Queensland Primary Industries and Fisheries

Beeftalk

Taking stock of your future

Prime news and views for beef producers of south-east Queensland

Issue 28 Spring/Summer 2009

in this issue

Queensland Government

editorial

After a good summer for most of south-east Queensland we have had a fairly mild winter, albeit with some short periods of very cold frosty weather. Memories of my childhood were revived when I camped with my grandson at Linville in early August to wake up to a heavy frost before riding up the range to Blackbutt.

The summer rains produced a good body of feed which dried off when the rain stopped in March/April. While this feed provided good bulk going into winter it was of lower than normal feed value. At Brian Pastures Research Station, NIRS dung analysis in May showed that the protein and energy levels were below those required for a pregnant cow to maintain liveweight. We've received many enquiries about supplementary feeding over the last few weeks which goes to show that cattle are obviously losing weight. Interestingly there has been a green pick for most of the winter in most areas. Forecasters are predicting the development of an El Niño weather pattern so take this into consideration when reviewing your dry season management plan.

Since the last edition of *Beeftalk* (April 2009) there have been some major changes to Queensland Government departments. The Department of Primary Industries and Fisheries no longer exists as a department in its own right. We are now part of the Department of Employment Economic Development and Innovation (DEEDI) in a group know as Queensland Primary Industries and Fisheries (QPIF). For you, our *Beeftalk* readers, we hope this will mean little if any change and that *Beeftalk* will continue to be produced.

In this issue we continue to provide information about carbon and the organic treatment of parasites. We often get enquiries about the mineral status of soils and the possibility of mineral deficiencies in cattle. In this issue we have a short article putting mineral deficiencies in perspective to other nutrient deficiencies particularly energy and protein. In the next two issues we will have articles on specific minerals. In two articles on the economics of beef production, producers are encouraged to 'do the sums' before changing to what may at first appear to be a more profitable production system.

In our last issue we profiled Ian McConnel, a new extension officer with QPIF who is now working in the southern part of south-east Queensland. We welcome Ian to the *Beeftalk* team and look forward to his input.

Happy reading!
The Ed

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Cattle transport – Loading strategies for road transport

The prosecution of a grazier for cruelty and failing in his duty of care to transport only animals fit to travel has recently received widespread media attention, highlighting the obligations of all involved in transporting stock.

A producer's decisions about handling standards for their stock will influence the actions of their stockmen preparing the stock for transport and of the drivers transporting the stock. These decisions, which will significantly contribute toward the final meat quality, include:

- how the cattle are handled from birth to transport
- which cattle are selected for transport
- how the cattle are segregated (by type, sex, horns, size)
- whether the cattle are offered feed and water while in the yards after mustering
- how long the cattle are held in the yards between mustering and loading
- whether and for how long the cattle are fasted prior to loading.

Good communication and cooperation between the cattle consignor (the owner or the owner's agent) and the transport driver will maximise animal welfare during transport. After consulting with the consignor, the truck driver will:

- decide on the loading density
- be responsible for the welfare of the animals between loading and unloading.

Early preparation and handling

Livestock that are prepared from an early age experience less stress and injury during transport. This preparation starts at weaning when are calves trained to normal handling practices, both in the yards and in the paddock. Quiet cattle that have been handled well travel better than cattle that have had limited handling.

Skilled stockmen work cattle without noise and bustle to reduce stress. Cattle travel better when they are quiet and will experience less stress and bruising. Rushed cattle are stressed cattle, and stressed cattle produce tough or dark-coloured meat.

Animal selection

Animals selected for transport must be 'fit to load', that is, they must be strong and healthy enough to undertake the journey. Animals that are injured, sick or in late pregnancy should not be transported.

Segregation

Cattle travel better when segregated according to horn status, size and sex. Transporting horned and hornless cattle separately decreases the risk of injury and losses from bruising.

Feed and water

Cattle begin to lose liveweight when they are taken off water and feed; most of the loss is gutfill (via faeces and urine). The greatest portion of this weight loss occurs between yarding and loading.

Cattle off grass lose weight at a faster rate than cattle off grain (feedlot).

Fasting

When cattle are fasted before transport:

- the animals travel better and are easier to unload
- the floors of trucks are drier and cleaner.

For short journeys it is recommended that cattle be kept off water for 6–8 hours and off feed for 6–12 hours before loading.

Decisions about time off water must take into consideration:

- the prevailing weather conditions
- distance to be travelled
- road conditions
- the cattle's previous feed
- the cattle's recent transport history
- when the cattle last had access to water.

It is essential that the total time off water – which includes time off water prior to, during and after transport – does not exceed the maximum water deprivation times outlined in the *Australian standards and guidelines for the welfare of animals–land transport of livestock* (available for download at www.dpi.qld.gov.au) and does not compromise the animal's welfare.

Rest

Cattle need time to settle after mustering and should be rested in the yards before loading. Decisions about how long to rest cattle should take into consideration:

- the time taken to muster and handle the cattle
- distance to be travelled
- prevailing weather conditions.

It is recommended that cattle be rested for a minimum of 6–12 hours before transport.

A survey of deaths among railed cattle from western Queensland showed that fewer animals died in transit when they were rested for more than 12 hours between mustering and loading.

Loading densities

Appropriate loading densities reduce stress, bruising and deaths during the journey. Decisions about appropriate loading densities must consider:

- the size, shape and horn status of the cattle
- the prevailing weather conditions
- distance to be travelled.

Loading densities must be assessed for each pen in the stock crate to ensure the animals are of similar size to

ensure they give each other mutual support.

Overloading increases the risk of an animal going down and being unable to get up again, and this risk is greater with horned cattle. When animals go down the risk of bruising, injury and mortality increases significantly.

More information

The following publications provide further information on loading livestock:

Australian standards and guidelines for the welfare of animals—land transport of livestock (available for download at www.dpi.qld.gov.au)

Is it fit to load? A national guide to the selection of animals fit to transport (available for download at www.mla.com.au).

Mean liveweight of cattle (kg)	Floor area (m^2/head)	No. of head per 12.2 m deck*
250	0.77	38
300	0.86	34
350	0.98	30
400	1.05	28
450	1.13	26
500	1.23	24
550	1.34	22
600	1.47	20
650	1.63	18

Recommended loading densities for adult cattle to be transported by road:

* Equates to a single-deck trailer.

Call QPIF on 13 25 23
Website: www.dpi.qld.gov.au (follow the links from 'Animals' to 'Animal welfare & ethics')

Acknowledgement: John Lapworth, Principal Project Officer, Industry Services, QPIF Animal Science.

Operating margin – the key to profit (or loss)

The dramatic rise in input costs has placed significant pressure on farm profit margins across the country.

The key to profit is the operating margin. This is the price you get for a kilo of beef less what it costs to produce.

Production costs are the single most important area to consider because this is the area where the producer has most control. You may be able to negotiate a small premium of 5–10c/kg in the price you receive, but differences in cost of production (COP) can be more than $1/kg.

Most high profit operators have an operating margin of 70–80c/kg which gives them a huge buffer if there are significant price falls or adverse conditions, enabling them to remain cash flow positive.

Most production costs are fixed so producers should concentrate on increasing kilograms produced by focussing on these key areas:

1. Lifting branding rates over the average branding rate of 65–70%
2. Cutting the death rate of breeders (an issue on the more extensive properties)
3. Concentrating on turnoff weights and not selling young cattle.

Aim for the top weight range of your target market and avoid store weaner sales. Selling weaners for what appears to be a price premium is a mistake because a weaner is a high price item; it has had all the running costs of a cow behind it. It costs approximately $250–$300 to run a cow for the year and growing out a steer costs only a fraction of that.

Allocating capital correctly is often more important than budgeting. When budgeting you need to know whether you can expect to have a surplus and how much it will be. You can then weigh up your priorities around reducing debt, buying your neighbour's property, or investing off-farm.

It is vitally important to do your sums correctly using realistic figures to produce accurate projections. A common error is to use the top market price rather than the average. Often, sums are just not done well enough.

Further information:

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Phil Holmes

Phil Holmes provides business advice to agricultural enterprises as the principal of Holmes & Company, a firm based in Sydney and Wagga Wagga.

Holmes & Company has advised corporate and family farm businesses in the New England area of NSW, Victoria, the Bass Strait Islands, Tasmania, South Australia and the Northern Territory. Holmes & Company also advises national and multi-national firms that provide essential inputs for Australian agriculture.

Phil's special interests are commercial beef production, agricultural sustainability, finance and equity investing, and general business performance. He is currently completing a PhD on the environmental and economic sustainability of arid rangeland beef production. Phil chairs the boards of directors of a number of private companies.

Use of fire in grazing country

Fire is a tool graziers can use to manage animal production and land condition. Like any tool it can be used or abused. Fire can be successfully used in many land types (particularly in those carrying native pastures) to improve feed quality, alter pasture composition, manage distribution of grazing, and maintain the tree–grass balance.

Successful outcomes will be achieved provided you:

- are clear about the objectives of the fire
- use an appropriate regime (timing, intensity, frequency)
- prepare adequately
- manage the risks, and
- evaluate the effectiveness of the fire.

Burning for the sake of burning makes little sense.

Fire in the landscape

There is good evidence that much of the Australian landscape has been shaped by fire. Many of the land types that produce beef in south-east Queensland are eucalypt woodlands with varying degrees of development. Where the production system is based on native pastures, these land types are well adapted to fire. Land types that are quite sensitive to fire include rainforests and scrubs. Highly developed sown pastures, especially in the higher rainfall areas, can also be sensitive to fire.

Regardless of the type of country or its level of development, wildfires are damaging. A well-planned fire regime, conducted to avoid or actively prevent wildfires, is an important management tool for improving land condition and animal production levels.

Fire and feed quality

Many graziers managing native pastures understand the benefits of fire for improving feed quality. Most of our native and sown grasses loose quality fairly rapidly toward the end of the growing season. By the end of the winter or dry season, crude protein levels are usually very low especially if there have been several frosts.

