break: the emergence of green grass in response to autumn rainfall in pastures that have previously dried off over the summer

Benzimidazoles: a class of anthelmintic chemical commonly referred to as the 'white drenches' – first released in the 1960s

Bos indicus: tropical breeds of cattle, eg Brahman, Sahwahl

Bos taurus: British and European breeds of cattle

Clinical disease: a state of infection or infestation sufficient to produce obvious signs of disease

Endemic: a parasite or disease is endemic to an area when it occurs on a regular basis

Epidemiology: the way a disease behaves in a population of animals

Generics: products with the same active ingredient, manufactured or marketed by companies other than the original patent holder

Inhibited: a temporary cessation in the development of a parasite's lifecycle

Infective larvae: the stage of the parasite lifecycle at which it can be ingested by an animal to become an adult parasite

Integrated pest management: the implementation of a range of options to manage a particular pest

Jaundice: yellow or orange colouring of the lips, whites of the eyes and skin resulting from the accumulation of haemoglobin pigment released when red blood cells die in large numbers

Levamisole: an anthelmintic chemical commonly referred to as 'clear' drench

Limiting parasite: the parasite that is least controlled by a drug

Macrocyclic lactones: a group of anti-parasitic drugs produced by the *Streptomyces* species of bacteria, eg Ivermectin, Abamectin, Moxidectin, Eprinomectin, Doramectin

Metacerceria: the infective stage of liver fluke on pasture

Miracidium: a stage in the lifecyle of *Fasciola hepatica* (the liver fluke), which hatches from eggs passed in cattle faeces before entering an intermediate host snail

Merozoites: the infective stage of tick fever that is injected into cattle when seed ticks, larvae or adult ticks feed

Ostertagiasis: disease caused by the small brown stomach worm *Ostertagia ostertagi*

Parasitism: infestation of an animal by parasites

Pour-on: a drug preparation that is applied onto the skin along the backline of an animal

Seed ticks: the first larval stage produced after tick eggs hatch; they survive on pasture for some time before reattaching to a new host

Semi-engorged: a female tick that has reached half her final size, ie 5–7mm

Set-stocked: pastures where cattle graze the same pasture year round with no strategy to reduce the incidence or severity of parasite-induced disease

Sub-clinical: disease sufficient to cause production losses but not yet capable of causing recognisable signs of disease

Submandibular oedema: bottlejaw – a swelling underneath the jaw of cattle resulting from blood protein loss, most commonly seen in cattle with heavy burdens of *Ostertagia* or liver fluke

Tick worry: rubbing and licking by cattle as they attempt to relieve discomfort caused by cattle ticks

Tick-safe pasture: a pasture with low levels of young seed ticks

Unstocked: where no stock are grazed in a paddock

Worm-safe pasture: a pasture that has low levels of worm larvae

Common name index

Scientific to common

Anaplasma marginale: tick fever, blood rickettsia parasite

Babesia bovis* and *Babesia bigemina: tick fever, blood protozoal parasite

Boophilus microplus: Australian cattle tick

Calicophoron calliphorum: paramphistomes or stomach fluke

Cooperia punctata: small intestinal worm

Bovicola bovis: biting louse

***Eimeria* spp.:** coccidial parasites, black scours

Fasciola hepatica: liver fluke

Haemaphysalis longicornis: bush tick

Haematobia irritans exigua: buffalo fly

Haematopinus eurysternus: short-nosed sucking louse

Haemonchus placei: large stomach worm; barber's pole worm

Ixodes holocyclus: paralysis tick

Linognathus vituli: long-nosed sucking louse

Ostertagia ostertagi: small brown stomach worm

Trichostrongylus axei: stomach hair worm

Common to scientific

Australian cattle tick: *Boophilus microplus*

Barber's pole worm: *Haemonchus placei*

Biting louse: *Bovicola bovis*

Black scours: *Eimeria* spp.

Buffalo fly: *Haematobia irritans exigua*

Bush tick: *Haemaphysalis longicornis*

Coccidia: *Eimeria* spp.

Large stomach worm: *Haemonchus placei*

Liver fluke: *Fasciola hepatica*

Long-nosed sucking louse: *Linognathus vituli*

Paramphistomes: *Calicophoron calliphorum*

Paralysis tick: *Ixodes holocylus*

Short-nosed sucking louse: *Haematopinus eurysternus*

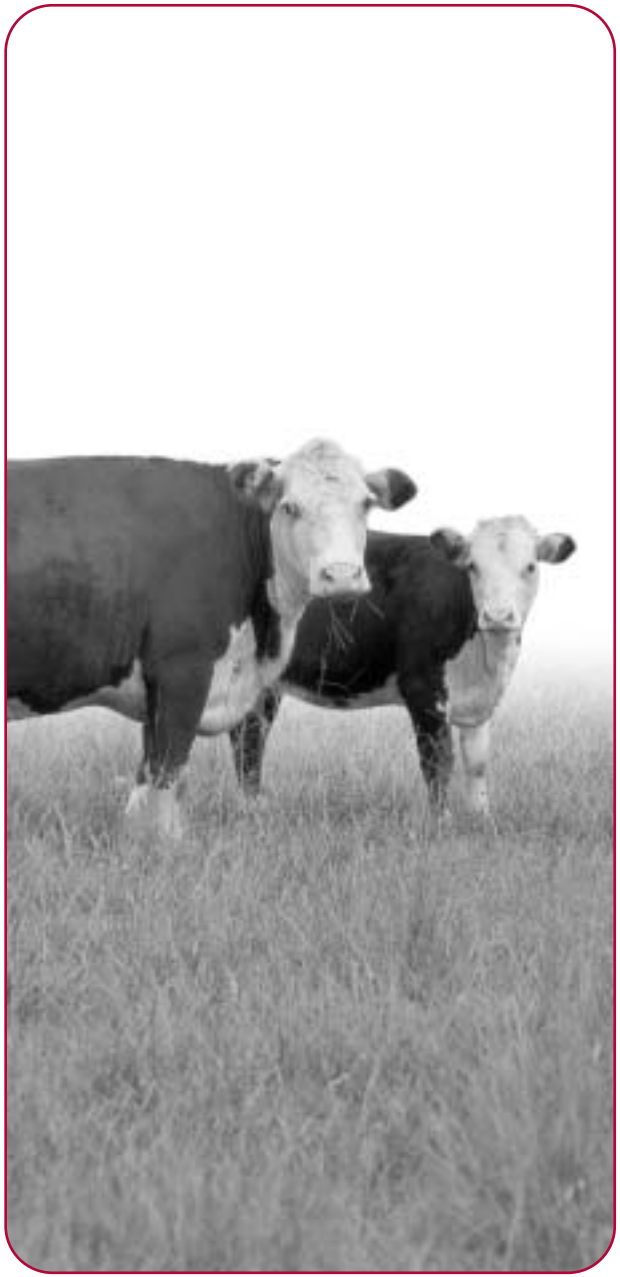
Small brown stomach worm: *Ostertagia ostertagi*

Small intestinal worm: *Cooperia punctata*

Stomach fluke: *Calicophoron calliphorum*

Stomach hair worm: *Trichostrongylus axei*

Tick fever: *Anaplasma marginale, Babesia bovis* and *Babesia bigemina*



Notes

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