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# Generating labelled leaf litter to follow nitrogen movement in soil under mangoes

Jo Tilbrook, Research Scientist, and Tony Asis, Agronomist, Darwin

*Figure 1: Jo and Tony infusing 15N into the xylem*

Understanding the turnover of nitrogen N from mango litter decomposition into the soil requires isotopically enriched ($^{15}$N) leaf litter. This is usually achieved through soil or foliar application of fertilisers, but for trees such as mango, the process is slow and a significant amount of expensive labelled N fertiliser is lost to the environment. A rapid labelling method to obtain direct and quantitative information on leaf uptake of nitrogen derived from fertiliser (NDFF) within a limited time is being developed. In this study the team is testing a xylem infusion technique to rapidly create $^{15}$N labelled mango litter. While there are risks to the tree; N toxicity, phloem death or infections, the risk mitigations in the methods are successful so far. Total leaf N of a tree is estimated and a calculated amount of labelled fertiliser in solution is infused into branch xylem over several hours. A week later the leaves are collected for processing and analysis. The pending data will indicate what quantity of labelled fertiliser is needed to generate litter with sufficient $^{15}$N enrichment to follow soil N mineralisation and gas emissions as the litter decomposes.

The leaves on Kensington Pride mangoes at Katherine Research Station (KRS) are being labelled via infusions of $^{15}$N fertiliser in solution into branch xylem tissue. After drying, the labelled leaf litter will be placed on soil under mango trees to decompose while soil N gas emissions and mineralisation are quantified.

*This project is supported through funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program, the Northern Territory Government Department of Primary Industry and Resources, Queensland University of Technology's Institute for Future Environments and Hort Innovation Limited. In-kind support is also provided by the Australian Mango Industry Association Inc.*

# New research on the benefits of phosphorus supplementation from Northern Territory Department of Primary Industry and Resources trial

Tim Schatz, Beef Production Systems Research Officer, Darwin

As we come to the time of year when cattle producers are thinking about wet season supplementation, it is timely to share the latest results from the NT DPIR phosphorus (P) supplementation trial at Kidman Springs (Victoria River Research Station). The trial is finding large benefits from P supplementation of breeding cattle on P deficient soils.

While the benefits of P supplementation are well known to some producers, it seems that many are not convinced enough to actually spend money on it, as sales figures show that adoption of P supplementation has been much lower than would be expected for the amount of P deficient country in northern Australia. Many previous trials have shown increased weight gain from feeding P supplements to growing animals during the wet season, but there haven't been any published studies showing significant increases in pregnancy rates from feeding mineral (dry lick) P supplements to breeding cattle in northern Australia. As a result extension officers and supplement manufacturers have had to give estimates of the benefit that producers might expect without hard data to back them up. This may contribute to the low adoption of P supplementation. Hopefully the results from the Kidman Springs trial should help to change that.

The results emerging from the research at Kidman Springs are providing compelling information for producers with P deficient country. In the trial there are two treatment groups (P+ or P-) that have been managed in exactly the same way since weaning except that their mineral loose lick supplement either contains P (P+) or does not (P-). The composition of the lick fed to each treatment is shown in Table 1. The lick is fed year round in troughs under supplement sheds. The cattle graze in two adjoining paddocks of native pasture that are acutely P deficient (Colwell P <4 mg/kg). The treatments swap paddocks each year to minimise paddock effects. The research is finding large benefits from P supplementation (see Table 2). A summary of these benefits is:

- P+ maiden heifers were 66 kg heavier at the end of their first mating as two year olds
- Pregnancy rates were 10 per cent higher in P+ maiden heifers
- Re-conception rates were 25 per cent higher in P+ first lactation heifers
- The average weight of P+ first lactation heifers was 120 kg higher when their calves were weaned
- The average weaning weight of calves was 34 kg heavier in the P+ treatment
- The overall mortality rate over the three years from weaning to 3.5 years old was 7 per cent lower in the P+ treatment
- Preliminary economic evaluation shows that by spending an extra $41 per head on supplement over the first three years the P+ treatment has produced about $300 per head more so far. If the heavier weight of the females retained is also included then it works out to be around $513 more per head

While this trial is showing large benefits from P supplementation, the response will vary depending on the level of P deficiency in the soils on which cattle graze. Benefits of this scale may not be seen where P deficiency is not as severe. Producers can get soil tests done if they are not sure of the P status of different land types on their property. Soils with a Colwell P level of less than 4 mg/kg are considered to be acutely deficient, while 5 mg/kg is deficient and 6-8 mg/kg is marginal. However there are often different soil types in a paddock and animals graze selectively so may be able target forage with higher P levels. Therefore while

soil testing can give an indication, it is not considered to be a definitive method of determining deficiency. Currently testing blood samples taken from growing animals (eg. 1-2 y.o) at the end of the wet season for Plasma inorganic Phosphorus (PiP) is considered to be the most reliable indicator of the P status of animals. However, as a rough guide, if your first lactation heifers look more like the ones in Figure 1 than Figure 2 then it is likely that they will benefit from P supplementation (unless you have a stocking rate problem).

It can be difficult to put supplements out during the wet season, but many producers have found innovative ways to do it and usually 'where there is a will there is a way'. Some have supplement dumps in shipping containers or under tarps scattered around their properties. It is really up to individual producers to weigh up the costs and benefits in their particular situation. The Kidman Springs P research trial is providing them with new information to do this.

Table 1. The contents of the loose mix supplement fed in the trial.

| | **Wet season** | | **Dry season** | |
|---|---|---|---|---|
| | P+ | P- | P+ | P- |
| Ridley Biofos MCP | 42% | | 25% | |
| Salt | 50% | 73.5% | 40% | 65% |
| Ammonium sulphate (Gran Am) | 7.5% | 7.5% | 10% | 10% |
| Urea | | | 25% | 25% |
| Limestone | | 17.5% | | |

Table 2. Results from the Kidman Springs P supplementation trial.

| | P- | P+ | Difference |
|---|---|---|---|
| Weaning weight (kg) (at start of trial) | 175 | 175 | 0 |
| Maiden heifer pre-mating weight (kg) | 238 | 270 | 32 |
| Maiden heifer post mating weight (kg) | 327 | 392 | 65 |
| Pre-calving weight (kg) | 324 | 393 | 69 |
| Weight when calves weaned (kg) | 262 | 382 | 120 |
| Maiden pregnancy percentage (%) | 60 | 70 | 10 |
| Calf loss rate (%) | 22 | 21 | -1 |
| 1st lactation heifer pregnancy rate (%) | 5 | 30 | 25 |
| Mortality rate to 3.5 y.o (%) | 8 | 1 | -7 |
| Weaning weight of calves (kg) | 139 | 173 | 34 |

## Photos of the heifers in the trial.

*Figure 2: First lactation heifers in the P- treatment*

*Figure 3: First lactation heifers in the P+ treatment*

The trial is on-going and will compare the kilograms of calves weaned from each treatment over several years. For more information contact:

Tim Schatz tim.schatz@nt.gov.au 08 89992332

# Limiting spray drift and improving coverage

Callen Thompson, Senior Extension Agronomist, Katherine

Agriculture in the Northern Territory is famous for its vast cattle stations but we know that within this landscape horticulture and hay production is often concentrated in specific areas where there is good soil and water. There is also likely to be lifestyle blocks in the same areas. In these intensive areas there is a significant risk of spray drift damaging neighbouring crops, pastures or the environment if chemicals are not applied properly.

### Key points:

- Weather, nozzles and boom height can effect spray drift and coverage.
- Drift is reduced by using coarse droplets, but coverage is decreased.
- Increasing water rate will increase coverage.

Using spray equipment, whether it be for weed, pest or disease control, is part of most agricultural systems and the Australian Pesticides and Veterinary Medicines Authority (APVMA) ensures that chemicals are safe for use as long as the applicator follows the directions on the label.

High value horticultural crops like mangoes, Asian vegetables and sandalwood are susceptible to herbicides such as 2-4,D, which are commonly used for broadleaf or woody weed control in pasture and hay paddocks. If these chemicals are applied in-correctly, in poor weather conditions or with inappropriate equipment, they can drift onto neighbouring crops. This may cause yield loss or even death to the susceptible 'off target' crop, which can lead to litigation if significant damage is caused.

