

Top Paddock

DEPARTMENT OF PRIMARY INDUSTRY AND RESOURCES



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Letter from the editor

The Department has changed! DPIF has been recombined with the Department of Mines and Energy, and we are now the Department of Primary Industry and Resources (DPIR). The Department welcomes the appointment of the Hon Ken Vowles, MLA, Minister for Primary Industry and Resources.

There is a topical focus on water in this issue of Top Paddock, ranging from the rain through the irrigation of various crops to the regulation of water supplies.

Many pastoralists in the Top End will have welcomed the rain we have received in recent days. The rain has provided fresh green pick for cattle and hopefully replenished water supplies. More follow up rain is needed to prevent rural Darwin from running out of water this dry season. It would be good to get this rain without it affecting the harvesting and quality of the current mango crop.

Cheers,

Arthur Cameron
Principal Agronomist

Changes to rural Darwin water regulations

The Minister for Land Resource Management recently announced the removal of the exemption from licensing requirements for bores pumping less than 15L per second in the Darwin Rural Water Control District. This change, effective from 6 July 2016, means those using water from bores other than for stock and domestic purposes in the Darwin Rural Water Control District are required to obtain a water extraction licence.

Residents in the Darwin Rural Water Control District, who take water from a bore for purposes other than stock and domestic use but do not hold a current water extraction licence, will need to obtain a licence and are advised to submit a licence application to Water Resources Division by **30 September 2016**.

The exemption has been in place since the commencement of the *Water Act* in 1992 and was originally established to foster agricultural and horticultural development in the Darwin rural area. Since the exemption was introduced, and more significantly over the last 10 years, there has been considerable residential, industrial, agricultural and horticultural development and increased competition for, and use of, groundwater resources in the region. The removal of the exemption will provide for improved reporting, monitoring and management of water resources by requiring heavy water users to be subject to licencing conditions, including the requirement to install a compliant water meter and monitor and report on water usage, contributing to better overall management of the resource.

Impacted users are encouraged to apply for a licence by 30 September 2016. Licences will be issued based on current usage and information to help calculate usage is provided in the application form. Water Resources Division staff are also available to assist with any aspect of the application.

No fees apply to water extraction licences, but applicants are normally required to meet application advertising costs. Applicants who apply by 30 September 2016 will not be required to cover the costs of this advertising.

To obtain a licence application or further information go to www.landresources.nt.gov.au or contact Water Resources Division on 8999 4455, waterresources@nt.gov.au or visit Level 4, Goyder Centre, 25 Chung Wah Terrace, Palmerston.

DPIR mango advice, now on YouTube

Chelsea Moore, Industry Development Officer, Darwin

The Northern Territory Department of Primary Industry and Resources has a new YouTube channel.

www.dpif.nt.gov.au/youtube offers short, technical videos on horticulture, with topics from practical demonstrations to understanding greenhouse gas emissions. The Growing Tips playlist is dedicated to Plant Industries content and for the mango grower, videos include demonstrations on grafting mangoes and measuring mango dry matters.

Our online videos allow growers to access technical demonstrations and information when they want to. This helps overcome the difficulties associated with distance and remote locations.

It is further expected that a selection of our videos will be translated into languages other than English to assist the large cohort of Northern Territory growers for whom English is a second language.

With new videos released every couple of months, growers can subscribe to the DPIR YouTube channel to find out when new clips are released.



DPIR's Growing Tips videos are a practical learning tool for growers



Growers were invited to look at the trials taking place at DPIR's Coastal Plains Research Farm at Middle Point

Coastal Plains Research Farm Field Day

Paige Richter, Technical Officer, Darwin

The NT Department of Primary Industry and Resources (DPIR) invited growers from the Darwin and Katherine regions to their field day at Coastal Plains Research Farm (CPRF) on Thursday 8 September. It showcased the current projects being worked on at the farm by Plant Industries Development staff. The field day included an informative tour of the farm and short presentations on the Cucumber Green Mottle Mosaic Virus (CGMMV) outbreak, on-farm biosecurity planning and changes to water licencing requirements in the Darwin rural area.

The farm tour began at the jackfruit seedling selection planting, which aims to develop locally adapted commercial scion cultivars for industry to propagate through standard grafting methods. This will reduce variability currently existing in seed-based orchards and improve consistent production of quality product for markets.

The rambutan trial at CPRF evaluates the performance of marcott-established, high-density clonal orchard systems. Rambutan trees are difficult to propagate and a lack of demand for planting stock means many fruit tree nurseries do not produce grafted rambutan trees. Rambutan growers are left to propagate their own stock and previous research identified marcotting (air-layering) as a reliable, easy method of clonal propagation. Results so far are good survival rates and uniform growth rates across four cultivars.

Advanced technologies will be used in a trial studying nitrogen nutrition in mango trees. Nitrogen has important physiological and morphological functions in the growth and development of mango trees. This trial will trace nitrogen fertiliser through the mango production system and determine how the plant uses it. With better understanding of this, mango producers can use nitrogen fertiliser more efficiently and develop nutrient management strategies to maximise growth, yield, and fruit quality.

CPRF's passionfruit trial aims to take advantage of the significantly higher prices the "Edulis" types return compared to Panama red types. Unfortunately "Edulis" types will not crop in our



Senior Agronomist Tony Asis discusses how we will go about learning more on nitrogen nutrition in mango trees

tropical climate. In 2014 DPIR crossed selected “Edulis” parents with selected Panama parents to combine desirable traits from both, principally the dark skin and flavour of “Edulis” and the fruit size and heat tolerance for flowering and fruiting of Panama. In 2015, 300 seedlings from those crosses were grown and the best 10 were selected and established at Berrimah Research Farm and at CPRF. Fruit assessments have begun this September.