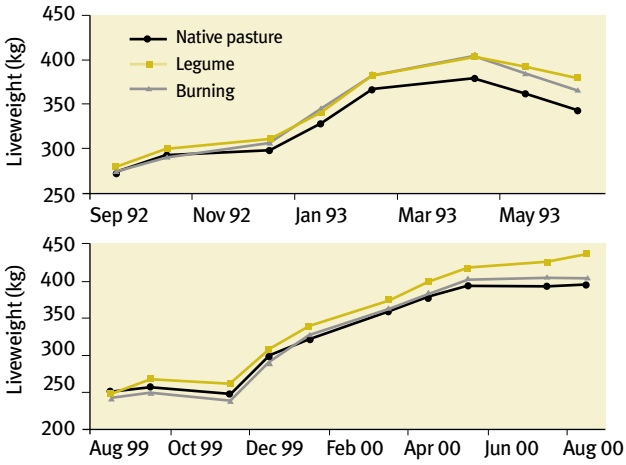

Figure 1. Varying responses in liveweight gain to burning at Galloway Plains

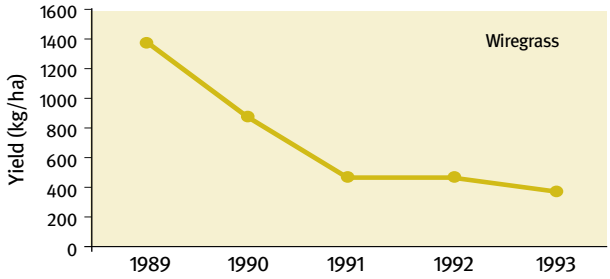

Figure 2. Reduction in wiregrass following annual spring burns

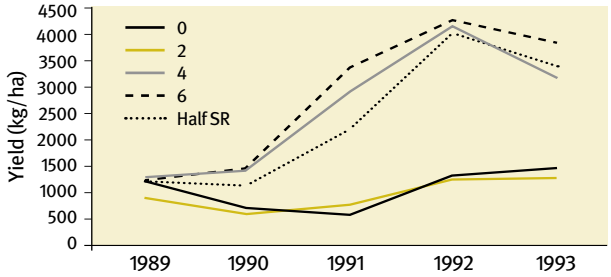

Figure 3. Response of black spear grass to fire and grazing management

A fire following the spring break removes rank growth and improves cattle access to the green pick. In many cases fire stimulates the mobilisation of nitrogen out of the large organic pool in the soil; this leads to better crude protein levels in the plant during the subsequent growing season.

Work at *Galloway Plains* near Calliope demonstrated that cattle grazing these pastures can be up 20 to 30 kilograms heavier at the end of the growing season than cattle grazing unburnt pastures in the same country. However these results were not replicated when the comparison was repeated some years later.

Fire and pasture composition

Most of our desirable native grasses are adapted to or dependent on fire. Many graziers will be familiar with black spear grass and forest bluegrass pastures being replaced by the unpalatable wiregrasses. Work at Brian Pastures research station in the early 1990s and on commercial properties during the mid to late 1990s clearly demonstrated the role of fire in improving the balance between black spear grass and wiregrass.

Fires in spring following 25–30 mm of rain are effective in reducing wiregrass (Figure 2) and promoting black spear grass (Figure 3). This process is greatly enhanced if grazing pressure is reduced either by spelling or by reducing stocking rates during the growing season following the fire (Figure 3).

Fire to manage grazing distribution

Cattle selectively graze the landscape. They tend to favour productive land types over poorer ones. Even

within a given land type cattle will graze some areas more heavily than others. Within a given area they will prefer the desirable grasses over the unpalatable ones. As a result paddocks are seldom evenly grazed and it is common to have patches of heavily grazed areas and lightly grazed areas.

Selective grazing is an evolved animal behaviour that allows animals to optimise their nutrient intake. From an animal production perspective selective grazing is a good thing and restricting it in any way will reduce individual animal performance. However persistent patch grazing will lead to a loss of land condition.

Fire can be used to even out the distribution of grazing. Burning areas of rank pasture will encourage animals onto the resulting green pick. Some graziers use fires at different times of the year to encourage cattle into rough country. In paddocks with definite patchiness, the ungrazed patches tend to carry a Spring fire while the heavily grazed patches often don't burn. In the following growing season, cattle will favour the burnt areas and so effectively spell the patches that were heavily grazed in the previous season. In this way, the grazing pressure is distributed across the years.

Work in the Victoria River District in the Northern Territory demonstrated how fire can be used to distribute grazing more evenly. Figure 4 shows the relative ground cover across two paddocks. The paddock on the left was rotationally burnt with about one third of the paddock being burnt each year. The unburnt paddock on the right had large areas of very low ground cover and large areas of rank, unused pasture. The burnt paddock was more evenly used, despite poorer topography and water placement.

Fire and woody weeds

Woody weeds and regrowth will compete with pasture for moisture and nutrients. Regular fires can prevent woody weeds and regrowth from becoming established, although it will have limited effect in removing mature shrubs and trees. The use of fire in managing woody weeds and regrowth is covered in greater detail in the associated article in this issue of *Beeftalk*: 'Use of Fire in Grazed Woodlands'.

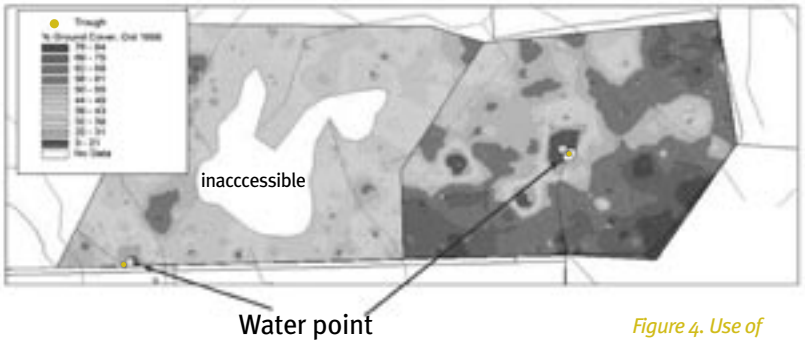

Figure 4. Use of fire to even out the distribution of grazing

Getting the regime right

A fire regime has three components:

- Timing (the season)
- Frequency
- Intensity (how hot the fire is and how fast it moves).

To even out patch grazing it may be enough just to take advantage of a good Spring break with a moderate intensity fire once every three or four years. A late summer or autumn burn of low intensity every couple of years may be sufficient to encourage cattle to work rough or timbered country.

To change species composition you may need to conduct annual Spring burns of low to moderate intensity for two to five years. To ensure sufficient fuel for the burns you may need to manage stocking rates ahead of time. After the burns you will need to continue with reduced grazing pressure to provide desirable plants with time to establish.

Controlling woody weeds or eucalypt regrowth may require a relatively intense fire every three to eight years. To achieve this you could burn later in the Spring when temperatures are higher. You may also need to spell paddocks in the growing season prior to burning to ensure sufficient fuel loads. In these situations you need to take extra precautions with fire breaks. If burning to manage wattles you may

Managing the risks

Most of the negative outcomes from fire result from having the wrong fire (usually too hot) at the wrong time.

Wildfires can do a lot of damage and are difficult to extremely dangerous to contain. Wildfires take off under these conditions: high fuel loads, low humidity, high temperature, and wind.

The risks associated with wildfires include:

- loss of feed
- loss of nutrients
- poor ground cover
- poor pasture response
- damage to infrastructure and timber resources
- litigation.

It is safest to burn in the cooler months. In grazing country, fire is most commonly used in Spring following rain. At this time of year the days are warm enough to carry a fire but the nights are still cool enough to contain it. A fire following 25–30 mm of rain tends to burn only the aerial parts of plants, leaving mulch on the ground to reduce run-off and erosion. Also, this amount of rain in spring is usually sufficient to stimulate new pasture growth.

Commence your preparation for burning well before spring arrives:

- Use grazing management to manage fuel loads.
- Clear firebreaks during autumn or winter.
- Source and/or service your fire-fighting equipment well ahead of time.
- Meet your legal obligations by obtaining a permit from your local fire warden, adhering to the conditions stated on the permit, and notifying your neighbours.

need a less intense fire more frequently.

Planning is important. You need to be clear about your objective for a fire and take the time to prepare properly for the appropriate regime. Each time you burn, review the experience. Assess how effective the fire was in achieving the desired outcome and learn from any mistakes.

Further information:

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Wild dog control

Wild dogs are a serious problem for all landholders in south-east Queensland. Wild dogs include purebred dingoes, dingo hybrids and domestic dogs that have wandered or been deliberately released. Primary producers, small area landholders and people living in the 'urban-rural fringe' can experience significant stock and pet losses to wild dogs. Wild dogs can pass diseases to livestock and people. Native animals are also at risk from predation and disease.

Depending on the availability of food and water, wild dogs can have territories ranging from 10 to 70 square kilometres in area, and can roam up to 20 km beyond those territories seeking vacant areas. Unbaited/unpatrolled areas can become wild dog refuges/breeding grounds. A coordinated, whole-of-community approach is therefore crucial for effective control.

A range of wild dog control methods are available to landholders, depending on the size and location of their properties. Methods include: shooting, trapping, fencing, employing livestock guardian animals (e.g. guardian dogs and alpacas), and poisoning (1080 baiting). Specific information on these control methods is available from your local council Animal Control Officer. The 'Wild Dog Control' fact sheet is available from Biosecurity Queensland.

Landholders with properties more than 40 hectares in size and more than 5 kilometres from a town area can become involved in a baiting program conducted by their local council. Your local council officer can advise you on alternative control strategies, regardless of whether you qualify for the baiting program. October/November appears to be the best time to start baiting for wild dogs because this is when juveniles become independent of their adult minders.

In a recently completed two-year study into best practice baiting, 49 wild dogs were collared and/or ear-tagged and monitored. The results showed:

- Some dogs ranged up to 600 km from the point where they had been captured and tagged/collared.
- Netting fences are barriers to wild dog dispersal; grids do not appear to compromise the effectiveness of netting fences as barriers.
- More than half of the dogs trapped in forested areas expanded their territories beyond the confines of the forest or dispersed into pasture and/or recently baited areas.
- At least part of the 'baiting effect' observed after autumn baiting can be attributed to reduced visibility – dogs are still present but avoiding areas of human activity whilst whelping and rearing their pups.
- Baiting every few weeks over the summer period from November to May may be more effective than conducting one or two baiting programs in autumn and winter, but this needs to be trialled.

Trials are now being conducted on a new toxin (PAPP) and the use of guardian dogs. The results of this research will be published in *Beefy and the Beast*, a newsletter from Biosecurity Queensland that provides updates on wild dog research.