Even if the chemical does not land on an off target crop it may contaminate the environment. In addition, chemical that is not landing on the desired crop is wasted, effectively decreasing the rate of chemical applied, decreasing the effectiveness of the job.

By understanding weather conditions, your equipment and the product you are using, you can limit the risk of off target drift while still getting good coverage.

## Coverage

Coverage is important as chemical that does not land on the target is wasted. This is effectively reducing the rate of product you are using, which can lead to reduced efficacy and low rate herbicide resistance. Products where this is especially important are insecticides fungicides and contact herbicides, especially when applying as a protective spray.

Products like glyphosate are translocated through the plant so coverage is not as important as the chemical will travel from the point of contact to the rest of the plant. Some products, like gramoxone, are extremely poorly translocated and rely on the whole plant being covered to achieve effective control.

Pre-emergent products like S-Metolachlor need good coverage as they act as a film, stopping weeds emerging through the top soil. Timing, solubility of the product and ground cover can affect the degree of chemical coverage achieved.

## Droplet size

Different nozzles can give you different droplet size ranging from very fine to extremely coarse. Fines droplets are small, slow moving and highly susceptible to drift while course droplets are large, fast moving and less susceptible to drift.

If landing on the desired target, fine and medium droplets will give a more even coverage compared to coarse droplets, unfortunately weather conditions and equipment setup can decrease fine droplet survival and increase movement off target. Good coverage can be achieved using coarse droplets if the water rate is increased.  Figure 1 shows water sensitive paper comparing two spray rates, 100 and 50 L/ha using air induction nozzles. The higher water rate achieved far greater coverage.

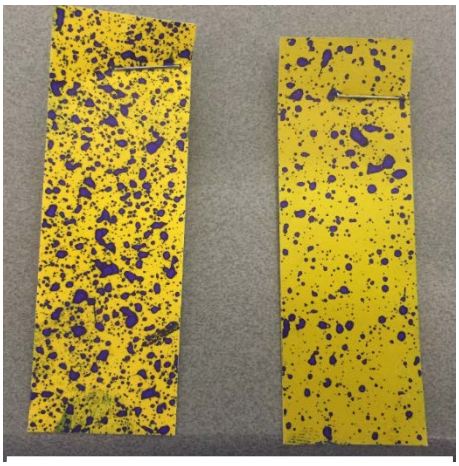

*Figure 3: 100L/ha of water on the left vs 50L/ha of water on the right. Both very coarse droplets.*

## Weather conditions effecting application

Weather in the Northern Territory is generally marginal for spraying. It is important we understand how weather effects spray quality and how we can manage it.

### Wind

Wind can blow droplets of target, this is called physical drift. It is important not to spray when wind is blowing towards susceptible crops. Risk of drift can be reduced by using coarse droplets because larger droplets have greater velocity and are less susceptible to being blown of target. Spray when wind speed is between 3-20km/h and is not gusting (some products like 2-4,D label requires less than 15km/h). Never spray when there is little to no wind (less than 3km/h) as this can allow fine droplets to float upwards into an inversion layer (see below). When you are measuring wind speeds always measure at boom height.

### Temperature

At high temperatures the weed may have shut down and not translocate the product so never spray when weeds are showing signs of stress. High temperatures can cause volatile chemicals to vaporise and lift of the target. This is called vapour drift and can happen hours after the chemical has been applied. Chemical companies recommend that you don't spray at temperatures over 30°C.

High temperature combined with low humidity can effect droplet survival due to evaporation. Using coarser/larger droplets will decrease the effect of evaporation. Because of this relationship, understanding Delta T is very important.

**Humidity and Delta T**

Increased humidity can reduce droplet evaporation rate. The relationship between temperature and humidity is expressed by Delta T. High Delta T (high temperature/low humidity) causes droplet evaporation and can limit the product hitting the target. Low Delta T (low temperature/high humidity) can be a drift issue as fines droplets have greater survival as they are not evaporated. The graph in figure four is a great tool to determine the right Delta T conditions for spraying. Delta T between two and eight is ideal.

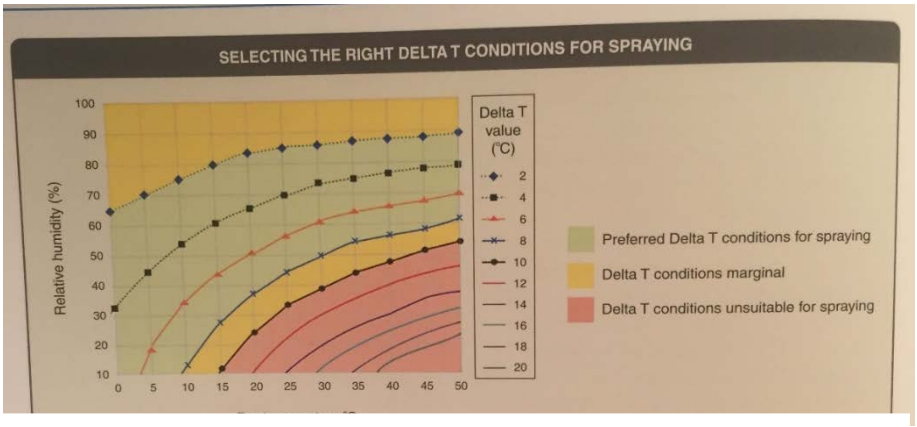


*Figure 4: Selecting the right Delta T conditions for spraying, Source: Jorg Kitt, Spraywise Broadacre Application Handbook, 2008*

**Surface temperature inversion**

A surface temperature inversion is commonly known as an inversion layer, and has the potential to cause chemical drift up to 30km from the area sprayed.

Under normal conditions temperature decreases further away from the ground. In an inversion event temperature increases with height. The cool air doesn't mix with the warm air and layers are formed. Fine droplets or vapour can be trapped in these layers and float away.

This often happens when there is low wind, high daytime temperatures and low night temperatures. Inversion layers usually occur early evening, night time and early morning. Dust, smoke and fog can indicate an inversion layer. Fine droplets are most susceptible.

## Using spray equipment to limit drift and maximise coverage

Weather conditions in the NT can be detrimental to achieving good spray outcomes. There are ways to maximise the chance off chemical reaching the target by spray-rig setup and selecting appropriate nozzles.

*Figure 5: Speed is an important factor in spray application*

### Boom height

It is important to set the boom high enough that there is overlap of nozzle fans but not too high that there is potential drift. Figure six shows that 110 degree flat fan nozzles should be 50cm from the target. If there is a false target, which may be stubble or crop. The boom should be 50 cm above that. Grains Research and Development Corporation (GRDC) data suggests that raising the boom from 50cm to 75cm increases drift potential four times. Counteract this risk by increasing droplet size to reduce driftable fine droplets. This will also improve coverage as larger droplets will have greater velocity and will get through the crop/stubble canopy.

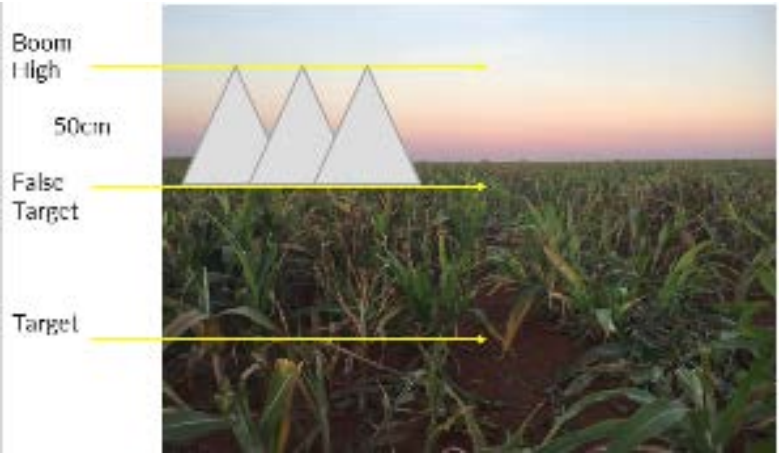


*Figure 6: Selecting boom height when there is a false target.*

### Speed

Increasing speed reduces the time it takes to spray a paddock which can be beneficial when trying to get a job done before weather conditions change. Unfortunately, increasing speed can lead to wind shear and eddies, which creates increased fine droplets. Increased speed without increasing water rate can decrease coverage, particularly with a standing target.