A demonstration of a termite aggregation drum struck great interest during the tour. The drum was placed over active *Mastotermes* termite galleries to lure them into the drum. After several weeks, the drum should be highly active with termites and can be treated with an appropriate termiticide. This allows a large number of termites to be treated at once and will ensure better transmission throughout the rest of the colony. Detailed information on termites and the use of aggregation drums can be found on the DPIR website at

https://dpif.nt.gov.au/_data/assets/pdf_file/0006/233619/734.pdf



Senior Technical Officer Michael Neal opens an aggregation drum in the jackfruit planting block. Inset: The total amount of termites in the drum after three weeks when it was emptied!

Following the lifting of restrictions on banana planting in the Banana Freckle red zone in early June, research on Panama disease in banana has been underway in a quarantine area at CPRF. Attendees were able to view the area where 27 varieties in a large replicated trial have been planted and planting holes inoculated with the disease (*Fusarium oxysporum* f. sp. *ubense*, Tropical Race 4). This trial will determine varietal resistant to the disease. More varieties will be planted and subjected to the disease later this year.

In another trial on Panama disease, 2000 banana plants from four parent lines will each be mutated via irradiation before being planted at CPRF. No two mutated plants will be the same, so the best resistant plants with good growth and fruit characteristics will eventually be cloned and further evaluated for commercial potential. All this research is part of a project supported by Queensland Department of Agriculture and Fisheries and by Horticulture Innovation Australia.

The cool season tropical grass trial concluded the tour. This trial has been looking at the performance of different tropical grasses through the dry season to determine if there may be more ideal alternatives to the proven Finecut Rhodes grass. So far all seven varieties have been comparable in yield to Finecut Rhodes grass, meaning there is potential for farmers to grow any of the tested varieties. Quality analysis testing should offer a better insight into which varieties are most ideal.

The field day was a successful event for Plant Industries and allowed us to show growers the work we are doing to support industry growth. CPRF is an important resource for enabling us to do this work and we appreciate the chance to invite growers to see the farm for themselves.

Irrigated Cropping Field Day

Peter Shotten, Systems Officer, Douglas Daly Research Farm

The economics of irrigated cropping on the Douglas Daly was the major discussion topic at the Irrigated Cropping Field Day held at the Douglas Daly Research Farm on 27 July.

Kate Peake, Regional Development Australia NT (RDA), has led a project looking at the economics of developing broad acre cropping in the Douglas Daly region.

Ian Baker, Ag Consultant, says there are many advantages in developing cropping in the Douglas Daly compared to other parts of northern Australia. Douglas Daly has farmers with freehold tenure, good soils and water, good infrastructure, good research and development support from government and good equity, who know their land.

The question is: why hasn't cropping development occurred? The current successful agricultural system in the Douglas Daly region is rain fed hay, cattle, forestry and horticulture. How can broad acre cropping develop? Markets for broad acre grain crops are large if we can show the economics are right.

Douglas Daly is unique in that there are established farmers that can add an irrigation cropping system to their existing business, thus spreading their risk through diversification.

The key parts of the RDA economic study are:

- the estimated cost of capital for establishing an irrigation system ranges from \$11,000/ha for an existing farm that has some infrastructure but requires more such as bores, pivots, fencing and some plant and equipment needed for the crops, up to \$28,000/ha for a greenfield site where initial tree clearing is required
- the annual net return needed to pay for the capital cost is around \$2,000-\$2,500/ha/year for an acceptable return on investment over 15 years
- the study selected broad acre crops and cropping systems that could produce the required revenue to generate the net return needed for the farmer to make a profit. This requires a multiple crop system (with multiple commodities such as grain and hay) as no single crop would be able to pay for the development costs of an irrigation system. In order to achieve this, a two or three crops per year system such as peanuts, aromatic rice and mung bean is needed to generate enough income to pay for the capital expenditure
- the technical gaps that need to be sorted include looking at the cropping system rather than a single crop so that multiple crops can be grown in a year without reducing yields or reducing soil quality.

The Peanut Company of Australia (PCA) and NT Department of Primary Industry and Resources (DPIR) joint trial of peanuts was viewed by participants and the agronomics and economics of the trial discussed. Peter Shotton, DPIR, explained that the three varieties trialled (Holt, Page and Kairi) were crops of potential but there was a need to get the economics right as well as implementing the peanut crop within a long term cropping rotation utilising follow-up crops that will benefit the soil as well as the next crops to be grown.

The challenge faced with growing an irrigated peanut crop is keeping a constant eye on pest and disease and to treat any outbreaks when they occur. Following a preventative spray routine with fungicide will keep on top of any fungal outbreaks. Another challenge is having the specialised equipment needed to harvest a peanut crop.



Peanut planting at Douglas Daly Research Farm

Lionel Wieck, PCA, viewed the crop and estimated the nut in shell yield was between 4–4.5 tonne/ha with a potential hay yield from the baled tops of around 2–3.5 tonne/ha. A peanut crop could be grown as a part of an irrigation cropping system whereby the peanut tops after the nuts are harvested can be used in two ways, to add nutrition to the soil by ploughing in or by harvesting as hay to feed cattle. Farmers within the Douglas Daly need a crop to complement their current farming systems of cattle and/or hay cropping and PCA would like to see peanuts being one of those crops.

Callen Thomson and Ian Biggs gave an update of the research and development work DPIR has been doing and presented some results of the current trial crops being grown at Katherine Research Station.

Shenal Basnayake, CEO of NT Farmers, also gave an update of the organisation's activities.

The participants then travelled to Mike Black's property to tour his mung bean crop where harvesting was just commencing. Mike has moved from melon production to mung bean production this year and his first crop of mung beans was planted at the end of May, being relatively quick to desiccation stage in around 60 days. This will allow two crops before the wet season as long as the yield is not compromised with the quick growing cycle.