Further information:

Your local council Animal Control Officer

Your local Biosecurity Officer

Biosecurity Queensland, phone 13 25 23 or visit www.deedi.qld.gov.au (select 'Primary Industries and Fisheries', then 'Biosecurity')

Lee Allen, Senior Zoologist, phone (07) 4688 1397 or email lee.allen@deedi.qld.gov.au

Greg Mifsud, National Wild Dog Coordinator, phone (07) 4688 1333 or email greg.mifsud@deedi.qld.gov.au

Managing buffalo fly – An integrated approach

As spring approaches, so too does the breeding season for buffalo fly. Significant numbers of buffalo fly can cause a range of problems including:

- reduced grazing time
- rubbing and hide damage and potential animal welfare issues
- lesions (hide damage) from the parasitic nematode Stephanofilaria stilesi
- pinkeye risk (up to 30% recorded in untreated cattle)
- production losses (e.g. 15% weight loss in beef steers, 0.5 L/day loss of milk production in dairy cows).

The recommended level for economic management of buffalo flies is around 100 flies per side (beef) or 30 flies per side (dairy).

Generally, the warmer and wetter areas closer to the coast provide a more ideal environment for buffalo fly breeding. In these areas some flies may survive over winter. Fly infestations can vary significantly between animals in the same mob. Numbers are generally greater on bulls than on steers or females; black animals carry more flies than lighter coloured animals.

A planned approach to buffalo fly control will help to:

- produce the most cost-effective result in reducing the impact of fly infestations
- prolong the useful life of chemicals
- reduce the risk of chemical residues in slaughter cattle.

Non-chemical control options

Cull susceptible cattle

Culling animals that are most susceptible to buffalo fly provides long-term benefits by reducing the population of genetically susceptible animals in your breeding herd and also short-term benefits by delaying or even preventing the need for chemical treatment.

Set buffalo fly traps

Because of the significant capital cost, buffalo fly traps are most cost effective where large numbers of animals can be channelled through a trap, such as in a dairy or cell grazing situation. Traps have reduced fly populations by up to 70%.

Safeguard dung beetles

Dung beetles reduce buffalo fly populations by removing or spreading dung so the flies can't breed in it. Dung beetles are most active in hot humid weather, which fortunately coincides with the period of high fly activity. Some chemicals used for parasite control in cattle are passed in the dung and kill the dung beetles and their larvae. This problem can be minimised by reducing chemical use at peak dung beetle breeding times and by using chemicals that are known to have little or no effect on the beetles.

Chemical control options

Three main chemical groups are available for buffalo fly control:

- Synthetic pyrethroids (SPs) – in sprays, ear tags and pour-ons
- Organophosphates (OPs) – in sprays, backrubbers and ear tags
- Macrocyclic lactones (MLs) – internal/external parasiticide pour-ons that are registered for buffalo fly as well as ticks, worms, lice.

SP/OP mixes are also available in spray and/or dip formulations (and are also registered for ticks).

The table below provides an indication of likely control periods, likelihood of chemical resistance, and likely activity of the chemical in the dung (and therefore its effect on dung beetles).

Resistance to SPs has been developing for some time and is widespread in Queensland and New South Wales. Even back in the 1990s there was a high level of resistance in far north Queensland and south-east Queensland (about 85%). There has been little evidence of resistance to OPs.

The effects of chemicals on dung beetles have not fully evaluated, but the following have been noted:

- No information is available on whether OPs

	Synthetic pyrethroids (SPs)	Organo phosphates (OPs)	Macrocyclic lactones (MLs)
Potential activity period of the chemical after a single treatment	21 days	4–7 days	Up to 21 days
Likelihood of resistance in flies to the chemical	Medium to high	? Low	Unknown
Likely activity period of the chemical where there is resistance in flies	Around 10 days	Less than 7 days	Unknown
Likelihood of chemical activity in the dung	Yes	Probably No	Yes

have toxic effects on dung beetles. However these chemicals are mainly excreted in the urine and so are unlikely to be harmful to dung beetles.

- SPs make dung toxic to dung beetles at all stages of the dung beetle life cycle. Effects vary between chemicals and beetle species.
- Some ML-actives increase mortality of young adult dung beetles, reduce breeding, and prevent dung beetle eggs and larvae from maturing for up to 2–3 weeks.

Choosing a chemical group

- Only use chemicals that are clearly still effective. A reducing control period indicates a build up of resistance. Generally, if the buffalo flies are resistant to one chemical within a chemical group they will be resistant to other/all chemicals in that group.
- Rotate chemical groups. Avoid using OPs for more that two seasons in a row or SPs for more than one season.
- Consider rotating chemical groups within a season.
- Consider the potential effect on dung beetles – particularly with respect to timing. Try to avoid using SPs and MLs early in the fly breeding season as this is also the breeding season for dung beetles. If flies are still bad during Autumn and into early Winter, using MLs at this time will have less effect on dung beetles and will be more cost effective if other parasites are present e.g. worms or lice in young cattle.

Application methods

The choice of application method(s) will depend on:

- labour availability and cost
- treatment cost
- capital cost
- period of control
- paddock/mob management.

Buffalo fly tunnel traps have a high initial capital cost but once set up have minimal ongoing operating costs and are more cost effective when used with large numbers of animals.

For most sprays the capital cost of the treatments is low but the application cost (mustering and labour) is high.

Self-application methods such as back or side rubbers have low labour requirements.

Tags provide longer term effectiveness but require higher labour inputs at the beginning and end of the treatment period.

Most chemical groups (SPs and OPs) can be applied by a range of methods.

Using chemicals

- Always check that the chemical AND the application method for that chemical are registered for the intended use.
- Always read and follow the manufacturer's instructions regarding safety, application rates, application method, and frequency of use.
- Apply at the recommended concentration and treatment interval; incorrect concentrations or treatment intervals can accelerate the build-up of fly resistance.
- Take all appropriate safety precautions when using the chemicals. Most buffalo fly chemicals have high poison ratings such as S5, S6 or S7.
- Always check the Withholding Period (WHP) and Export Slaughter Interval (ESI) for the chemical/application method and plan treatments accordingly. Avoid using products with long ESIs for turnoff cattle.

Maximising the benefit

Develop an Integrated Control Strategy by addressing these factors:

- Plan and prepare well.
- Co-ordinate with your neighbours – if possible!
- Consider all parasites.
- Vary management actions according to climatic conditions.
- Use a combination of treatment/control methods.
- Rotate chemicals and chemical groups.
- Incorporate non-chemical strategies.
- Consider the potential impact on dung beetles – particularly early in the breeding season.
- Tolerate low buffalo fly numbers.

Further information:

The website of the Australian Pesticides and Veterinary Medicines Authority can be searched for detailed information on all chemicals registered for agricultural use.

A list of buffalo fly control treatments, current at the time of printing, can be obtained from the author.

Further information can also be obtained from state department websites and the MLA website.

Australian Pesticides and Veterinary Medicines Authority (APVMA) Website: www.apvma.gov.au

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Use of fire in grazed woodlands

Australia's woodlands are by their very nature unstable. In the absence of disturbance, a woodland will tend to thicken. The trees will increase in size until either competition between trees limits their growth or some calamity such as drought kills some of the trees. Old age is also a factor in tree death with the older trees often the first to die in a drought. Episodic wild fires along with climate change around 100 000 years ago and subsequent burning by Aboriginal people have also been implicated in the rise and dominance of fire-tolerant species in Australia, particularly the eucalypts.

Prior to European settlement, frequent and systematic burning by Aboriginal people was responsible for maintaining large areas as semi-open woodlands with a good layer of fire-tolerant grass growing between the trees. Periodic burning achieved this vegetative balance by keeping eucalypt and other native woody seedlings and suckers small enough to have minimal effect on pasture production.

Following white settlement fire was still used to help keep grazed eucalypt country open and productive but the intensity, timing, frequency and scale of fires differed from the Aboriginal 'fire-stick farming' regime.

In recent years burning has not been possible in many areas because the combined effects of poor summer rain and the introduction of *Bos indicus* cattle and the use of dry season supplements resulting have resulted in low fuel loads. Without regular burns the under-storey woody plants have been thickening up with a consequent loss of pasture production and ultimately also of carrying capacity.

Re-introduction of fire as a management strategy is essential for the long-term stability and productivity of grazed woodlands. Unfortunately, in many areas trees have grown above the height where fire will effectively control them, even when there is enough fuel to carry a fire.

Eucalypts

The 'TRAPS' woodland measurement program, part of the MLA sponsored project 'Understanding the dynamics of Queensland's grazed woodlands', showed that fire killed very few small, suppressed eucalypts but regularly checked their growth. Suppressed lignotuberous (a large underground 'root' that stores food for the plant) suckers can survive like this for a very long time (monitoring shows more than 25 years). Other work in northern Australia's savannahs has shown that most eucalypts taller than two metres are resistant to fire. Fire can be used to prevent woodland thickening in eucalypt woodlands and forests.

Wattles

The MLA-funded project on the effect of fire on wattles at *Wigton* near Gayndah in the Burnett highlighted the differences in the response to fire between wattle species. A spring burn killed almost all the mature wattle plants at the site. One species, early flowering black wattle (*Acacia leiocalyx*) responded to being burnt by producing a profusion of root and butt suckers as well as some new seedlings. Another black wattle species, *A. grandifolia*, only regenerated from seed and apparently did not have the ability to root sucker. Subsequent fires over the next five years reduced the population of both species to about the original population but kept those plants so small they had little effect on pasture productivity.

Without these fires the wattle regrowth would have completely dominated the pasture. The reaction of these two wattle species to fire is indicative of the effect on most wattles and, in fact, most acacias. Fire will keep wattles in check but as a general rule will not eliminate them.

Currant bush, Burrum bush

In central and north Queensland there has been an increase in the density of currant bush (*Carissa ovata*) and Burrum bush (*C. lanceolata*) over vast areas of cleared and uncleared semi-arid eucalypt woodlands. This represents a severe constraint on the availability of herbage to the grazing animal and reduces the already low carrying capacity of these beef cattle pastures.

In a study in the Mount Coolon area of central Queensland, plots heavily infested with currant bush were fenced to manage grazing and allow fuel to accumulate. These plots were burnt either once, twice or three times with burns either one or two years apart. After burning many of the larger currant bush plants fragmented into several smaller plants due to this shrub's habit of rooting along its sprawling branches. Few plants died as a result of burning but the fire greatly reduced the overall canopy area of the currant bush and allowed pasture grasses to re-colonise the areas formerly covered. No new currant bush seedlings were found.