### Water rate

Increasing water rate is the easiest way to increase coverage. If coarse droplets need to be used for drift reduction, increasing water rate can significantly reduce the issue of poor coverage generally associated with increased droplet size. Water rate can be increased without decreasing speed, if you have the correct nozzle.

## Nozzle selection

There are many different nozzles but for broadacre boom spraying, the main groups used are conventional flat fan nozzles, pre-orifice flat fan nozzles and air induction nozzles. Characteristics of these nozzles can be seen in table three.

Table 3. Characteristics of commonly used nozzles (photo credit: TeeJet)

| **Conventional nozzles** | **Pre-orifice flat fan nozzles** | **Air induction nozzles** |
|---|---|---|
| - XR TeeJet<br>-single orifice<br>-produce large amount of fines | -Turbo TeeJet<br>-pre-orifice and an exit orifice<br>-drift reduced by 50%<br>-Fine to course, depending on pressure | Agritop AirMix Flat Fan<br>-TTI TeeJet<br>-Low pressure variants can produce a medium droplet<br>-Droplets are generally course to extremely course |
| | | |

The pre orifice meters flow and restricts the amount of liquid which decreases internal pressure. This leads to larger droplets. The difference with air induction is that they contain a venturi which draws air bubbles into the liquid stream. The droplets exiting the nozzle are generally course to very cause and are filled with air. This can create a cushioning effect when they hit the plant so they don't bounce off, which can happen with large droplets from conventional nozzles.

*Figure 7: Choosing the right nozzle for the job is essential*

Colours of the nozzle represent its size of the nozzle e.g. all yellow nozzles are 02 (0.2 gallons per min @ 2.8bar). The larger the nozzle, the more water it puts out. All nozzle manufacturers have charts for their nozzles. A nozzle chart allows the user to pick the appropriate nozzle for the water rate, speed and pressure the want to use.

## Application technology workshops

The Department of Primary Industries and Resources and NT Farmers identified the need for greater training in application technology and applied for funding from Federal Government's National Landcare programme promoting sustainable agriculture. This funding was used to run training workshops at Douglas Daly, Katherine and Darwin. A YouTube video was also produced to demonstrate nozzle selection. Click the link below to watch.

https://www.youtube.com/watch?v=WmOnIcMyZGc

If you would like further information about improving your application practices or would like staff within your organisation to attend a spray technology workshop, please contact Callen Thompson Callen.thompson@nt.gov.au

*Figure 8: Attendees of the Douglas Daly Spray Technology Workshop*

## Spotlight on technology – Snap Card App

Continuing with the theme of improving spray application (see article in this issue), the focus on this editions 'spotlight on technology' is an app that gives spray applicators the ability to assess the coverage they are achieving with their spray-rig. Applicators can place water sensitive paper (available from rural retailers) on their target, be it the crop, a weed or a mango leaf. They then spray the target and come back to collect the water sensitive paper. The applicator can then use the app to assess the percentage of coverage.

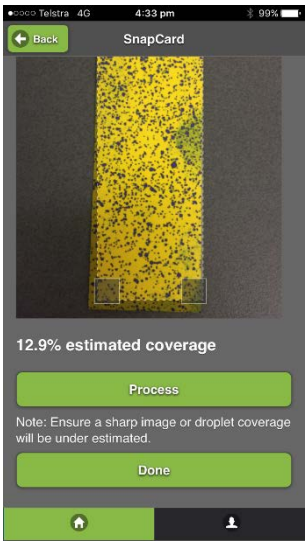


*Figure 9: A screen shot of the Snap Card app*

The user can compare different spray-rig settings to assess what is giving the best results for their current environmental conditions.

The app was developed by the Department of Agriculture and Food, Western Australia, and the University of WA's (UWA) applied entomology program. This was supported by funding from the Council of Grain Grower Organisations and the GRDC.

For more information go to: https://grdc.com.au/resources-and-publications/groundcover/ground-cover-supplements/ground-cover-issue-122-spray-application/app-provides-snappy-spray-assessment

DPIR has a great YouTube video demonstrating how to use water sensitive paper: https://www.youtube.com/watch?v=WmOnIcMyZGc

# What is an average season? Living in the good country, for now

Robyn Cowley, Rangeland Scientist, Darwin

Rain in your part of the world has been pretty reliable of late. But if you've only lived here for the last 20 years, which seems like a pretty long time really, you might not realise how good it's actually been. You just happened to have lived through the wettest period in the last century. Check out the rainfall and modelled pasture growth over the last century at locations in the central and southern Victoria River Downs (VRD) and Sturt Plateau in figures 10 and 11 and table four below.

Most of the last 20 years had above average growth, and any dryish year was backed up by an above average year. No drought, no worries. But if you were here between 1950 and 1970, it was a very dry affair, with mostly below average rainfall and pasture growth, although the pasture quality would have been a lot better, because in drier years the nutrients don't get diluted in larger plants.

There tends to be cycles in wetter and drier periods. You can see the waves of moisture rolling in and out over the last century. But we've just had 20 wet years, so what's next?

It depends who you ask. Some think that it might stay wetter, although it never has before, so this may be somewhat wishful thinking. Some scientists think that pollution in Asia has changed the monsoon to give us more rainfall. Well we better hope they don't clean up their act I guess! The climate change projections for future rainfall are not too bad in this part of the world (similar or more rainfall), unlike in southern, eastern and south west Australia, where it is projected to get drier. But unfortunately just about every climate change model has a different opinion about what's going to happen to rainfall, so your guess is probably as good as theirs.

So, assuming the rainfall is roughly going to be the same, but still variable – drier times are probably coming.

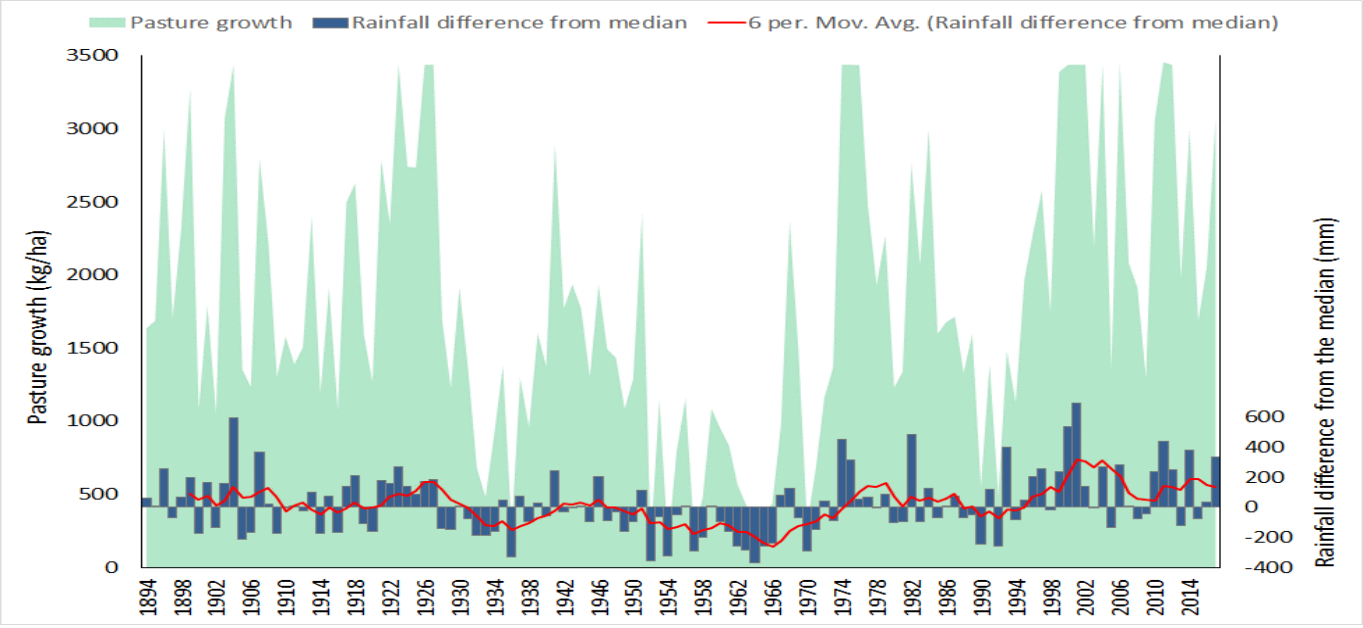


*Figure 10: Modelled pasture growth and rainfall (difference each year from the long term median) over time on an alluvial land type in the southern VRD.*