The mung beans are contracted as a seed crop with the first crop yielding around 1.5 tonne/ha and Mike is hoping that the second crop's yield will improve. He is experimenting with fertigation to see if this will improve the yield.

The use of dripper irrigation is being used, as melons had been grown here and so far there have been no issues with using this type of irrigation for mung beans.

The mung beans, will be sent to Kingaroy, QLD once they have been harvested and have passed all the tests for disease. There they will be bagged up for growers to plant out. Presently there is a better return on seed crops and mung beans worldwide are receiving very good prices.

The crop rotation that Mike has planned is two crops of mung bean followed by a grass crop to break up the rotation.

The Field Day was organised by RDA with excellent support from DPIR, PCA and NT Farmers.

Virtual mango researchers meeting

Cameron McConchie, Research Leader, Darwin

An inaugural virtual meeting was held at Berrimah Research Farm on 29 July to share with mango growers the latest in mango research and development. Using the virtual meeting format, DPIR was able to host presentations from NSW and QLD, and have the presenters listen in and respond to questions. These facilities are also installed at Katherine Research Station and the Arid Zone Research Institute. Any participant with a good internet connection can log into the department's virtual meeting rooms. The virtual meeting enabled interstate researchers who are working on cross commodity projects, to update local mango growers on progress without physically travelling to the Northern Territory.

Dr John Wilkie, Department of Primary Industries NSW, presented his work on planting density, investigating the relationship between flowering intensity and crop load, and development of improved rootstocks.

Prof Andrew Robson, University of New England, and Prof Kerry Walsh, Central Queensland University, who are both involved in a national tree mapping project supported by Horticulture Innovation Australia (HIA), introduced the use of satellite and ground-based data collection to understand tree health and to measure crop load. Kerry also described the development of the F-750 Produce Quality Meter by Felix Instruments, to non-destructively monitor mango dry matter in ripe fruit. This had previously been restricted to hard green mangoes. These developments will be used to support the 2016 maturity standards recently released by the Australian Mango Industry Association (AMIA).

Trevor Dunmall, AMIA, described the processes for accessing new mango cultivars and the upcoming pre-harvest meetings in the NT. He also told the group about the appointment of Jessica Harding as the new Supply and Communications Manager at AMIA and the training available for growers wanting to be involved in mango exports.

Ian Smith, NT Department of Land Resource Management, gave a presentation on the changes to water licensing in the Darwin rural area. Greg Owens, NT Farmers Association, offered to assist any growers who may have difficulties with the documentation.

Our department researchers from the Plant Industries Development group (PID) gave an overview of the exceptionally warm weather conditions this year in Darwin, with night temperatures not dropping below 20°C until 20 July. These conditions were ideal for testing the capacity of chemicals to induce flowering in mangoes under non-inductive conditions. They also emphasised the warning of an early Wet, allowing mango growers time to apply their protective sprays and for chemical providers to have the products in stock.



Dr Cameron McConchie using a backpack mist sprayer to test products for effectiveness to induce flowering in non-inductive conditions

Dr Mila Bristow introduced a new project that aims to better understand the role of nitrogen in mangoes and improve profitability, while Dr Brian Thistleton updated the progress of research on fruit fly and other insect pests of mango. Dr Tony Asis introduced the concepts of using ionomics to diagnose the nutritional status of mango trees and provided an example of how this may be applied to resin canal discoloration studies.

Bob Williams, Director of PID, explained changes in funding opportunities from HIA and updated the progress of the Northern Australia Cooperative Research Centre. He also introduced the other national research programs and international aid programs that could assist our local industries.

Finally, Jenny Hill from the DPIR Market and Enterprise Development group, described how they had been working with the AMIA to facilitate market access and reduce maximum residue limits for the fungicide Scholar® (by Syngenta, active ingredient: Fludioxonil) into a range of markets. She clarified import quotas and analysed international export trends.

The use of the virtual meeting format proved the versatility of the system and the department intends to use these facilities more extensively in the future.

The presentations from the day are available on the NT Farmers website at <http://ntfarmers.org.au/blog/sam-tocknell/mango-rd-day>

Free online course for BOM Climate Outlook Service

The Bureau of Meteorology (BOM) has released a new free online course to aid in the understanding of their [Climate Outlook](#) service. The training is ideal for decision-makers in climate-sensitive industries such as farmers, agronomists and resource managers, and can be completed on an individual basis or within a workshop environment.

The course covers topics such as Australia's climate variability, the impact of climate drivers such as the El Niño–Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD) in Australia and how to interpret the Bureau's climate outlook maps. It has a particular focus on the use of probabilities in climate outlooks, as well as how to interpret and apply information on model skill. The course can be accessed via the following link https://www.meted.ucar.edu/training_module.php?id=1247#.V6rKNE3Nu71

For more information please contact Perry Wiles, P.Wiles@bom.gov.au from BOM.

Darwin weather characteristics

Jude Scott, Media and Communications Manager, Bureau of Meteorology

The dry season officially ends on 30 September and although temperatures and humidity are on the rise across the Top End, it's not unusual to see some drier weather pushing in from the south during late August and September.

The build-up is the transition period between the last weeks of the dry and the onset of the first monsoon (characterised by widespread, significant rainfall over at least a few days, with a marked drop in temperature) in the Top End.

There are two phases to the build-up:

- during the first phase, we see more clouds in the sky, humidity on the rise and warmer overnight temperatures (from late August and into October)
- the second phase is where the storm clouds start to build and we see fairly regular showers and storms in the late afternoon and early hours of the morning (from mid-October to December)

September is usually the first month we feel build-up conditions kicking in, with the warmer nights (average overnight temperature in Darwin of 23°C versus 20.3°C in August and 19.3°C in July) and more humidity in the afternoons (47% relative humidity at 3pm versus 40% in August and 37% in July).