Burning currant bush in spring is a viable option for controlling its canopy expansion. Usually conditions at this time of year are hot and dry, causing some stress to the current bush, but there

is a good chance of follow-up rain. This provides the greatest success by removing the above-ground portion of the plant at a time when pasture species will likely be able to respond to the reduction in canopy cover. A fire is required at least once every five years. For a good result at least one year's growth of grass needs to be available as fuel for the fire.

Fire as a management tool

If fire is to be used to maintain pastures in grazed woodlands and prevent woodland thickening, it is necessary to have a practical fire management strategy for the whole property.

In the semi-arid grazed woodlands of central and north Queensland it is necessary to burn at least once every five to six years. In south-east Queensland the fire interval may need to be less with a fire every three to five years. Missing one of these fires means tree seedlings and shrubs will be able to grow above the height at which fire will knock them back down to ground level.

In order to guarantee a successful fire, sufficient fuel is required. The easiest way to achieve this is to take advantage of the better grass growth experienced in better seasons. Ensuring sufficient fuel in drier years is more difficult and requires a reduction in stocking rate.

Whilst many landholders are reluctant to reduce stocking rates in poor seasons, it is probably the best option in the long run as it allows annual rotational burning of all paddocks, helping guarantee a stable, productive and sustainable pasture. The cost of alternatives, such as chemical treatment or mechanical clearing, has increased significantly in recent years. In many situations the use of these alternatives has been restricted by legislation.

Conclusions

- Australia's woodlands are not static and change over time with climate and fire.
- Fire is a preventative tool that checks the growth of eucalypts, acacias and other woody weeds to maintain a grassy understorey.
- In the absence of fire, grazed woodlands will tend to thicken at the expense of pasture productivity and ultimately carrying capacity.
- The use of fire to manage woodland thickening needs to be compared with chemical or mechanical alternatives, which are increasingly limited by economic or legislative controls.
- As a management tool, the use of fire needs to be deliberate and planned. This often includes adjusting grazing management to ensure sufficient fuel for an effective burn.

Adapted from an article by Paul Back, a woodland ecologist and woody weeds specialist recently retired from DPI&F.

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Soil organic matter and carbon sequestration in pastures

In the last *Beeftalk* issue we introduced Australia's carbon pollution reduction scheme and its implications for the beef industry. This article now addresses some of the questions from readers about organic matter, soil organic carbon, the impacts of cropping on soil carbon, and the potential to sequester carbon under pastures.

Soil organic matter and soil organic carbon

Organic matter is critical for healthy soils that support productive pastures. It makes soils resilient by providing food for soil microbes, provides a store of relatively available nutrients, and bonds soil particles for a stable structure. This organic matter includes living plants, animals and microbes, as well as litter on the soil surface and degrading and decomposing materials.

The soil biota (soil animals, plants, microbes) and the types of soil organic matter depend on soil moisture, temperature and the quantity and quality of the plant materials returned to the soil. The length of time various types of organic matter last in the soil is shown below.

- Plant residues on the soil surface (last for weeks–months)
- Buried plant residues and roots (last for months–years)
- Small fragments of 'particulate' organic matter that provide energy for microbes (last for years–decades)
- Highly decomposed 'humus' that supplies slow release nutrients for plants (lasts for decades–centuries)
- Resistant relatively inert organic matter (lasts for centuries–millennia)

Soil organic carbon is used to estimate organic matter levels. Organic matter is about 60% carbon,

so soils with 1% organic carbon will contain about 1.7% organic matter. Most agricultural soils in Queensland contain 0.5–2.5% total organic carbon in the top 10 cm of soil, which roughly equates to 5–25 t/ha of organic carbon or 8–40 t/ha of organic matter.

That's a lot of carbon and shows why soils are the third largest store of carbon on earth after oceans and geologic sinks like coal seams. Indeed, there's 2–4 times more carbon in soils than there is in the atmosphere and about 4 times more in soils than in all the vegetation on the earth. So while many people talk about planting trees, beef producers are interested in their ability to sequester carbon in their soils to improve their 'carbon budgets'.

Australia's hot and relatively dry climate and the high costs of measuring soil carbon makes the current economics of sequestration difficult, but there are opportunities to increase soil organic carbon which will help and also make soils healthier. To recognise these opportunities we need to understand how carbon works and why we have the current levels of soil carbon.

Soil organic carbon levels reflect inputs and breakdown

The level of organic carbon in the soil is determined by the balance between the amount of dry matter grown and returned to the soil and the rate at which the organic carbon in the soil is broken down by soil fauna and microbes. Consequently, soil carbon levels tend to be highest in cool wet climates where there is plenty of water to grow lots of dry matter and the cool conditions slow the rate of decomposition.

Ways to increase soil organic carbon in grazing systems

Beef producers can increase soil organic carbon by growing the best pastures they can and returning more dry matter to the soil. In Queensland, much of this extra carbon will then break down in our warm conditions to benefit our soils (support soil microbes, supply nutrients, maintain structure) and improve our soil carbon levels. So, growing better pastures that produce more dry-matter will sequester more carbon and make soils more resilient.

Key practices for achieving this are:

- grazing to maintain 'pasture species' that are Palatable, Perennial and Productive (3P)
- keeping at least 40% cover to maximise water infiltration
- introducing legumes to minimise nitrogen deficiency in grass pastures, and
- considering phosphorus fertiliser to maintain production.

Continuous heavy grazing (plant on right) reduces plant vigour and organic matter input to the soil

These practices will maintain the health of perennial grass tussocks that would suffer and produce less dry matter if subjected to prolonged heavy grazing (see photo). Good grazing practices also minimise the erosion which can dramatically reduce levels of soil organic carbon levels by removing the topsoil into which most of the organic matter has been deposited.

Carbon losses and gains in mixed farming–grazing systems

Soil organic carbon levels usually decline from their native levels when we grow annual crops. Indeed, a recent 'Healthy Soils' project compared carbon levels on over 140 grain farms and showed that cropping typically reduces soil organic carbon levels by about 40%. This loss of between 5 t/ha and 10 t/ha of soil organic carbon (or 8 t/ha to 17 t/ha of organic matter) reduces the soil's ability to support biological activity and supply nutrients such as nitrogen to crops. It also reduces the capital value of the land because each 0.1% change in soil organic carbon on a soil test (or 1.7 tonne of good quality soil organic matter) may contain up to $200 worth of nitrogen, phosphorus and other nutrients. These losses occur because:

- annual crops produce less dry matter than perennial native systems
- cultivation breaks soil aggregates and exposes organic carbon to decomposition
- erosion removes surface soil that is rich in organic carbon
- fallowing for soil moisture keeps the soil moister, which leads to more decomposition of soil organic carbon over summer than native systems that keep the soil dry (our fallows store only 20–25% of the rainfall; most of our rain

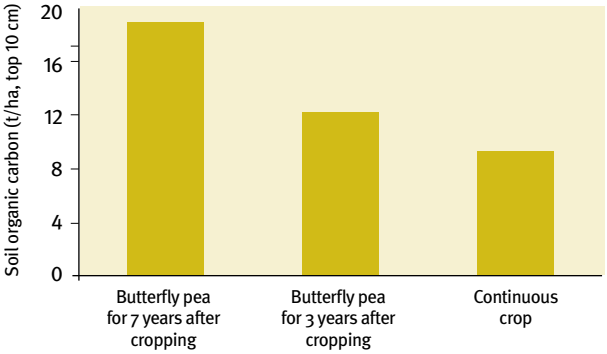
is wasted as evaporation and grows little that contributes dry matter back to the soil)

- crop species break down faster and have less extensive root systems, and
- we harvest and remove product for sale.

Soil organic matter levels will then reach a new lower 'equilibrium' for cropping where the dry matter inputs equal the continuing decomposition of organic matter by soil biota. Remember, the amount (or lack) of dry matter returned to the soil is a key driver for the declining levels of soil organic matter in our crop lands. We can maximise the amount of dry matter returned in cropping systems by growing as many good crops as we can, maintaining stubble and never burning or baling stubbles.

Tillage and soil disturbance breaks open soil clogs and speeds up carbon breakdown to some extent. The major benefits of zero-tillage cropping systems in Australia come from growing more and bigger crops rather than from incorporating stubble.

Soil carbon improves with mixed pastures (e.g. butterfly pea)



WANTED – Weaners for drench comparison project

Do you:

- Suspect your weaners are affected by worms after weaning?
- Routinely treat with the same drench?

Would you like help finding out whether worms are a problem for your weaners? Help is at hand!

Queensland Primary Industries & Fisheries (QPIF) is seeking cooperation from graziers who

- have between 40 to 60 beef weaners in one line that could have worms
- are (preferably) located in higher rainfall areas of coastal Queensland.

QPIF will monitor the worm burden in your weaners for up to 6 months after weaning. If worms are present in significant numbers we would like to trial and monitor the effectiveness of a number of drench types, including a new drench formulation that will be released shortly.

If you are interested in being involved in this Weaner Drench Evaluation Program, please contact the QPIF staff, based at the Animal Research Institute Yeerongpilly, listed below.

Wayne Ehrlich
Phone: 0417 685 424
Email: wayne.ehrlich@deedi.qld.gov.au

Maxine Lyndal-Murphy
Phone: 07 3362 9447
Email: maxine.lyndal-murphy@deedi.qld.gov.au

Forage crops that are grazed rather than baled will help maintain soil organic carbon levels because the dry matter is largely returned to the soil and not sold off-farm. Manures also help but break down very quickly and so we have to keep using them to maintain levels. We can also add charcoal or other 'Char' products which do lift the soil carbon levels but they are relatively inert and do little to improve the soil.

Research confirms the best strategy for building soil organic carbon is to grow perennial pastures that have extensive roots and produce more dry matter. Data from the 'Healthy Soils' project again shows what is possible. For example, the chart below shows the steady improvements in total soil organic carbon from 3 years and 7 years of a mixed grass and butterfly pea pasture on a heavy clay soil near Emerald. These pastures showed similar proportional increases in total nitrogen and microbial biomass and illustrate the potential for pastures to sequester carbon and rebuild resilience into these soils.

To date, there has been considerably less data available from extensive grazing systems for comparing soil organic carbon levels and the types of organic carbon that develop under different pastures and grazing management systems. New projects funded by the Australian and State Governments are assessing carbon levels in different pastures and grazing systems across the nation. In southern Queensland, the Murilla LandCare Group based in Miles has gained Commonwealth Government funding through a FarmReady Industry Grant to engage 50 landholders in the Miles, Dulacca, Drillham, Tara and Condamine areas to compare soil carbon levels under their pastures. Expected comparisons include 'good' vs 'poor' native pastures, native pastures vs sown pastures, and vigorous vs rundown buffel pastures. Soil sampling will be carried out on all participating properties so that producers can assess their situation on a paddock-to-paddock basis. This will provide a snapshot of current soil carbon levels and a good idea of the potential for further sequestration in beef production systems in southern Queensland.