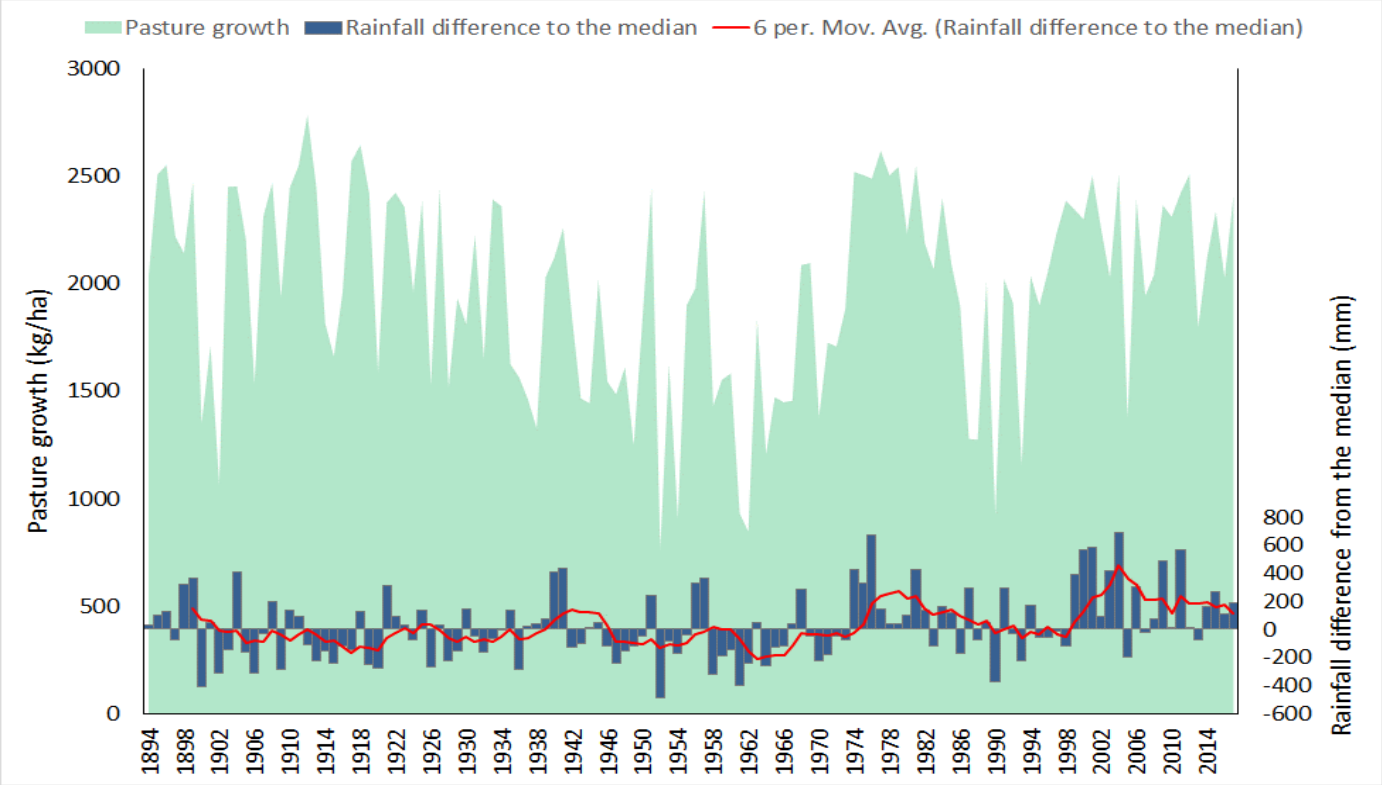


*Figure 11: Modelled pasture growth and rainfall (difference each year from the long term median) over time on the Banjo land system at Larrimah.*

What would a drier cycle of the climate mean for your area? Because it's been wet lately you have probably been able to carry more stock than the long term safe carrying capacity. If you are in the southern VRD you might have been safely carrying closer to 16 AE/km$^2$ on your black soils, the safe level for a 70$^{th}$ percentile year (Table 4). But if the climate switches to a drier period, like 1985 to 1994, suddenly the safe carrying capacity would be more like a 30$^{th}$ percentile year, or 9 AE/km$^2$, almost half what was safe during wetter times.

In the Sturt Plateau the rainfall is higher, so pasture growth varies less year to year (table four) and there's much less difference between the top 30% and bottom 30% of years in safe stocking rate than for the southern VRD. The central VRD falls somewhere between the other two locations in year to year variability in growth and safe stocking rate.

Because you don't know when the next failed wet is coming, the best way to manage seasonal risk is to (1) moderately adjust stocking rates seasonally around the long-term safe carrying capacity and (2) don't exceed safe stocking rates more than one year in three. Degradation events tend to occur when one or more dry years follow a run of good seasons, when stock numbers have increased but are not reduced quickly enough in response to the sudden turnaround in seasons. Unfortunately degradation can happen very quickly, but can take a very long time to reverse, if it can recover at all. Having stocking rates low enough to permit pasture recovery in better seasons is also an important component of keeping your pastures in good condition, so they can make the most of the rain that falls and grow to their potential. Having pre-planned strategies that have inbuilt thresholds and triggers for intervention to quickly respond to changing forage availability will minimise the chance of degradation events.

It may be about to get drier. History repeats through cycles of drier and wetter seasons. We've just had two decades of amazing rainfall and growth. What is your contingency plan for when seasons are drier again?

- Do you have spare ungrazed areas?
- Do you have animals built into the system that can be easily offloaded?
- When will you move or sell stock?
- Do you have decision points during the wet season that trigger action?

Is your planned level of development economically sustainable if we now have two decades of drier seasons? Hope for the best but plan for the worst.

Table 4: Seasonal variation in pasture growth and safe stocking rate for three locations and two land types over the last 126 years in 'A' condition.

| Alluvial land type | Grassland Southern VRD | | | | | Open woodland Central VRD | | | | | Open woodland Larrimah, Sturt Plateau | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentile year | 10 | 30 | Median 50 | 70 | 90 | 10 | 30 | Median 50 | 70 | 90 | 10 | 30 | Median 50 | 70 | 90 |
| Rainfall (mm) | 309 | 424 | 519 | 617 | 787 | 436 | 588 | 703 | 799 | 942 | 512 | 640 | 763 | 889 | 1147 |
| Pasture growth (kg/ha) | 550 | 1290 | 1660 | 2290 | 3430 | 1300 | 1780 | 2310 | 2600 | 2730 | 1940 | 2380 | 2870 | 3440 | 3740 |
| Safe stocking rate (AE / $km^2$) | 4 | 9 | 11 | 16 | 23 | 9 | 12 | 16 | 18 | 19 | 13.5 | 16 | 19.5 | 23.5 | 25.5 |
| Red soil land type | Short grasses, southern VRD | | | | | Perennial grasses on limestone, central VRD | | | | | Gravelly red soils at Larrimah, Sturt Plateau | | | | |
| Pasture growth (kg/ha) | 390 | 740 | 970 | 1280 | 1910 | 740 | 1030 | 1270 | 1590 | 1960 | 1355 | 1708 | 2030 | 2360 | 2500 |
| Safe stocking rate (AE / $km^2$) | 1 | 2.5 | 3.5 | 4.5 | 6.5 | 4 | 5 | 6.5 | 8 | 10 | 7 | 9 | 10.5 | 12 | 13 |

## Optimise watermelon crop pollination using honey bees

Dr Ian Biggs, Senior Research Agronomist, Katherine

Insect pollination is essential in watermelon due to the plant having separate male and female flowers (often on different plants) and the large sticky pollen grains which prevent other means of pollination. Each seed is formed from the union of a single pollen grain and a single ovule. Failure to pollinate will result in abortion of the fruit, while poor pollination results in small misshapen fruit. Each stigma requires at least 1000 pollen grains evenly distributed over all three lobes to ensure complete fertilisation of ovules. To achieve this, it has been estimated that at least nine bee visits per female flower is required. This is required in seedless melons as well, as it stimulates the required hormone production to ensure the production of large, well-shaped fruit.