Sea breezes during August and September can still be quite refreshing – sea breezes are the result of hot air rising over the land and cooler air from the ocean being drawn in across the coast. However, as the sea surface temperature increases during the build-up months, sea breezes become warmer and more humid.

As clouds build during the day across the Top End during the build-up, we often see rainfall in the afternoon and evening. However early build-up thunderstorms tend to form inland, and can struggle to reach coastal areas, which can be frustrating for many Darwinites.

Climate outlook

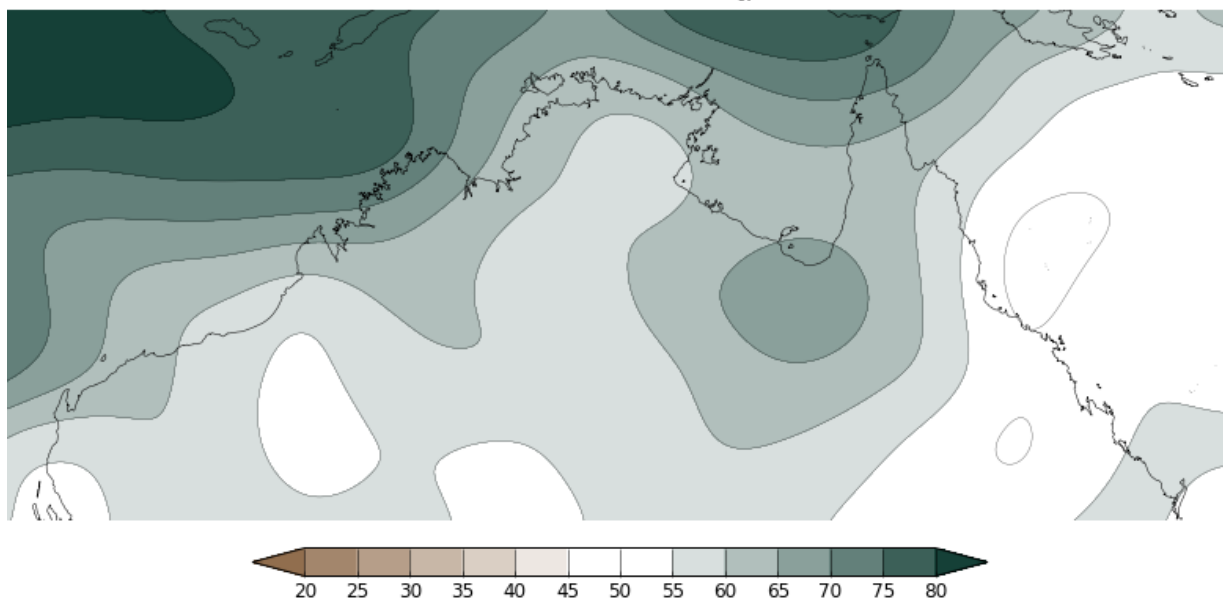
Two key climate influences can affect the weather conditions in the Top End during the build-up:

- [Indian Ocean Dipole](#) (IOD): The sea surface temperatures in the Indian Ocean impact rainfall and temperature patterns in Australia. The IOD is currently negative, which means there is an increased chance of above average rainfall in the Top End during the build-up months
- [El Niño/La Niña](#): 2015/16 saw a strong El Niño, with lower than average rainfall and higher than average temperatures across most of the NT. This year, expectations are that we will move into a neutral-to-La Niña phase, which increases the chances of higher than average rainfall during the early wet season for the NT.

The [Madden-Julian Oscillation](#) (MJO) plays a role in shorter term weather outlooks (weekly to monthly timescales), and can enhance rainfall in the Top End when in the northern Australian region.

Rainfall onset in the north

Chance of observing early Northern Rainfall Onset
Product of the Bureau of Meteorology

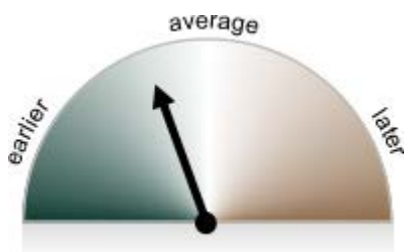


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Model Run: 21/08/2016
Issued: 25/08/2016

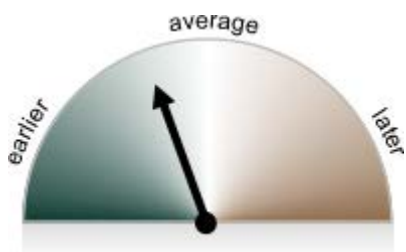
Map from the BOM website showing the chance of early northern rainfall onset

Regional Outlooks



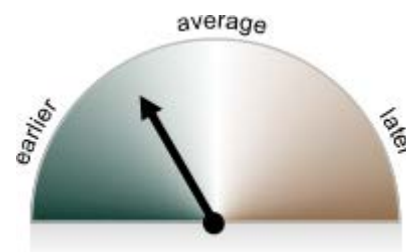
Ord River region

Chance of early onset: 55% - 60%



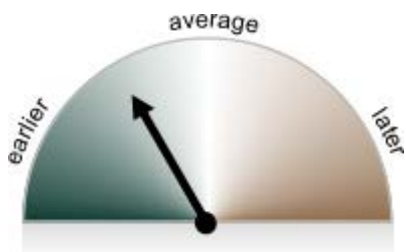
Darwin-Daly region

Chance of early onset: 55% - 60%



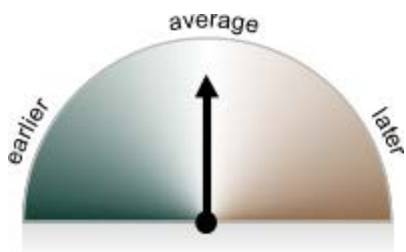
Cape York region

Chance of early onset: 65% - 70%



Mt Isa region

Chance of early onset: 65% - 70%



Bowen region

Chance of early onset: 50% - 55%

Goodbye and best wishes

The Department farewelled long term employee Trisha Cowley last month. Trish has worked for the Northern Territory Government for 10 years, and is leaving her position as the Pastoral Production Extension Officer at Katherine Research Station. She and her family have moved to a farm in NSW and we wish her all the best in the future.