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Soil biology – what is it all about?

There has been much talk in recent years about our soil biology and how it can help pasture and crop production. A plethora of information and products claim to improve our soil biology. Add to this the issue of soil carbon and soil biology can become complex and confusing.

So what is soil biology and how does it help our production?

Soil biology starts with carbon. Humus present in the soil provides food for the most basic single-celled animals, which then provide a food source for the next animals up the food chain and so on. The interactions between life, predation, death and decay of these animals in the soil make up the complex system known as a soil food web.

The soil food web describes the basic relationship between all levels of life in the soil. The photosynthesis and growth of plants provide the basis for this food chain, where the ultimate consumers are grazers and predators. In turn the waste products of the higher level groups as they live, die and decompose provide food for the plants. In some cases the loss of one animal or plant species from the soil food web can lead to a breakdown in the whole cycle.

The sheer mass of soil organisms is remarkable. Research at Beverley in Western Australia found approximately 800 million protozoa/m^2, 900 000 nematodes/m^2 and 130 000 mites/m^2 in soil under pasture. In NSW research on cropping soils found 486 kg per ha (carbon) of microorganisms to a depth of 30 cm in a stubble paddock. This equates with more than 1 adult-equivalent beast grazing in the top 30 cm of soil per hectare.

These soil microorganisms work to:

- fix nitrogen
- increase soil carbon
- release locked up soil minerals
- detoxify poisons
- feed plants and soil life
- build soil structure.

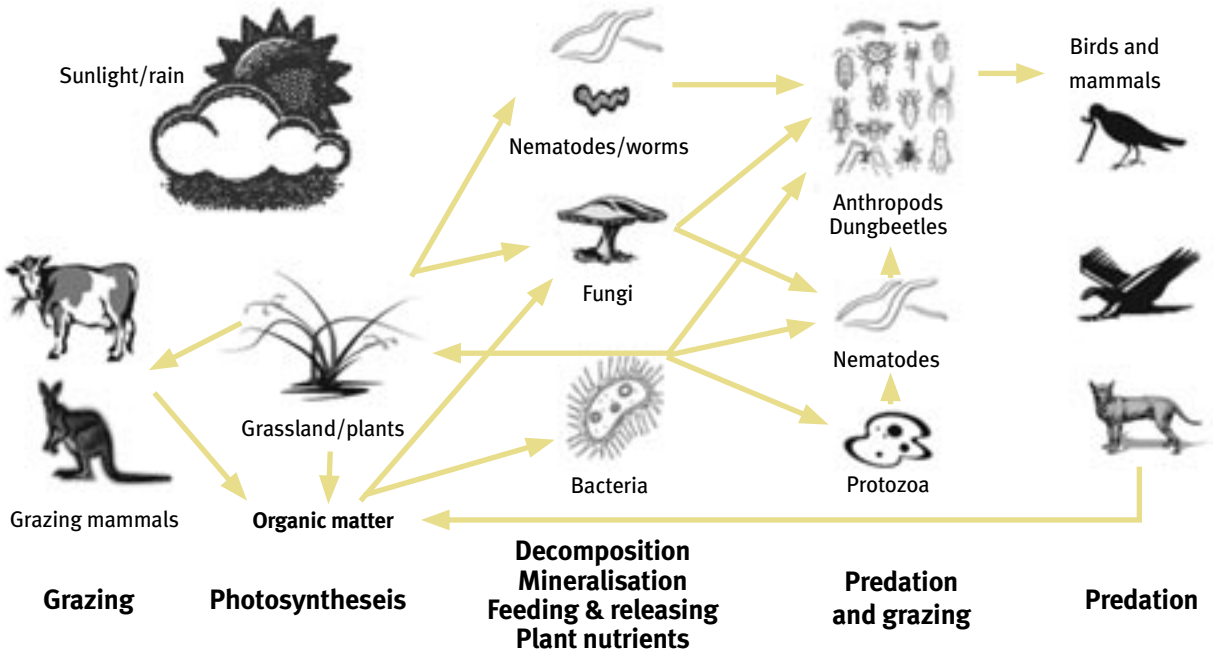
In general, the more biological life in our soil, the greater the potential for improving or maintaining current production levels.

To increase and maintain soil biology in pastures we need to:

- maintain groundcover at 50 per cent organic matter
- reduce rainfall runoff and erosion
- spell paddocks to allow for pasture recovery
- maintain stocking rates appropriate for current seasonal conditions
- increase/maintain pasture species diversity.

Soil biology suffers if there is insufficient groundcover because:

- soil moisture is decreased and temperature increased
- wetting/drying cycles are faster
- organic matter in the soil is reduced, and is



often only provided by one or two plant species rather than by a range of species, and

- soil may be disturbed by erosion, vehicle traffic and tillage.

Claims are made for the effectiveness of many products and practices, such as compost tea, for increasing soil biology. Some studies on cropping soils have found that minerals will increase the diversity of soil biology simply because there are different substrates for the soil organisms to live on. In general, however, there has not been a great deal of research in Australia.

The websites below provide considerable information on a range of practices and products should you consider undertaking a small-scale trial on your own property.

Further reading:

www.soilhealth.com
www.asssi.asn.au
www.soilfoodweb.com.au
www.soilhealth.segs.uwa.edu.au
http://attra.ncat.org/attra-pub/PDF/compost-tea-notes.pdf
http://soils.usda.gov/sqi/publications/publications.html#btn

References:

http://www.soilhealth.segs.uwa.edu.au/components/measuring

http://www.soilhealth.com/animals/

'Organics and Soil Carbon: Increasing soil carbon, crop productivity and farm profitability' by Andre Leu, accessed at: www.amazingcarbon.com/Leu%20-%20Organics%20and%20soil%20carbon.pdf

'Future Directions for Dryland Soil Management Under Direct Seeding Techniques – an Australian Perspective: Part 1' by Neil Southorn, Ian Packer, Brian Murphy and John Lawrie, accessed at http://www.soil.org.au/vol5_p.htm

Further information:

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Termite control in cattle yards

It's becoming increasingly difficult to use chemicals to control termites in cattle yards. The problems associated with organochloride (dieldrin etc) residues in meat in the late 1980s and a number of other chemical residue problems have made everyone very cautious about what is recommended or used. A number of chemicals have been withdrawn from the market and most chemical companies have removed any recommendation for use near livestock from their labels.

Two chemicals that may be able to be used are chlorpyrifos and permethrin. Even products containing these chemicals do not specifically say that they are safe to use where livestock may be held or grazed. The best recommendation is to talk to your retailer or company representative.

Creosote derived from coal tar can still be used to treat cattle yards. This product should be handled carefully as some users have had allergic reactions.

An old but proven method to control termites in posts, recommended by Ron Kirk from 'Yenda' Brahman stud at Gayndah, is to use coarse salt. Put a cupful of salt in the bottom of the post hole and another half to one cupful about one third of a metre from the bottom of the hole. Half to one cupful near the surface will stop grass growing around the post.

Alternatives to chemical weed control

The cheapest weed control option obviously is to prevent weeds becoming established in the first place. To ensure we do not introduce weeds onto our property, we can adopt these weed management principles:

1. Awareness – be aware of potential and existing weed problems.
2. Detection – look for any new weed infestations before they become large or widespread.
3. Planning – prioritise the treatment of weeds by considering which weeds most threaten the profitability of your grazing enterprise.
4. Prevention – far better than a cure; paying $100/hour for a contractor to clean down seed-laden machinery is much cheaper than any 20 litre drum of chemical.
5. Intervene – doing it early keeps a potentially large problem manageable.
6. Control and monitor – regularly check areas where you have controlled weeds to ensure success.

In many situations the most efficient way of dealing with a weed problem is to use a combination of controls. For example, large

infestations of lantana are best removed mechanically or by burning; regrowth can be treated with chemicals or new seedlings removed by hand.

Faced with the rising cost of chemicals and uncertainties about chemical safety, many producers are considering alternative weed control options.

Mechanical control is the most obvious non-chemical weed control option but it is not covered in this article.

Much of the alternative weed control technology has been developed for cropping situations and may not be applicable to woody weed treatment. That said, some of the alternatives to chemical weed control are:

- **flame weeding**
- **steam weeding**
- **oil-based herbicides**
- **vinegar**
- **UV treatment**
- **soil fertility management**
- **animal/species management.**

Flame weeding uses LP gas as a direct flame or an infrared burner to contact plants and produce heat that will vaporise water in the plant cells. The plants lose moisture and photosynthesis is inhibited. To test if the flame weeding has been successful, squeeze a treated leaf between your thumb and finger; if a visible thumbprint remains this indicates the weed has been subjected to sufficient heat and should be dead within three days. Flame weeders are commonly used in horticulture on tractor-mounted units. Handheld wands are also available for use on individual plants. The main disadvantages of flame weeding are the danger of fire and the cost of gas.

Steam weeding has been used in many horticultural applications. Steam weeding is more effective at killing plants than flame weeding. However steam weeders generally require significant energy inputs to heat the water and can require significant amounts of water.

Vinegar (acetic acid) has been found to be a useful herbicide for broadleaf weeds and grasses. Generally the acetic acid content in vinegar is about 5% but a level of 10% is needed to treat most weeds. One proprietary brand also has 4% salt with the acetic acid. Trials have shown that 10 to 20% concentrations of vinegar are effective on broadleaf weeds but less successful on grasses. Vinegar may seem innocuous but a concentration of 10% acetic acid will cause skin irritation, produce fumes and potentially cause eye irritation/damage.

Oil-based herbicides are generally based on pine oil. These sprays remove the outer wax layer of the plant, causing it to dehydrate. Oil-based herbicides also reduce the viability of any weed seeds in the soil that are contacted by the spray. Some of these sprays are registered for use on organic farms. Application times and methods differ from those of other common herbicides so this must be taken into consideration.

UV treatment (ultra-violet light) is being used in Europe as a weed control method which may have application here as the science and practicalities of the method are further developed.

Soil management can affect the number and type of weeds that will grow. A number of weed species have specific soil requirements such as low calcium or phosphorus. A soil test and a change in soil fertility based on the soil test may be the easiest option to control such weeds.