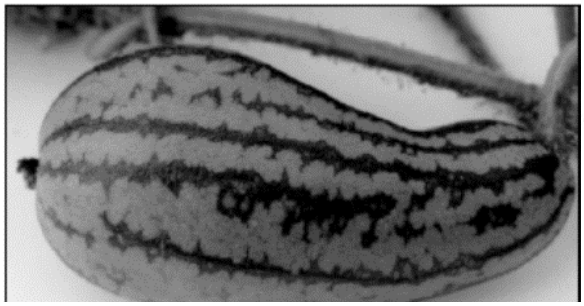

*Figure12: Immature melon with poor shape due to insufficient*

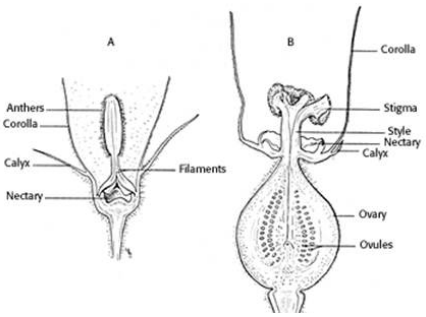


*Figure 14: Diagram of male (A) and female (B) melon flowers*

## Rules for use of honeybees to optimise watermelon crop pollination:

1. Healthy honeybee colonies to be installed.
2. Select hive sites that allow all weather, 24 hour access for beekeepers.
3. Timing of hive placement to ensure target crop ready for bee pollination.
    a. Female flowers have appeared.
    b. At least 10% of crop in flower.
    c. Hives to remain for at least 3 weeks or for the duration of active flowering.
4. Overhead irrigation and sprays are not to be conducted when flowers are open and bees are flying. Foliar sprays should be applied in the late evening or at night.
5. Density of honeybee hives to be a minimum of 2.5 hives/ha with a target density of three to four hives/ha. A greater hive density maybe required to boost pollination if in-crop pollinating conditions are poor or if external conditions might distract honeybees from the target crop, e.g., rival flower source.
6. Hive placement. This can be a point of contention between the grower and beekeeper as the grower wants ready access for the bees to the crop while the beekeeper wants easy access to the hives.
    a. Slash grass in the area where hives are to be placed to ensure there are no high plants that may impede honeybee flight around the hive.
    b. Place hives so that they do not receive direct spray from irrigation systems or farm spray operations.
    c. Place hives so that there is no more than 500m to centre of target crop and no more than 300m between hive clusters.
    d. Place hives so that they are not in a hollow where cool air will pond.
    e. Place hives so that they receive morning sun.
    f. Remember bees like to work up hill and along crop rows.
    g. Place hives so that the target crop is between the hives and a competing flower source.
    h. Hives should be protected from strong winds and prevailing winds.
    i. Avoid walls or fences between hive and crop.
    j. Locate away from farm workers and livestock.
    k. Avoid dwellings and irrigation valves or locations which require regular visits from farm workers.
    l. Bees require access to clean water, especially during hot weather. Aim to have water 100 m from hive but no more than 500m. If using tanks place small floats on the water so as to reduce bee drowning.
7. Alternative flower sources noted or removed.
8. Ensure that all farm/crop chemicals used are low toxicity to bees and are used at evenings or when bees are not flying. Chemical residual times are noted and if necessary hives should be removed until toxicity hazard is reduced.

http://beeaware.org.au/pollination/pollination-and-pesticides/pesticides-toxic-to-honey-bees/

## Explanation of rules:

1. Healthy honeybee colonies

Strong colonies are superior pollinators. To ensure colonies are in a healthy state, regularly observe bee activity and look out for dead bees around the hive. If anything unusual is observed contact your apiarist immediately.

Note that in tropical climates colonies are usually not as populous as temperate climates and tend to have more even numbers of bees throughout the year.

2. Site access

Beekeepers require an all-weather, easy access (including night access) for trucks and a bobcat. Ease of access will help ensure reduced labour costs for beekeepers and can help ensure preferred distribution of hives around farm and may reduce hive rental costs.

3. Timing of hive placement

While it is considered that watermelon flowers are moderately attractive to honeybees and a rich source of nectar and pollen, the pollen is deficient as a protein source. In addition, the relatively low flower density means bees can be easily distracted away from the watermelon crop to more plentiful flower sources. It is best to have bees that are inexperienced at foraging in the area of the crop. Ensure that alternative flower sources are either removed or hives placed away from these alternative sources.

Bees should be introduced when the first fruit-producing flowers appear and when 10 per cent of the crop is in flower. Honeybees should be kept on the crop for at least three weeks or as long as there is active flowering occurring.

4. Overhead irrigation and sprays

Overhead irrigation reduces bee foraging rate for nectar and pollen. Open flowers fill with water which dilutes nectar and reduces attractiveness to bees. Avoid irrigating or spraying during bloom times or during daylight hours, especially early morning when flowers are opening and bees are active.

5. Density of bees

The goal is to use the minimum hive density that provides maximum crop pollination and therefore maximum yield potential. Generally any factor that reduces overall pollination efficiency requires an increase in bee density to overcome.

A general starting density is 2.5 hives/ha though up to 6 hives/ha maybe required. Increasing hive number will depend on colony strength and weather. A greater hive density maybe required to boost pollination if in-crop pollinating conditions are poor or external conditions are likely to distract honeybees from the target crop, e.g., rival flower sources. Use grower and beekeepers experience to reach a final hive density for crop.

6. Hive placement

It is in the grower's interest to ensure that hives are placed as close to the crop as possible and there is a uniform distribution of bee foraging over the crop to ensure uniform pollination. The number of foraging bees visiting the crop, the amount of pollen collected, and crop yields all generally increase the closer the

hives are to the crop. Bees prefer to forage within 100 m of the hive and recommendations from the United States of America (USA) are generally for hives to be placed at 150 m intervals and within 150 m of the centre of the crop. However, it is known that *A. millifera* can forage over 2.5 km from the hive and Australian recommendations are for allowing up to 500 m foraging distance. Place hives so that all areas of the target crop are within 500 m of a hive. Ensure that the distance between hives is not more than 500 m and ideally less (~ 300 m). This will ensure there is competition between bees for floral resources in the target crop.

The foraging distance is reduced in cold and wet weather so there may be a need for greater hive dispersal if such conditions prevail.

Hives should be placed on knolls and away from hollows where cold night air might pool. Hives should be exposed to morning sun as this will stimulate bees to be active early in the day – a time which coincides with the watermelon flowering cycle.

Hives should be protected from prevailing winds and should also be sheltered from strong winds and rainy weather. Ensure no structures or vegetation inhibit bee access to the hive or travel between the hive and the target crop. There should be no solid barrier (wall or hedge) between the hive and the target crop.

Locate hives away from areas where is likely to be regular interaction with farm workers, pedestrians, livestock, and farm machinery movements. Also avoid dwellings, farm buildings, and irrigation valves.

Bees require easy and ready access to clean, non-contaminated water sources, especially in hot, dry weather. It is especially important that the water source is not contaminated with fertiliser runoff, e.g., nitrates. **If an adequate natural water source is not available then alternative water sources will need to be provided**. Ensure these water sources are within 100 to 500 m of hives and if required have floats on the surface to reduce bee drowning.

7. Alternative flower sources noted or removed

Honey bees are easily distracted from watermelon crops due to the low flower density and therefore low nectar and pollen resource. To reduce the risk of bees abandoning the target watermelon crop potential alternative flower sources should be removed where possible. This can be done by either mowing or herbicide. Where it is not possible to remove competing flower resources, locate hives on the opposite side of target melon crop from the distracting flowering plants.

*Figure 15: A female watermelon flower*

*Figure 15: A male watermelon flower*

8. Farm/crop chemicals

Studies from the USA have measured 121 chemical residues in pollen samples and found on average 6.7 different chemicals pre pollen sample collected. Ensure that all chemicals used are low toxicity to bees and are used at evenings or when bees not flying and residual times noted. Care needs to be taken with systemic insecticides that may have been used in previous crops, e.g., seed dressings. There is some evidence that insecticides persist in soil for extended periods and are then being present at low levels in subsequent crops. While not toxic to adult honeybees, these sub-lethal levels are thought to predispose honeybees to other diseases, and may be toxic to bee larvae and young honey bees.