Goodbye and Best Wishes

Stu and Trish have gone to greener grass
Where they'll grow cattle of a different class
Headed to the hills around Armidale
Our eyes fill with tears as she sets sail.
She's counted grass, been one of the team
Forever and a day as it would seem
But start as she did in 2006
In cut off shorts with legs like sticks
Belt hung so low Kieren thought she would trip
Fashion icon always is our dear Trish.
As well as count grass, she ran Live Weight Gain
Often covered head to toe in bovine poo stain
She then spread her wings and ran PDSs
Polled genes and HGPs removing the guesses
Bull breeding and EBVs were some of her passions
Also calculating supplementation breeder cow rations.
"Herd efficiency is paramount!" we would hear her cry
"Why feed a non-performer?" with hands in the sky
A great extension officer has been our dear Trish
Positively influencing beef in the north was her only wish
Calendars full of workshops, year in, year out
Her dedication to her industry was without a doubt
She came to town foot loose and fancy free
Now leaving with husband, bub and dog aplenty
We will miss her car dancing, work ethic and smile
As she hits the road for many a country mile
We wish her little family well as they leave paddocks of brown
And thank her from the bottom of our hearts as they leave K-town.

From all in the Pastoral Production Team



Trish will be sadly missed at KRS



Always a happy smile, even when working in the mud!

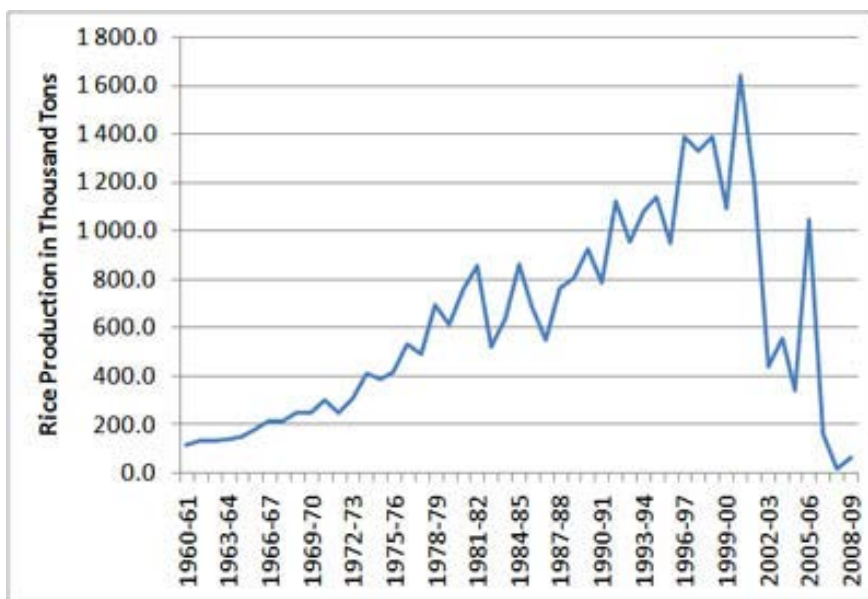
RIRDC Rice research meeting, Yanco Agricultural Institute, NSW

Ian Biggs, Senior Research Agronomist, Katherine and Nick Hartley, Senior Technical Officer, Darwin

Rice production in Australia has been based around the Murray River since a demonstration 200 acres was developed in 1908, with the first commercial production beginning in 1924. Australian rice production rose to a peak in 2000. However, droughts since 2000 resulted in production dropping to 14 700 tonnes (t) in 2008. This along with reductions in water allocations from the Murray Darling irrigation systems forced the rice industry to look for ways to reduce water use and obtain greater yield per megalitre (ML) of water. The ongoing impact of this water shortage is highlighted by the 2016 Riverina rice harvest being 245 000 t compared to 690 215 t in 2015. Nationally, the rice industry has a target production of approximately 1.3 million tonnes per year.

Rice production in the NT will require close support from, and collaboration with, the greater Australian rice industry. As we develop a rice industry for northern Australia it is important to maintain linkages with SunRice, the major Australian agribusiness in rice breeding, agronomy, extension, processing and marketing.