Animal management or variation in grazing species can be a useful management tool. Camels and goats have been used with success in controlling some weeds but they may be more difficult to manage than the weed. This would need to be investigated in depth before adopting this type of weed management.

Before we try to control any weed it is important to ask:

1. Is the weed a threat to productivity, health or the environment?
2. Is the weed costing more to control than it is worth?
3. Is the weed a symptom of dry seasons or overstocking?
4. Is the weed Declared and required to be controlled by law?

More information from:

www.richgro.com.au – vinegar/salt herbicide (search on 'acetic')

www.acaengineering.com.au – steam weeders

www.certifiedorganics.info – pine oil-based herbicide

www.gameco.com.au – flame weeders

Further information:

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Organic treatments for parasites

Internal parasites

Many compounds shown to be effective against early worm stages in laboratory studies have been generally disappointing when tested in live animals. Treatments administered orally are often broken down by microbes and enzymes in the cattle gut before they can affect worms. Homeopathic remedies have also been tested but usually yield disappointing results in structured trials.

Organic drenches have been shown to have measurable effects, but the reduction in worm numbers is generally much less marked than with chemical parasiticides (less than 50% reduction compared to greater than 95% expected from an effective chemical drench). Hence where organic drenches are used management approaches to reduce exposure of young stock to worms are particularly important.

The question of safety and toxicity with organic treatments is an important one. Just because a treatment is deemed to be organic, it cannot be assumed that it is necessarily not toxic to animals or humans and does not leave residues.

Some compounds tested with possible effect include drenches made from extracts of wormwood (*Artemisia* spp.), neem, garlic, a range of tropical plant extracts (some of these known to have side effects), cider vinegar, various clay products and diatomaceous earth. Essential oils such as eucalyptus oil, lemon myrtle oil and clove oil have also been suggested, but the concentrations needed could irritate mucous membranes and present a toxicity risk. Copper, often administered as copper sulphate, can provide good effect against barbers pole worm (*Haemonchus*) but care also needs to be taken to avoid toxicity problems.

With organic treatments for worms it is still important to avoid treating when treatment is not really necessary. Treating older stock is seldom warranted. In young cattle other diseases or nutritional upsets can cause similar signs to worms so it is wise to get a worm egg count done to confirm a worm problem before treating for worms.

Strains of the bacteria *Bacillus thuringiensis* (*B.t.*) that kill larval and adult worms have shown promise in research studies. *B.t.* is registered in Australia for insect control on plants but not for application to animals.

The nematode trapping fungi, *Duddingtonia flagrans*, has provided good effects against worms when fed to cattle and is registered for gastrointestinal worm control in some overseas countries. However it is not yet registered in Australia. *Duddingtonia* does not affect worms in the animal's gut and is basically a pasture cleaning technology. The spores are eaten by the cattle and then passed out in the faeces to germinate and trap newly hatching worm larvae by means of sticky loops.

External parasites

Animals can generally tolerate a level of external parasites without suffering any significant production loss. For example, treatment is generally only recommended for buffalo fly when numbers exceed 200 per animal (100 per side). Treatment for ticks is often recommended only when more than 20 ticks larger than 5 mm are seen on one side of several animals. Lice are usually only a problem in stressed animals and generally cause little production loss, although skin damage, poor appearance and damage to fixtures from animals rubbing can be problems. In most animals lice numbers will fall to non-detectable levels during summer without treatment.

For external parasites, a quite extensive range of compounds, particularly plant extracts, have been

Organic production systems and severely parasitised animals

Clearly, leaving animals untreated where animals are under stress from parasites and no effective organically accredited treatment is available is unacceptable from a welfare perspective.

Most organic accreditation systems provide for the use of non-organic accredited compounds to treat animals under stress from parasites without compromising the overall accreditation of the property. These provisions usually include conditions that the treated animals:

- are removed from organically accredited land
- do not come into contact with other animals in the herd, and
- must not be sold into organic markets.

Producers should check with their accrediting body for specific guidelines on how to deal with heavily parasitised animals.

It should also be noted that all commercially sold parasiticides, whether organic, biological or synthetic chemicals, must be registered before they can be legally applied to food animals. The APVMA considers that a product is likely to require registration if any claim is made on a label, advertisement or website that the product is intended to modify the health, production, performance or behaviour of animals.

For full details on what constitutes a veterinary chemical product contact the APVMA:

Postal: APVMA, PO Box 6182, Kingston, ACT 2604
Phone: 02 6210 4700
Website: www.apvma.gov.au/about_us/contact.shtml

demonstrated to have effect as biocides or repellents and a number are currently under research. They can be effective in reducing pest numbers but are generally less persistent than conventional chemical pesticides and may require frequent re-application. Most organic treatments will not kill lice eggs, necessitating a second application after all of the eggs have hatched, about 2-3 weeks later, to eradicate lice.

The problem of short protection times can be overcome to some degree by self-application with dust bags, back rubbers or rubbing posts. QPIF is currently studying the effectiveness of using these application methods to administer organic treatments for buffalo fly.

The most commonly noted compounds for controlling external parasites are natural pyrethrins, rotenone and sulphur. These are included with synthetic chemicals in some commercial formulations, but only one product containing no synthetic pesticides, a dust containing rotenone and sulphur, is registered for cattle and this only for controlling lice on calves.

Other commonly noted plant extracts shown to have activity against ectoparasites include neem and a range of essential oils, in particular tea tree oil, eucalyptus oil, and geraniol (found in many plants including lemongrass, citrus and geranium). Geraniol has shown good effect against horn flies, a northern hemisphere species closely related to buffalo fly.

A number of parasite control products registered for use on companion animals contain essential oils and eucalyptus oil is a constituent (together with synthetic chemicals). One such project is registered for application to cattle for protecting wounds against flystrike. Cypress oil extracts have shown activity against ticks in QPIF studies and research into the effects of tea tree oil against buffalo flies and lice is currently underway.

Some other compounds have physical action against ectoparasites. Diatomaceous earth can disrupt the wax layer on the insect cuticle, leading to dehydration and death. Some soaps with a similar action and oils that block the insects' spiracles (breathing apertures) or directly affect the insect nervous system have also been shown to have effect against ectoparasites. These compounds are not generally as toxic as chemical pesticides so it is critical to treat animals thoroughly to gain good effect; a number of applications may be necessary.

Some biopesticides have also been shown to be effective against cattle ectoparasites. Different strains of *Bacillus thuringiensis* (*B.t.*) have been shown to have effect against buffalo flies, lice and ticks, although they have not been registered for use on cattle. The fungal biopesticides *Metarhizium anisopliae* and *Beauveria bassiana*, which infect lice, ticks and buffalo flies, have shown promise in QPIF studies. Strains of biopesticides vary in efficacy and it is important to choose a suitable strain to fit the use.

Parasitic wasps, similar to those being tested by QPIF for release in feedlots for nuisance fly control, can also parasitise buffalo fly pupae and may help to regulate the size of fly populations. Entomopathogenic nematodes, small worms that can invade and kill insects and some ticks, may be able to attack the pasture phase of flies and ticks; these nematodes have not been tested for application to cattle. In addition, as previously reported in *Beeftalk*, QPIF and the University of Queensland have commenced research into the potential of an intracellular bacterium (*Wolbachia*) as a biocontrol for buffalo fly.

Further information:

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Timely tips for south-east Queensland

Spring
September, October, November

BREEDING

Breeders

Assess breeder condition for mating. First calf cows may need extra care.

Vaccinate maiden heifers for vibriosis (2 vaccinations 4 to 6 weeks apart), and possibly three-day sickness and pestivirus.

Vaccinate maiden heifers for leptospirosis if a problem has been diagnosed (2 vaccinations 4 weeks apart).

Calves

Make up calving kit (calf pulling gear, chains, buckets, clean water, antiseptic, gloves, boots and overalls). Have all calving gear clean and ready to go.

Wear appropriate safety gear (long gloves etc) when assisting a birth. Leptospirosis (from infected urine),'Q' Fever etc are very serious diseases in humans.

Know telephone number of local vet.

If possible keep calving cows, especially heifers, in readily accessible paddocks fairly close to homestead.

Check calving cows regularly, especially heifers.

Record all cows and heifers with calving problems; sell them and their calves as soon as practical.

Order NLIS ear tags or rumen boluses for calves branded this year.

Bulls

Evaluate information available on potential bull supplies.

Purchase bulls according to guidelines. Remember weight (weight gain) and numbers (fertility) are what make money.

Check purchased bulls are in working condition, not fat sale condition.

Check all bulls for soundness (physical and reproductive) as well as for injuries, stiffness of gait, cuts or swelling. Cull any bulls with permanent defects.

Obtain bull breeding soundness evaluation tests for all bulls to be used.

Cull bulls on age (over 6–7 years).

Vaccinate bulls for three-day sickness (BEF) and vibriosis (2 doses 1 month apart initially, then annual booster) and pestivirus.

Check mating paddocks are secure.

Avoid mixing bulls of different ages if possible.

Growing cattle (steers and cull heifers)

Consider vaccination against three-day sickness (BEF), particularly forward stock close to turnoff.

NUTRITION

Review dry season management plan and climate forecasts.

Reassess pasture quantity and quality in relation to ground cover and feed values at the end of the dry season.

If season hasn't broken, feed energy and protein supplements to heavily pregnant or lactating breeders and to weaners to maintain liveweight.

Evaluate effectiveness and cost benefit of Winter supplementation program.

Re-order supplement supplies for next dry season

Summer
December, January, February

Breeders

Mate heifers with young bulls earlier than rest of herd.

Heifers should be well grown and in strong condition but not over fat.

Calves

Brand, dehorn, castrate, tag and vaccinate (5-in-1 or 7-in-1).

Enter new calves onto herd performance recording program.

Bulls

Observe bulls in mating paddocks. Are they all working?

When mating multiple bulls with a group of cows, put same age and weight bulls together to avoid dominant behaviour by bigger older bulls.

Growing cattle (steers and cull heifers)

Weigh; assess individually rather than on herd average.

Assess performance against required target.

Consider HGP implants for steer calves for non-EU sale.

Evaluate markets and plan sales. Do you need to book cattle into meatworks or feedlots?

Start phosphorus supplementation program in deficient areas. Continue until end of growing season.

Timely tips for south-east Queensland

PASTURES

Check pastures at the Spring break: Is there enough ground cover?