Other chemicals such as fungicides may not be toxic to adult bees. However, pollen from flowers sprayed with fungicide will have fungicide on the pollen. When this contaminated pollen is carried back to a hive the fungicide can be toxic to the brood.

You can check toxicity of chemicals by referring to the APVMA web site (https://apvma.gov.au/) look for the environmental assessment section of chemical reports.

Some useful websites:

- http://www.agrifutures.com.au/rural-industries/honey-bee-pollination/
- https://honeybee.org.au/
- http://horticulture.com.au/co-investment-fund/pollination-fund/
- http://www.crchoneybeeproducts.com/
- http://beeaware.org.au/

Animal Health

DEPARTMENT OF **PRIMARY INDUSTRY AND RESOURCES**

# November 2017

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## Livestock disease investigations

The Department of Primary Industry and Resources (DPIR) provides a free disease investigation service to livestock owners for diagnosis of notifiable emergency, exotic and endemic disease, including zoonotic diseases. Berrimah Veterinary Laboratories provide free diagnostic testing for exclusion of notifiable disease for all disease investigations, and subsidies are available to private veterinarians for significant disease investigations in livestock. The Northern Australia Enhanced Disease Surveillance program has been introduced from 2017-2019 on a trial basis providing increased subsidies for cattle and buffalo disease events reported to and investigated by private veterinarians. This program recognises the higher costs and challenges associated with conducting disease investigations in more remote regions.

During July to September 2017, 70 livestock disease investigations were conducted to rule out emergency diseases or investigate suspect notifiable diseases across the Northern Territory (NT). Figure 1 shows the number of investigations by species of livestock.

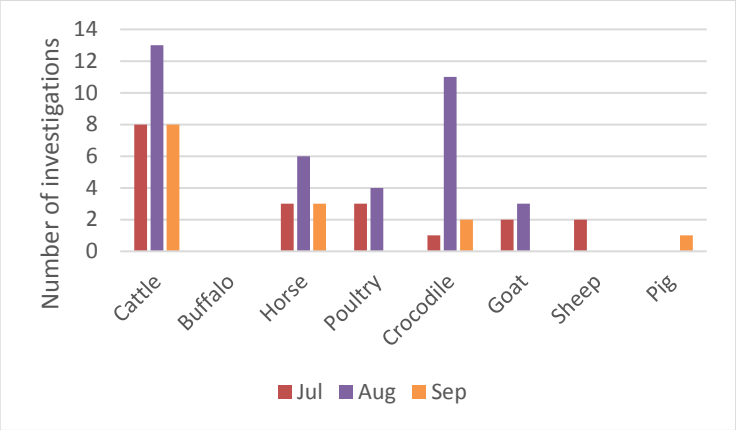



*Figure 6. Livestock disease investigations by species for July to September 2017*

Berrimah Veterinary Laboratories processed 177 livestock sample submissions, including samples to substantiate proof of disease freedom certifications, for accreditation programs and targeted surveillance to support market access. The following case reports are a selection of disease incident field investigations during the quarter.

## Foot and Mouth Disease excluded in salivating cattle in Alice Springs

The manager of a property in the Alice Springs region reported four 2-3 year-old crossbred Hereford steers with signs of weight loss, salivation and loss of muscle/movement control. The steers had been recently yarded and were due to be transported for slaughter. Examination of stock by DPIR veterinarian found affected steers to have the symptoms reported, as well as being in respiratory distress. The most severely affected steer was euthanased for post mortem examination.

*Figure 7 The affected steer was salivating and in respiratory distress.*

Post mortem examination revealed water in the lung tissue and evidence of a healing tongue lesion. While it was suspected that the steer was persistently infected with bovine viral diarrhoea virus, samples were referred to the Australian Animal Health Laboratories (AAHL) to exclude exotic diseases including Foot and mouth disease (FMD) and Vesicular stomatitis (VS) for the tongue lesion, and Haemorrhagic septicaemia and Contagious bovine pleuropneumonia for the lung lesion. Tests excluded all exotic diseases.

Bacteriology culture found moderate growth of a *Pasteurella multocida* from the lung lesion. The diagnosis of the lung lesion was severe pneumonia.

*Pasteurella multocida* also plays a leading role in the development of bovine respiratory disease (BRD), a condition also known as 'shipping fever'. The condition commonly arises where the causative organism becomes established by secondary infection, following a primary bacterial or viral infection. This usually occurs after stress. In the case of BRD, pasteurellosis is usually preceded by viral infection with either infectious bovine rhinotracheitis (IBR caused by bovine herpes virus type 1), bovine viral diarrhoea virus (BVDV), para-influenza type 3 (PI3) or bovine respiratory syncytial virus (BRSV). The viral inflammation of the respiratory passage initially causes lung lesions and suppresses immunity allowing the bacteria to proliferate. BRD is a major production issue for beef feedlots and dairy.

While the IBR serological blood test results were negative, a positive BVD antigen ELISA blood test and a negative BVDV AGID antibody blood test confirmed the steer was persistently infected (PI) with BVDV. The *P. multocida* bacterial infection combined with the viral BVDV infection led to the BRD syndrome, intensified by the stress of mustering and yarding.

BVDV Type 1 is endemic in the Northern Territory cattle population, with most herds and up to 70% of cattle exposed. In-utero infection can result in PI animals which show signs of poor development, ill-thrift and early death. These PI cattle are immune-suppressed and may also develop the more acute and often fatal mucosal disease which presents as severe gastro-intestinal ulceration.

Vaccines are commercially available for the main respiratory viruses and bacteria that contribute to BRD, including IBR and BVDV. The vaccines are not widely used in Territory, but should be administered prior to entry into the feedlot and mixing of cattle.

A recommendation was made to cull the remaining three clinically affected steers. There have been no further clinical problems reported from this herd of cattle.

*Figure 8 Affected steer in poor condition.*

*Figure 9 Other steers from the same group were in excellent condition*.

## Pneumonia due to pasturellosis causes mortality in Brahman cows in Katherine

In August, a private veterinarian investigated mortality in a group of 180 Brahman cows which had recently been transported to a property in the Katherine region. Over a two-week period approximately 50 cows had shown signs of nasal discharge and coughing, and 30 had died.

On clinical examination the affected cattle were having trouble breathing, with heavy breathing rates and nasal discharge. A single three year-old cow was euthanised and post-mortem examination revealed liquid in the lungs, as well as the lung sticking to the thoracic wall. Examination of lung tissue under the microscope revealed a severe pneumonia, consistent with *Mannheimia haemolytica* infection. There was no microscopic evidence of viral involvement, and a heavy growth of *M. haemolytica* was cultured from lung samples. A diagnosis of pneumonic pasturellosis (shipping fever) was made. While shipping fever usually involves infection caused by *P. multocida* in cattle, it may also be caused by *M. haemolytica* in the absence of *P. multocida*. It is likely that the recent stress of mustering, long-distance transport and yarding resulted in the high morbidity and mortality in this case. This level of pneumonia is an infrequent situation in northern beef herds.

Vaccines are commercially available for the main respiratory viruses and bacteria that contribute to BRD, including IBR, BVDV and *M. haemolytica*. The vaccines are not widely used in Territory, but should be administered prior to entry into the feedlot and mixing of cattle – a process known as 'backgrounding'.

## Slaughtering, processing and sale of meat in the Northern Territory

The slaughtering, processing and sale of meat for human consumption is regulated under the Northern Territory *Meat Industries Act 2011 and* associated Regulations.

The slaughtering of animals for human consumption has been a common practice on stations over many years, providing meat for owners, managers, employees and guests. It is not an offence to slaughter an animal on your property for consumption by your family and staff, provided it is consumed on the property on which it was slaughtered. The meat must not be sold, bartered, or given away.

The meat may be provided to paying guests in facilities where supplying meat is not the primary source of income e.g. Bed and Breakfast facilities. Any paying guests must be informed and non-paying guests should be advised that the meat has not undergone an Ante Mortem or Post Mortem inspection by a qualified meat inspector.