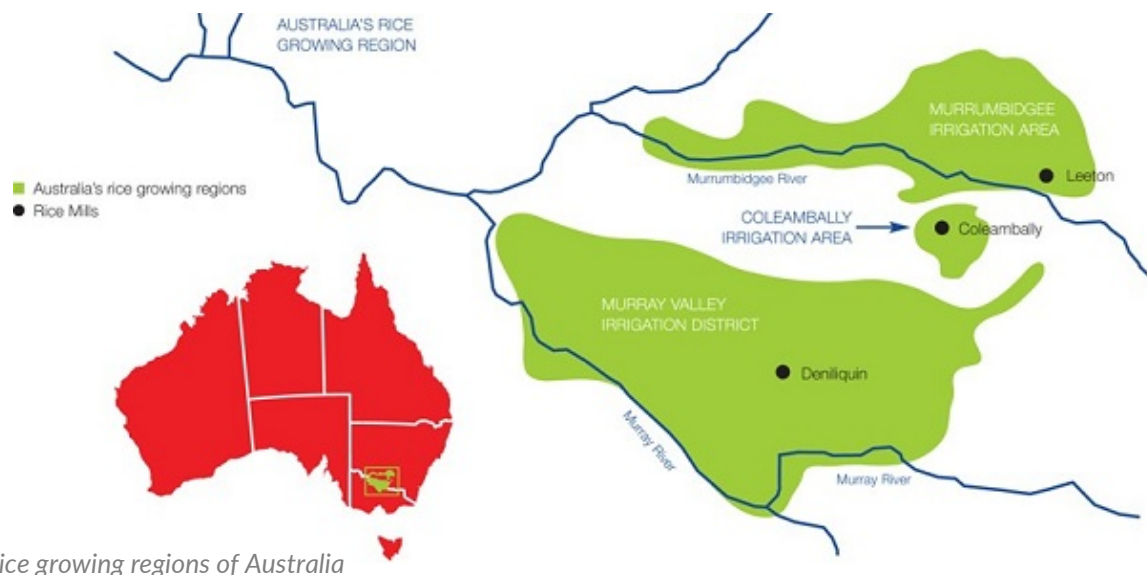
NT DPIR has a long and ongoing relationship with NSW DPI and SunRice in the variety screening work undertaken at Tortilla. This trip to Yanco reinforced that relationship and has the potential to develop future work in rice research in the Top End.



Australian rice yields 1960 to 2009

The rice meeting held at the Yanco Agricultural Institute, brought together over 50 rice growers, researchers, agronomists, millers, rice industry stakeholders, and RIRDC research managers. It was important for seeking research directions for aerobic rice agriculture in both southern and northern Australia. Southern Australian rice is typically grown as paddy rice and can use up to 24 ML of water per crop. Though on average, Australian rice growers yield 10 t/ha and achieve the 1 t/ML target.

Of the many issues raised; new varieties to suit the aerobic systems was a common request. Other topics for research raised included: decision support systems for when to water, new varieties (drought and blast tolerant lines), weed control and crop rotations, precision tillage, fertiliser placement and fertiliser form, nitrogen transformation and availability of nitrogen in the soil under wetting and drying conditions, soil chemistry and soil health, and increased labour requirements with increased irrigation demands.



The meeting also discussed research results of various RIRDC funded projects in the rice sector. Topics ranged from weed management and new herbicides, through breeding, irrigation, nitrogen processes, remote sensing and data collection, using microwaves to kill weeds and weed seeds in soil. Of interest to the NT was a discussion by several presenters around the use of plant growth regulator MODDUS[®] (by Syngenta, active ingredient Trinexapac-ethyl) in various studies. One set of experimental data indicated variable impact on yield with significant yield increases at only one of three sites. MODDUS is not yet registered for use on rice.

Soil carbon benefits through reforestation

Department of Agriculture and Fisheries, Queensland Government

The following is an excerpt summary of a project run by Tim Smith, Queensland Department of Agriculture and Fisheries (QDAF). Mila Bristow, Principal Research Scientist, and Cassie McMaster, Plant Pathologist, NT DPIR, assisted in this project.

Changes in soil carbon occur slowly and the stability of soil carbon depends on environmental conditions and land management practices. Permanent crops such as trees are generally considered to sequester carbon in the soil, but there are few reliable datasets on soil carbon stocks and the transfer of carbon during reforestation.

The *Soil carbon benefits through reforestation* project aimed to determine soil and biomass carbon changes from reforestation across hardwood and softwood, savanna and rainforest ecosystems in subtropical and tropical Australia. The regions sampled included mixed species rainforest plantings in the wet tropics of north Queensland, spotted gum plantings in the Burnett and Scenic Rim regions of south-east Queensland, Pinus plantations in the south-east Queensland coastal lowlands and African mahogany in the Douglas Daly region of the Northern Territory and in Kununurra in Western Australia.

The researchers compared pasture with reforested areas, as well as including three-way comparisons with remnant native vegetation areas where available, in order to quantify changes in soil carbon with land use. They found that soil carbon levels had declined with land-use changes from remnant native vegetation to pasture, and that cultivation caused further declines.

Reversing soil carbon decline through reforestation is a slow process; it typically takes more than 15 years for the soil carbon levels to exceed that of pasture. Younger reforested areas had similar soil carbon levels to pastures, but older plantations had increased soil carbon (especially when organic matter was included) beyond the levels achieved with pastures.

In addition to comparing soil carbon changes between reforested areas and previous land uses, the research team conducted sampling intensity studies, with a view to refining soil sampling techniques. It was determined that a minimum of eight plots of 10 bulked soil cores were required to minimise sampling error in variable reforestation sites.

The project also involved an economic analysis of the profitability of reforestation projects. This can help landholders make decisions about reforesting their land and demonstrate the potential of crediting carbon in both the soil and biomass of a forest. This aspect of the project examined species including African mahogany, spotted gum (utilised for multiple building materials), and mixed-species environmental plantings.

The results demonstrated that additional income through carbon credits or alternative sources (such as tourism as found in north Queensland) is required to provide viable returns for hardwood plantations and amenity plantings. High value species such as African mahogany were likely to provide economic returns to the grower.