Consider spelling pastures early in the growing season to benefit pasture composition. Prolonged heavy grazing of fresh growth will reduce the proportion and vigour of desirable pasture species.

Consider burning native pastures to maintain good pasture condition and control woody weed growth.

Check and control weeds before they seed. Actively patrol known 'hot spots'. Check supplementary feeding areas for weeds.

Watch long-range weather forecasts for suitable time to plant pasture.

If pasture development is a part of your overall plan, sow pastures if seasonal conditions are favourable. If you can't get the pasture in by the beginning of October, wait until February to reduce the risk of failed establishment due to dry and/or hot conditions over November–January.

Evaluate post-drought pasture management.

Spell leucaena for at least 2 months.

Consider applying maintenance fertiliser to sown pastures.

Lock up paddocks to build up pasture grass seed banks in soil.

Consider growing a Summer forage crop to carry cattle while pasture paddocks are being spelled.

Consider setting areas aside for re-forestation.

PARASITES & DISEASES

Vaccinate breeders, bulls and growing cattle as appropriate (see sections under Breeding and Growing Cattle above.)

Obtain cattle dip analysis and adjust chemical level if necessary.

Check early calves (late Winter) for scrub ticks.

Start tick control program.

Check weaners for worms (faecal sample to WormCheck program) 1 month after season has broken.

Continue tick control program.

Check young cattle for worms. Treat if necessary. Send faecal samples for WormCheck 2 weeks after treatment to check for worm drench resistance. Take samples from smallest animals.

Control buffalo fly where applicable with correct sprays, insecticidal ear tags and buffalo fly traps.

Make sure all chemical treatments used are entered into correct files for trace-back.

BUSINESS

Meet with all staff to discuss progress of business and plan for future – retirement and succession planning.

Review overall property management and any changes that may be necessary.

Review breeding program; assess whether it is producing animals suitable for market requirements.

Have annual health check.

Have a break with family over Christmas.

Evaluate markets and plan sales for coming year.

Review marketing options.

Update the NLIS database with purchases, sales and deaths.

Check all permits and registrations are current.

PROPERTY MAINTENANCE

Check mating paddocks are secure.

Check river and creek crossings before wet season.

Before end of dry season check for leaking underground piping by surveying paddocks for green patches.

Maintain fire fighting equipment, extinguishers etc and ensure staff are fully trained in their use.

Clean around buildings and check gutters are free of leaves.

Ensure fire breaks are maintained and serviceable.

While water is in dams creeks etc do annual maintenance on windmills and watering points.

Do workplace health and safety audit of property.

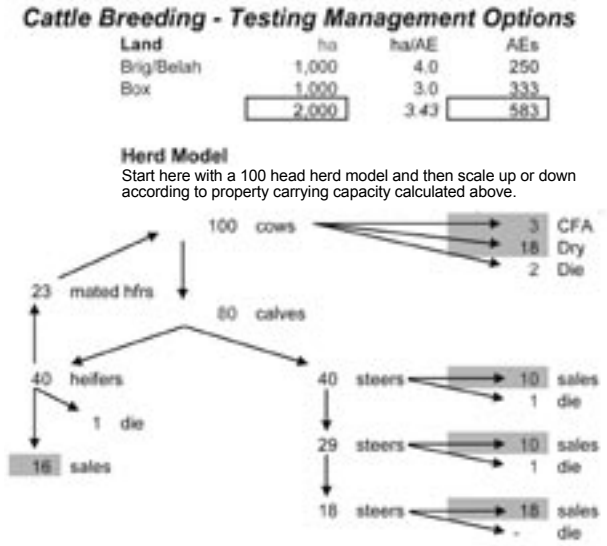
Do annual electrical safeties check on all household and farm equipment.

Consider attending Chemical Accreditation Program through AgForce SMART train.

Carry out vehicle and machinery maintenance during 'wet season' break; especially look after dry-season supplement feed-out trailers etc so they are ready for the next dry.

Clean up shed.

Testing your management options



Are you interested in analysing the economics of your grazing enterprise?

Would you like to determine the profitability of your whole farm system?

Might a change in your production system result in greater profit?

This one-day workshop combines a simple, powerful process with an easy-to-use spreadsheet tool to assess the profitability of enterprise and management scenarios and answer questions such as:

- What are the economics of breeding versus trading?
- Am I better off selling stores or finishing cattle for slaughter?
- What if I buy more land?
- How economical is supplementary feeding really?

The 'whole farm economics' format enables you to construct a concise economic summary of your business. Using this, it will be easy for you to test what drives profit.

During the workshop we will methodically assess the profitability of enterprise and management changes for a hypothetical property using a simple excel spreadsheet (which you can take home). We will be using the tools to ask 'what are the economics of...' a range of components in managing a grazing enterprise. You learn the process and get the tools.

The workshop is FarmReady-approved, which means eligible participants can claim 100% reimbursement for eligible attendance-related costs. The course fee is $330 (GST inclusive) and half price for a second or third person from the same business.

For more information or to register, please phone your local *Future Beef* team member:

Brisbane	Felicity McIntosh	3362 9538
Bundaberg	Bill Schulke	4131 5828
Dalby	Roger Sneath	4669 0808
Gayndah	Russ Tyler	4161 3726
Gympie	Sonia Sallur	5480 4412
Ipswich	Ian McConnel	0407 168995
Kingaroy	Damien O'Sullivan	4160 0717
Miles	Kay Taylor	4628 5200
Nambour	Jim Page	5453 5819
Roma	Tim Emery	4622 9903
Toowoomba	Mark Best	4688 1611

Or contact Roger Sneath at
Email: roger.sneath@deedi.qld.gov.au

Mineral deficiencies

Supplementation with minerals is often seen as the 'silver bullet' or 'cure all' for many production problems. This is rarely the case.

While deficiencies of some minerals have been recorded in south-east Queensland, the main nutrients limiting production are energy and protein. In many cases where a mineral deficiency has been diagnosed, correcting that deficiency has not lead to an economic increase in production. It is important to ensure that the intake of energy and protein is adequate before any mineral supplementation is started.

Remember, a soil mineral deficiency for some crops does not equate to a deficiency for grazing cattle. If you are looking at soil tests results, make sure these are interpreted for cattle requirements and not for cropping.

If you suspect you have a mineral deficiency on your property, follow these steps to ensure a correct diagnosis:

- Is the supply of energy and protein adequate?
- Is there a history of a mineral deficiency on your property or in your district?
- If you believe testing is necessary, seek professional advice to
  - ensure the correct test is done
  - ensure a correct interpretation of the test results.
- If a deficiency is indicated, do some test supplementation and compare any increase in performance with the costs involved.

Further information:

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Mining – Landholder rights?

What do you do when a mining, oil or gas company tells you they want to come onto your property and explore for minerals or gas and that there's nothing you can do to stop them?

With nearly 80% of Queensland now subject to Mineral Exploration permits, Mineral Development licences or Authorities to prospect for petroleum, many landholders will find themselves in this situation. For property owners this prompts many questions and a great deal of concern regarding their rights and future.

The Queensland Government has appointed Toowoomba-based Legal Aid Solicitor Glen Martin to provide landholders with free legal advice and assistance regarding mining issues and related activities including mineral exploration, gas and oil exploration and production, gas and oil pipelines, fossicking, quarrying and infrastructure development.

With the lack of real cohesiveness and integration across the relevant areas of law, and the absence of judicial authority specific to compensation resulting from gas and oil exploration, the issues regarding mining are challenging.

Glen urges landholders to seek legal advice as soon as they are approached by any mining, oil or gas companies wanting to enter their land. His experience suggests that land owners who enter into compensation agreements without legal help may be happy with the outcome at the time but can find themselves severely disadvantaged down the track.

Specialist lawyers such as Glen can provide landholders with advice, help to interpret and draft documents, and assist with negotiating with mining, oil or gas companies. Although Glen does not represent landholders in court, he can represent people in compensation agreement negotiations and provide a specialist opinion to clients and their private solicitors about their cases and related court proceedings.

Glen is also a member of Agforce's mining taskforce which is comprised of organisations such as the Queensland Resources Council, Australian Petroleum Production and Exploration Association, Australian Mining and Exploration Council, Queensland Farmers Federation and Department of Environment and Resource Management.

In Glen's experience, many companies take their landholder liaison very seriously, approaching the process in a proper manner and not just rolling up to a landholder's doorstep dictating what is going to happen.

Companies need to be genuinely courteous and sensitive and need to take a realistic approach to compensation. They must be willing to discuss the needs of the landholder and enter into negotiations that reflect the true value of the impact of any exploration or mining-related activities and the landholder's potential losses. Companies also need to manage and monitor the actions of their contractors.

Glen can initially provide up to six hours of advice and minor assistance to rural landholders impacted by mining and related issues. This can be extended to 35 hours for complex matters.

Further information:

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Gerry McKie
Community Liaison Officer
Queensland Mines and Energy
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Waanda McCarthy
Deputy Mining Registrar, Roma
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Todd Ellis
Deputy Mining Registrar, Roma
Phone: 07 4624 1540

Further useful information is provided at:
http://www.dme.qld.gov.au/mines/land_owner_occupier_information.cfm

Book review

On the (growth) path to profit

On the (growth) path to profit examines the extensive research conducted by the Beef CRC into cattle growth paths and the effects of growth restrictions during pregnancy, lactation, backgrounding, finishing and just prior to slaughter.

This booklet is the latest publication from the Cooperative Research Centre for Beef Genetic Technologies (Beef CRC). Following on from *Science for Quality Beef* (2007), *Key Messages for Commercial Breeders in Southern Australia* (2006) and *Producing Quality Beef* (2003 and 2004 editions), *On the (growth) path to profit* identifies opportunities to profit from research carried out by the Beef CRC.

On the (growth) path to profit includes case studies that demonstrate Beef CRC research in the farm environment and concludes with beef extension network contacts for Australia and New Zealand.

On the (growth) path to profit can be viewed online at http://www.beefcrc.com.au/Publications#Growthpathsbook and is available for free by contacting:

Alison Betts
Communications Manager
CRC for Beef Genetic Technologies, Armidale
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What is a zoonotic disease?

Key points

- A zoonotic disease is a disease that can be transmitted from animals to humans.
- The risk of infection from a zoonotic disease is low, but producers should take care to prevent some of the more serious or common bacterial and viral infections.
- Good basic hygiene, careful herd and flock management and, in some instances, vaccination can mitigate the risks of contracting a zoonotic disease.