The sale of station slaughtered meat in a roadhouse or community store situation is considered to be an offence, and is not permitted. All meat used in these operations must be sourced from a licenced processor. The use of station meat houses to process meat for sale is not permitted unless licenced by Department of Primary Industry and Resources.

It has been common practice over many years for stations to supply meat to Aboriginal communities located on cattle stations and this practice is legal and may continue provided the meat does not leave the property of slaughter, is not on-sold, or given to others. This means that where an animal is slaughtered on a station for a local community, the carcass cannot be dressed by community members and removed from

the property. If the animal was removed from the property live and transported to the community for slaughter, Northern Territory Waybill and National Livestock Identification System regulations would apply.

The supply of meat donated by a company or station to a community event such as a rodeo or campdraft is acceptable, provided that the meat is consumed on the station on which it is slaughtered and not on-sold at the event. If there is an abattoir located near the station it may be beneficial to slaughter the animal through the abattoir as the standard of meat preparation meets the Australian hygienic meat standards. The station or event co-ordinator should be able to negotiate a service kill in this situation.

All meat sold to the general public for human consumption must be processed in a registered establishment that has been issued with a stamp that has an Establishment Number. Meat must be inspected by a qualified meat inspector with a minimum Certificate III in Meat Safety.

Further information and advice concerning slaughtering and processing may be obtained from the DPIR:

David Frost
Senior Meat Industry Officer
Telephone: 89992255
Mobile 0401113090

## New Livestock Biosecurity Network staff member for Northern Australia

Jess Rummery has joined the Livestock Biosecurity Network (LBN) as Manager – Biosecurity and Extension for Northern Australia. She joins LBN fresh from a role within the Australian Department of Agriculture and Water Resources, which predominantly focused on live exports. Jess brings a great deal of experience to LBN, adding her professional experience to her qualifications in animal science, public administration and national biosecurity policy.

The new LBN coordinated role aims to support producers across the Territory and the rest of northern Australia. One of Jess's first responsibilities was to deliver biosecurity planning workshops to producers in Alice Springs, Tennant Creek, Katherine and Darwin throughout September.

Jess is based in Darwin, and is available to speak to producers and provide information on Biosecurity Planning and the Livestock Producers Assurance (LPA) program.

Jess can be contacted on M: 0499 077 213, E: jrummery@lbn.org.au

# Brands, National Livestock Identification System and waybills in the Northern Territory

## Brands

Under the Northern Territory (NT) *Livestock Act 2011*, a NT registered brand is required on all cattle prior to being moved off their property of origin, unless they are under eight months of age. Brands can be used on horses, buffalo and camels, but it is not compulsory.

The NT *Livestock Act 2011* and associated Regulations uses a three-letter brand system, where one letter must be the letter 'T', and a distinctive (symbol) brand system. Branding is a clear way of identifying ownership of stock. In any proceedings, proof that an animal is branded in accordance with the provisions of the *Livestock Act* with a registered brand is prima facie proof that the animal is the property of the owner of the registered brand. It is important to note that National Livestock Identification System (NLIS) devices do not constitute proof of ownership.

**Cross-branding**

Cross-branding of cattle after purchase is not mandatory in the Northern Territory: however, if livestock are not cross branded, it provides no legal claim to purchased stock. Purchased cattle need to be cross-branded correctly to provide evidence of ownership. The Livestock Regulations clearly stat that:

1. the first brand applied to livestock must be in the position described on the Certificate of Registration for the brand
2. each subsequent brand applied to livestock may be in any other position, where there is sufficient space, specified in Schedule 2
3. a person commits an offence if the person applies a registered brand to livestock in a position other than is required or permitted by sub-regulation (1) or (2)

A brand should not be applied over an old brand. It is an offence to place a brand on the cheek.

**Brands – Sale of a property**

While the sale of a property may include the stock, the brand cannot be sold to the new owners. Options for brands after the sale of a property are as follows:

1. If an agreement is made in the sale contract to transfer the brand to the new owners, an application to Transfer Brand must be lodged with the Registrar.

2. If the registered owner of the brand no longer wishes to use the brand, it may be cancelled. An Application for Cancellation of Brand must be lodged with the Registrar.

3. If registered owner of the brand wishes to keep the brand, but move it to a new property, a Request to Change of Run must be lodged with the Registrar, together with original certificate/s for amending.

If not the registered owner of new property, Owners Permission to Use Run form is required and must be lodged with the Registrar.

4. If other brands are registered for use on property/parcel of land, then the new property/land owner/s will need to complete Owners Permission to Use Run form, and lodge with the Registrar.

5. If the new owner of the land does not want to have other brands registered for use on their property/parcel of land (e.g. continue agreements previous owner/s may have had) then the new Owner must complete Owners Permission to Use Run - REVOKED form and lodge with the Registrar.

**BRANDS ARE NOT TRANSFERRED AUTOMATICALLY BY A PROPERTY SALE OR BY A WILL**

A brand is registered to a person or company for use on a nominated NT property only. **Under no circumstances are these brands to be used in any other state or territory. This means the branding iron can only be used by the registered owner (or their representative) on the registered Northern Territory property as stated on Brand Certificate/s.** It does not restrict branded cattle being agisted on other properties. To brand on a NT property not registered with the Registrar is an offence under the *Livestock Act 2011* and associated Regulations, and incurs a penalty.

If you are wanting to transfer your brand to a new property, or use your brand on a property for a specified period of time, please contact your local Regional Livestock Biosecurity Officer.

Further NT brands information and forms are at:
https://www.nt.gov.au/industry/agriculture/livestock/brand-and-identify-livestock/livestock-brands-in-nt

## National Livestock Identification System (NLIS)

National Livestock Identification System (NLIS) is Australia's system for identifying and tracing livestock for food safety, product integrity and market access purposes. NLIS was introduced by industry and enacted in State and Territory legislation. In the Northern Territory (NT), NLIS commenced on 1 July 2007, and has been operating now for over a decade.

In the NT, all cattle and buffalo must have an approved NLIS device attached to their off side (right ear) before they are moved off a property, regardless of the destination. All sheep and goats must have an approved transaction tag for any movement off a property.

The owner of the property must ensure all cattle or buffalo (including calves) moving off the property have an NLIS device attached to the right ear before the livestock movement begins. While calves and weaners under eight months of age do not require a brand for movement, they must have an NLIS device. Livestock that were born on the property of origin are to have a white 'breeder' NLIS device, cattle that were not born on the property (e.g. agistment cattle, purchased cattle, cattle in transit and strangers) and do not already have a NLIS device, must have an orange 'post breeder' NLIS device attached prior to moving off the property.

Please note that calves born in transit are not an exception to the rule. If calves are born in transit yards, or arrive in transit yards without a NLIS device, the transit yard is required to apply an orange 'post breeder' device.

NLIS devices are specific to the property that they are ordered for. It is an offence to apply NLIS devices to livestock on a property that the NLIS devices are not registered to.

For further NT information on NLIS and forms see: https://www.nt.gov.au/industry/agriculture/livestock/brand-and-identify-livestock/nlis-in-the-nt

## Waybills

You must use a Northern Territory (NT) waybill to move all of the following kinds of livestock from one property to another within the NT:

- alpacas, camels and llamas
- cattle and buffalo
- deer
- goats
- pigs
- sheep.

You do not require a waybill for horses or poultry.

A waybill is a record of livestock details and movement. When you move livestock the waybill travels with the stock from the property of origin to the destination property. It is an offence to move cattle without a waybill in the NT.

Waybills are an important part of the National Livestock Identification System and provide detailed information which is used to trace animal movements. The system also acts as a deterrent to stock stealing, identifies the property of origin to abattoirs and export markets, and provides detailed documentation for station management.

It should be noted that any stranger cattle need to be provided with their own separate waybill if travelling in a consignment of cattle going to a property other than their most recent property of origin, e.g. transit yards, export yards, or abattoir. If stranger cattle are being returned to their property of origin, a waybill needs to accompany the cattle.
For more information about waybills, how to fill them in and what you must do with them, read the Agnote Waybills in the NT (500.9 kb).