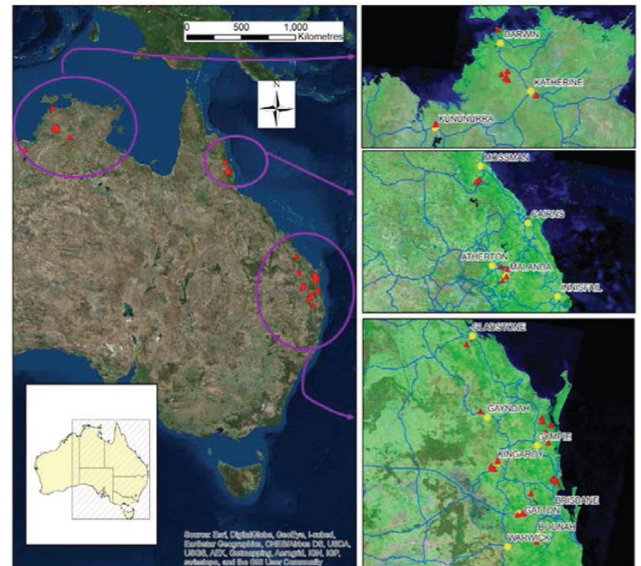
Based on the current carbon prices and substantial costs, significant land use change to carbon forestry is unlikely. However, there may be financially viable options in other similar ventures without large establishment costs, such as through natural regeneration of forested areas.

This project gives some confidence to policymakers, industry groups and farmers that trees in the landscape can rebuild carbon stocks where they have previously been depleted.

The benefits of reforestation extend beyond economic considerations, however. The strategic incorporation of trees in the landscape benefits agriculture through rehabilitation of degraded land, windbreaks for crops, livestock shelterbelts, buffer zones for watercourses and wildlife corridors. Rather than impeding on agriculture, this all contributes to long-term sustainability.

For more information please contact Tim Smith, QDAF, at 0427 820 894 or tim.smith@daf.qld.gov.au

The full article can be accessed at <https://publications.qld.gov.au/dataset/30c84c38-6320-4da3-8e8f-4db6ef4e166f/resource/16306c5f-9272-4020-9224-a9898d5137e3/download/nscpcasestudysoilcarbonreforestationbenefits.pdf>



The regions sampled for the project included savanna areas in the NT and in Kununurra in WA, mixed species rainforest plantings in north QLD, spotted gum forest inland from the Burnett region, and pine forest in the coastal lowlands of QLD

Pastoral Market Update

DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES



Live Cattle Exports via Darwin Port – AUGUST 2016

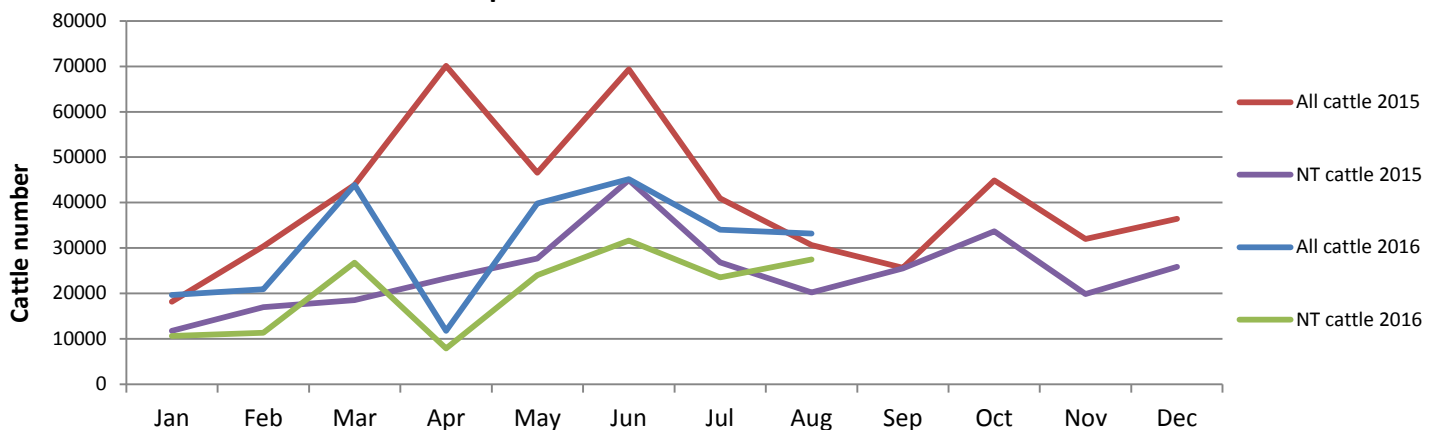
Please note: figures are for cattle exported through the Port of Darwin only; some NT cattle are exported through interstate ports.

Destination	Export of ALL CATTLE (including interstate) from Darwin Port							Export of NT CATTLE from Darwin Port (estimate only)						
	2014	2015	Last year to 31/08/15	YTD to 31/08/16	August	Last month	Difference	2014	2015	Last year to 31/08/15	YTD to 31/08/16	August	Last month	Difference
Brunei	4,925	4,122	3,249	3,379	1,080	300	780	4,925	2,069	1,450	2,314	895	207	688
Indonesia	386,183	341,759	233,768	205,443	30,588	27,843	2,745	251,232	197,155	121,526	134,962	25,357	19,243	6,115
Philippines	16,080	23,611	15,273	4,697	0	0	0	11,221	13,559	7,387	3,236	0	0	0
Sabah	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sarawak	0	300	300	1,220	0	1,220	-1,220	0	0	0	843	0	843	-843
Malaysia	22,309	11,503	11,503	9,854	1,507	4,647	-3,140	15,708	7,499	7,499	6,698	1,249	3,212	-1,962
Vietnam	64,461	100,119	78,321	20,975	0	0	0	41,391	63,998	47,787	13,168	0	0	0
Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thailand	0	6,154	6,154	0	0	0	0	0	3,610	3,610	0	0	0	0
Cambodia	0	0	0	2,766	0	0	0	0	0	0	1,936	0	0	0
TOTAL	493,958	487,568	348,568	248,334	33,175	34,010	-835	324,477	287,892	189,260	163,157	27,502	23,505	3,997

AUGUST at a glance

- 33,175 cattle through the Darwin Port during the month; 835 less than last month and 3,997 more than in August 2015.
- 27,502 NT cattle through the Darwin Port during the month; 3,997 more than last month and 8,245 more than in August 2015.