Q fever

Q fever can be carried by domestic and wild animals. The wind can spread the bacterium, which can live in the dust for many months.

Animal handlers, farmers, veterinarians, meatworkers and biological researchers working with pregnant animals are most at risk. Infection may produce a sudden illness similar to the flu. About one third of those with Q fever are hospitalised, mainly due to heart effects. Deaths are rare but 10–20% of people have prolonged fatigue which may prevent a few from ever returning to work.

Strict hygienic practices must be followed when handling pregnant animals, hides, wool, straw or other contaminated material. Prevent the inhalation of dust or fluid droplets; disinfect and dispose of material; and treat cuts and abrasions promptly.

A very effective vaccination for preventing Q Fever is available.

Leptospirosis

Leptospirosis affects all farm animal species and can be fatal. Clinical signs are fever, haemolytic anaemia, abortion, infertility and weak newborns. In cattle, a specific form of mastitis, known as milk-drop syndrome, can occur.

Leptospirosis is spread mainly by ingestion or by contamination of cuts and abrasions by the urine of infected animals. Leptospirosis is generally not transmitted from person to person. Water in ponds or pools that has been contaminated with urine also poses a risk. Wild pig hunters are at risk too.

Use good personal hygiene. Wear boots when handling stock. Avoid contact with animal urine. Use rubber or plastic gloves if there is the possibility of contact with urine. Cover cuts and abrasions with waterproof dressings. Regular vaccination of cattle (particularly in dairies) and pigs may reduce the risk of spread.

Vaccinating animals against this disease is the best way to prevent it from affecting production and being transferred to humans.

Brucellosis

Brucellosis in cattle was eradicated from Australia by the end of the 1980s but a few people who caught it from cattle before eradication may still suffer ill effects from the disease.

A form of this bacterial disease occurs in wild pigs. Most human infections in Australian now are related to wild pig shooting and processing in Queensland. People dealing with wild pigs should wear protective clothing including boots, gloves and eye protection.

Hydatid disease

Hydatid disease is associated with cysts that can form and grow in the liver, lungs, brain, kidneys, bones and other tissues. This disease occurs in humans and animals such as cattle, pigs, goats, wallabies and kangaroos.

The cysts are stages in the life cycle of a small tapeworm of dogs and dingoes. The dog or dingo eats the cysts, the tapeworm develops, and the eggs that are shed develop into new cysts if humans or animals (other than dogs or dingoes) eat the microscopic eggs.

To prevent infection, ensure children and adults wash their hands after handling dogs and before eating or smoking. Don't allow dogs access to uncooked sheep, wallaby, kangaroo, cattle or feral pig offal. Stop dogs from roaming. Treat dogs regularly for tapeworms with tablets containing praziquantel. Avoid handling dingoes. Take care in areas that could be contaminated with dingo faeces.

Hendra virus

Hendra virus is a very rare cause of disease in horses and humans but it is highly fatal. Scientists believe that Hendra virus is normally a virus of flying-foxes (fruit bats). The few cases of Hendra virus infection in humans have resulted from very close contact with infected horses. Hendra virus is highly infectious if a human is exposed to a sick horse.

Ross River virus

First isolated from *Ochlerotatus vigilax* (previously called *Aedes vigilax*) mosquitoes collected in 1959 near the Ross River in Townsville, the cause of Ross River virus (RRV) disease was confirmed in 1971.

Fever and other constitutional symptoms are usually slight. A rash can occur up to two weeks before, or after, other symptoms. The rash, absent in about one-third of cases, is variable in distribution, character and duration and may be associated with spots inside the mouth, on the palates and inside the cheeks. Rheumatic symptoms are present in most (but not all) patients; these consist of arthritis or arthralgia primarily affecting the wrist, knee, ankle and small joints of the extremities. Swelling in the lymph

glands of the neck occurs frequently. Numbness, tenderness and 'pins and needles' in the palms and soles are present in a small percentage of cases.

Prolonged symptoms are common. In some cases, symptoms may return from time to time with decreasing severity for up to a year. Symptoms persisting longer than a year may be due to other reasons.

Barmah Forest virus

The Barmah Forest virus (BFV) was first isolated in 1974 from *Culex annulirostris* mosquitoes collected in the Barmah Forest near the Murray River in northern Victoria and simultaneously from mosquitoes collected in south-west Queensland. It has also been isolated from numerous other mosquitoes including the coastal species *Oc. vigilax* and *Oc. camptorhynchus*, which have a salt marsh habitat, and from the midge *Culicoides marksi* in the Northern Territory. Subsequently, BFV has been detected in most parts of mainland Australia, and serological surveys indicate that it causes widespread human infection

Similar to Ross River virus (RRV) disease, symptoms include fever, arthritis, arthralgia and rash, but with BFV disease the rash seems to be more common and more florid. Similar to RRV disease, there is a high subclinical rate of infection (infection without symptoms of disease) and a low rate of disease in children. Recovery usually occurs within several weeks but lethargy, arthralgia and myalgia can persist for over six months. Confusingly, outbreaks of BFV disease sometimes occur concurrently with RRV disease.

Murray Valley encephalitis virus

Murray Valley encephalitis virus (MVEV) is a flavivirus. It has the capacity to cause severe human disease, with encephalitis being the most notable clinical feature.

MVEV was first isolated from patients who died from encephalitis in the Murray Valley in Victoria and South Australia in 1951. It was previously included as one of the causative agents in the disease called Australian encephalitis, which also included disease caused by Kunjin virus, another flavivirus. MVEV is now specifically recognised as causing the disease Murray Valley encephalitis.

MVEV can commonly infect humans without producing apparent disease, or it may cause a comparatively mild disease with features such as fever, headache, nausea and vomiting. In a small percentage of people infected, mild non-specific disease symptoms may be followed by a progression of the disease and involvement of the central nervous system, causing meningitis, or in the worst scenario, encephalitis of variable severity. Signs of brain dysfunction, such as drowsiness, confusion, fitting, weakness, or ataxia (loss of coordination of muscle movement) indicate the onset of encephalitis.

Zoonosis	Number of human cases
Q fever	343
Leptospirosis	106
Brucellosis	46
Barmah Forest virus	2061
Murray Valley encephalitis virus	2
Ross River virus	5491

Number of reported human cases of zoonoses in Australia, 2008

Note: There are no Australian statistics available for Hendra virus.

Acknowledgement: This article was adapted from 'Preventing zoonoses' which appeared in the winter edition of the MLA publication Frontier. The material for this article was compiled from information from the Queensland Primary Industries and Fisheries and the Australian Government Department of Health and Ageing.

Further information:

Animal Health Australia
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Australian Veterinary Association
Phone: 1300 137 309 or 02 9431 5000
Email: members@ava.com.au

Websites:
www.animalhealthaustralia.com.au/nahis
www.deedi.qld.gov.au
www.primaryindustry.nt.gov.au

If you would like a copy of *Beeftalk* mailed to you, please complete the following form and send to Editor, *Beeftalk*, QPIF, PO Box 118, Gayndah, Qld 4625 or Email russ.tyler@deedi.qld.gov.au

Name: .....

Address: .....

Postcode: ..... Shire: ..... Property Number: ..... No. of cattle: .....

Phone: ..... Fax: ..... Email: .....

Which of the following best describes you?

☐ Beef producer ☐ Agribusiness outlet ☐ Education ☐ Other (please state) .....

Lifetime traceability – what does it mean?

The National Livestock Identification System or NLIS is a permanent lifetime traceability system designed to track individual animals and their movements for the purposes of:

- biosecurity;
- food safety;
- product integrity;
- market access; and
- other industry related purposes.

What does lifetime traceability (LT) mean?

LT is a status assigned on the NLIS database to an animal where all movements between Property Identification Codes (PICs) in its life have been recorded sequentially on the database. The NLIS database monitors cattle movements between PICs and triggers a 'system transfer' when a missing movement is detected. This occurs when the 'FROM' PIC in the uploaded file is different to the PIC on which the NLIS device is registered. The database automatically moves the device to the 'FROM' PIC and inserts a gap in the device's life history (shown as 'XXXX XXXX'). The LT status of the animal is removed and the database processes the new movement.

What does the loss of LT mean?

Cattle that do not have LT may attract less competition in the market place and so may receive a reduced price As only cattle with LT can be considered for markets that require this status. Cattle with LT can be considered for all markets and so may attract greater competition.

Maintaining LT

To maintain LT producers should ensure that every movement of animals under their management is reported to the NLIS database. Producers who purchase cattle should ensure that they have LT before they purchase them.

Information about LT is available from the NLIS website at www.nlis.com.au – select 'Using the NLIS database', then 'User guides and reference cards' which will take you to 'Tech tips'. Of particular interest are 'Correcting NLIS transfers', 'Reasons for loss of Lifetime Traceability' and 'NLIS Database Quick Reference for producers and feedlots'. These are also available from the NLIS Database Helpline on 1800 654 743.

Further information

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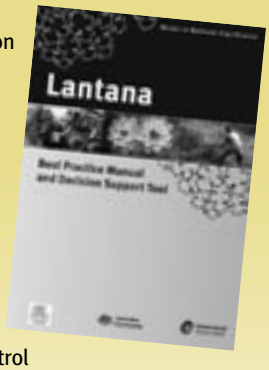
new product

Lantana control – the future

Lantana control in Queensland is set to become high-tech with the September release of a new Decision Support Tool by the Lantana Weeds of National Significance Program.

The new computer-based tool has been designed to assist land managers with tailoring integrated control programs for their properties – promising more cost-effective management outcomes.

The Lantana Decision Support Tool includes interactive calculators that provide landholders with realistic predictions for the costs and benefits of control programs. With this more accurate information and less guesswork, land managers will be able to tailor three to four year management sequences for their properties, integrating control techniques appropriate for their situations.



The Decision Support Tool is built on information gathered from three years of adaptive management trials at 11 sites through the east coast distribution of Lantana camara. Experimental sites included a range of conservation and primary production areas to provide a broad picture of how lantana responds to management actions.

A *Lantana Best Practice Control Manual* has been developed for use in conjunction with the Decision Support Tool and constitutes the most comprehensive source of lantana control information currently available in Australia. These materials are the culmination of the three-year project which was funded by the Federal Government and supported by Biosecurity Queensland.

To order your free copy of the *Lantana Best Practice Control Manual* and Decision Support Tool from Biosecurity Queensland, contact the Queensland Primary Industries and Fisheries on 13 25 23.

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