**Release of new Antimicrobial Resistance website for Antibiotic Awareness Week**

Antibiotics are not commonly used in Northern Territory livestock, but globally this is an enormous one-health issue that is emerging. Our current lifestyle depends on the continued successful use of antibiotics and all users are urged to consider responsible antibiotic use to limit the development of antimicrobial resistance (AMR). The Australian Chief Medical and Veterinary Officers have issued a joint statement on AMR and developed a website (www.amr.gov.au) that contains general advice for all stakeholders.

Australian Government
Department of Health

Australian Government
Department of Agriculture and Water Resources

**Statement from Australia's Chief Veterinary Officer and Chief Medical Officer on how Australians can reduce antibiotic resistance**

World Antibiotic Awareness Week, 13 – 19 November 2017

To mark World Antibiotic Awareness Week for 2017, we are calling for all Australians, including all prescribers in human and animal health, to pause and consider antibiotic use.

Antibiotic resistance is happening now in Australia and around the world. We need to take urgent action to reduce antibiotic resistance in Australia.

The more we use antibiotics, the more chance bacteria have to become resistant to them.

We know that antibiotics are overused in human health in Australia. Australia is currently ranked one of the highest users of antibiotics compared to similar countries.

A growing number of infections – such as pneumonia, tuberculosis, and gonorrhoea – are becoming harder to treat as the antibiotics used to treat them become less effective.

The rise in resistant infections means that both human and animal health care professionals are left with limited, or in some instances, no available treatment options.

**Even if new antibiotics are developed, without behaviour change, antibiotic resistance will remain a major threat.**

Antibiotics are important medicines, however it is also important that everyone understands that they only work against bacteria. Antibiotics do not work against infections caused by a virus and will not make you feel better.

There are many things that you can do to take action. Visit the new www.amr.gov.au website to find out more information on what you can do to combat antibiotic resistance in Australia.

The website has information for various audiences including:

- General public
- Animal owners
- General practice
- Hospitals
- Aged care
- Veterinary practice
- Agriculture and industry

We encourage all Australian's to get involved in our efforts to reduce antibiotic resistance in Australia.

Dr Tony Hobbs, Acting Chief Medical Officer
Dr Mark Schipp, Chief Veterinary Officer

# Pastoral Market Update

DEPARTMENT OF PRIMARY INDUSTRY AND RESOURCES

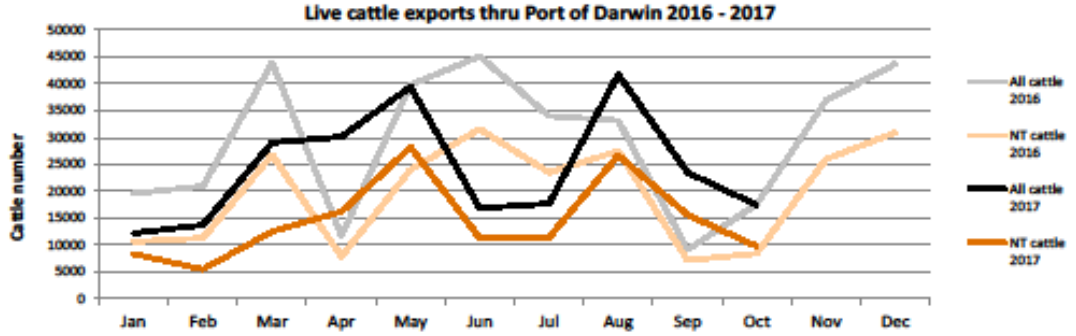
## Live Cattle Exports via Darwin Port – OCTOBER 2017

*Please note: figures are for cattle exported through the Port of Darwin only; some NT cattle are exported through interstate ports.*

| Destination | Export of ALL CATTLE (including interstate) from Darwin Port | | | | | | | Export of NT CATTLE from Darwin Port (estimate only) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | Last year to 31/10/16 | YTD to 31/10/17 | Oct | Last month | Difference | 2015 | 2016 | Last year to 31/10/16 | YTD to 31/10/17 | Oct | Last month | Difference |
| Brunei | 4,122 | 3,379 | 3,379 | 1,893 | 0 | 767 | -767 | 2,069 | 2,314 | 2,314 | 1,138 | 0 | 509 | -509 |
| Indonesia | 341,759 | 296,230 | 223,025 | 193,148 | 12,886 | 18,671 | -5,785 | 197,155 | 195,037 | 143,383 | 115,270 | 7,216 | 12,398 | -5,182 |
| Philippines | 23,611 | 4,697 | 4,697 | 0 | 0 | 0 | 0 | 13,559 | 3,236 | 3,236 | 0 | 0 | 0 | 0 |
| Sabah | 0 | 0 | 0 | 1,500 | 0 | 0 | 0 | 0 | 0 | 0 | 967 | 0 | 0 | 0 |
| Sarawak | 300 | 1,220 | 1,220 | 2,138 | 1,798 | 0 | 1,798 | 0 | 843 | 843 | 1,189 | 1,007 | 0 | 1,007 |
| Malaysia | 11,503 | 10,959 | 9,854 | 10,934 | 1,693 | 1,890 | -197 | 7,499 | 7,476 | 6,698 | 6,655 | 948 | 1,255 | -307 |
| Vietnam | 100,119 | 36,405 | 30,093 | 31,513 | 1,092 | 2,167 | -1,075 | 63,998 | 24,783 | 20,326 | 19,716 | 612 | 1,439 | -827 |
| Egypt | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Thailand | 6,154 | 0 | 0 | 800 | 0 | 0 | 0 | 3,610 | 0 | 0 | 535 | 0 | 0 | 0 |
| Cambodia | 0 | 2,766 | 2766 | 0 | 0 | 0 | 0 | 0 | 1,936 | 1,936 | 0 | 0 | 0 | 0 |
| TOTAL | 487,568 | 355,656 | 275,034 | 241,926 | 17,469 | 23,495 | -6,026 | 287,892 | 235,625 | 178,736 | 145,470 | 9,783 | 15,601 | -5,819 |

## October at a glance

- 17,469 cattle through the Darwin Port during October; 6,026 less more than last month and 113 less than in October 2016.
- 12,531 NT cattle through the Darwin Port during October; 7,058 more than last month and 9,783 less than in October last year.




## OTHER LIVESTOCK EXPORTS VIA DARWIN PORT

*Includes NT and interstate stock.*

| Destination | Buffalo | | Goat | | Camel | |
|---|---|---|---|---|---|---|
| | YTD | Oct | YTD | Oct | YTD | Oct |
| Brunei | 148 | 0 | 0 | 0 | 0 | 0 |
| Indonesia | 795 | 101 | 0 | 0 | 0 | 0 |
| Philippines | 0 | 0 | 0 | 0 | 0 | 0 |
| Sabah | 0 | 0 | 0 | 0 | 0 | 0 |
| Sarawak | 0 | 0 | 0 | 0 | 0 | 0 |
| Malaysia | 3,971 | 0 | 0 | 0 | 0 | 0 |
| Vietnam | 3,074 | 105 | 0 | 0 | 0 | 0 |
| Egypt | 0 | 0 | 0 | 0 | 0 | 0 |
| Thailand | 0 | 0 | 0 | 0 | 0 | 0 |
| Cambodia | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 7,988 | 206 | 0 | 0 | 0 | 0 |

## NT CATTLE MOVED INTERSTATE

| Destination | Oct | YTD to 31/10/2017 |
|---|---|---|
| NSW | 198 | 15,657 |
| QLD | 7654 | 123,168 |
| SA | 7060 | 58,350 |
| VIC | 1730 | 9,088 |
| WA | 4964 | 28,825 |
| Total | 21,606 | 235,088 |

**NATIONAL CATTLE PRICES**
www.mla.com.au/prices-and-markets

**CURRENCY EXCHANGE RATES**
www.oanda.com/currency/converter

| Total Cattle, Port of Darwin | | | | | | | | NT Cattle, Port of Darwin | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 547,514 | 295,605 | 269,617 | 246,990 | 559,616 | 495,958 | 487,568 | 355,656 | 504,618 | 272,749 | 258,797 | 254,249 | 508,784 | 524,477 | 287,892 | 235,625 |

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# Katherine region events calendar

| Event | Location | Date | |
|---|---|---|---|
| Grazing Fundamentals EDGE Workshop | Katherine Research Station | 15th February 2018 | Jodie.ward@nt.gov.au |

Please email us with updates of events happening in your area: krs.dpir@nt.gov.au

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