Live cattle exports thru Port of Darwin 2015 - 2016



OTHER LIVESTOCK EXPORTS VIA DARWIN PORT

Includes NT and interstate stock.

Destination	Buffalo		Goat		Camel	
	YTD	August	YTD	August	YTD	August
Brunei	599	499	0	0	0	0
Indonesia	0	0	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	840	840	0	0	0	0
Vietnam	1,339	0	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	2,778	1,339	0	0	0	0

NT CATTLE MOVED INTERSTATE

Destination	Number
NSW	1,603
QLD	30,740
SA	6,869
VIC	1,359
WA	4,260
Total	44,831

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							
2008	2009	2010	2011	2012	2013	2014	2015	2008	2009	2010	2011	2012	2013	2014	2015
364,944	347,314	295,605	269,617	246,990	359,616	493,958	487,568	295,539	304,818	272,749	253,797	234,249	308,784	324,477	287,892

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September 2016

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Livestock disease investigations

The Department of Primary Industry and Fisheries (DPIF) 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.

During the April–June 2016 quarter, 102 livestock disease investigations were conducted to rule out emergency diseases or investigate suspect notifiable diseases across the Northern Territory. Figure 1 shows the number of investigations by species of livestock.

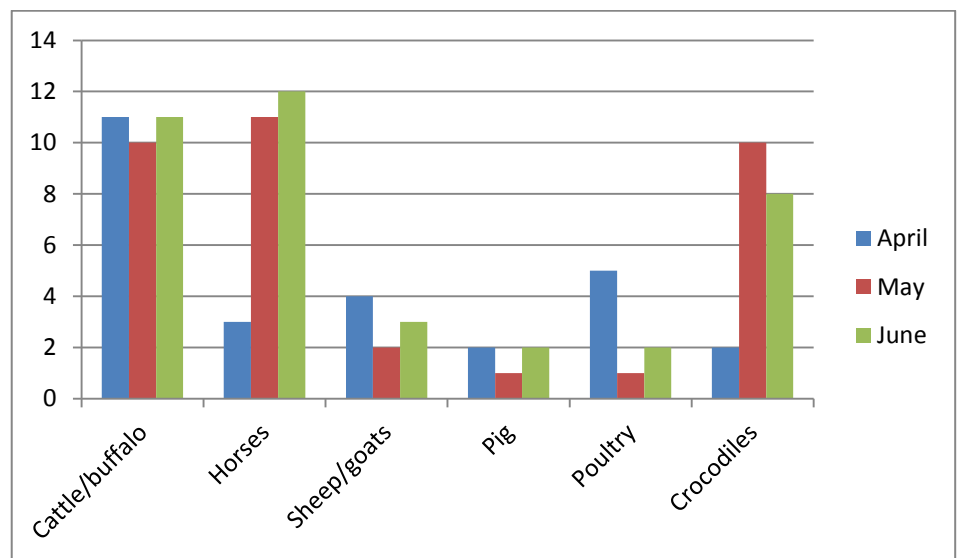


Figure 1. Livestock disease investigations by species for April - June 2016

Berrimah Veterinary Laboratories processed 216 livestock sample submissions including 86 samples to substantiate proof of disease freedom certifications, and for accreditation programs and targeted surveillance to support market access.

The following case reports are a selection of field investigations of livestock disease incidents during the quarter.

Livestock disease investigation case reports

Sudden deaths in weaners at mustering

Sudden death in 10 of 1500 weaner cattle during a muster on a property in the Darwin region was investigated. Staff had mustered and spelled the cattle the night before with no losses observed. The following morning, staff saw affected cattle briefly stagger, go down and have seizures before rapid death, within minutes, over the final 4 km of the muster.



Figure 2. Haemorrhage from mouth of cattle in anthrax exclusion case

Initial examination of the carcasses occurred several hours after death due to the isolated location of cattle. Examination showed rapid decomposition with blood present at the anus and nostrils and/or mouth of all carcasses. As these clinical signs were consistent with anthrax – a zoonotic notifiable disease which can be fatal to people, a blood smear was taken and submitted to the veterinary laboratory to exclude anthrax before a post-mortem was attempted.

Anthrax is caused by the bacteria, *Bacillus anthracis*. In grazing livestock anthrax usually presents as the sudden death of one, or a group of animals in a mob. Affected stock often show few or no signs of ill health before they die. Anthrax survives for long periods in the environment

by forming tough spores which lie dormant in the soil, and its re-appearance is unpredictable. It can recur more than 50 years after the last known case on a property. Carcasses of animals that have died from anthrax are full of infectious bacteria. A feature of anthrax infection is failure of the blood to clot, so after death blood and body fluids ooze from the nostrils, mouth and anus. **Although there has never been a case of anthrax reported in the NT, anthrax should always be excluded from cattle which die suddenly with blood oozing from the nostrils, mouth or anus.**

In this case, post-mortem revealed all carcasses to be in moderate stages of decomposition, having died up to 30 hours previously. All animals were in good body condition with no external wounds. Carcasses had trapped air under the skin, with some having bruising and swelling of the abdomen.

There was an increased amount of abdominal fluid containing blood and blood serum in several animals. Examination of rumen contents showed all animals had adequate green roughage present. The rumen of one steer contained numerous 1-2cm unidentifiable green seeds. No unusual material was found in any of the other animals.

The veterinary laboratory cultured a species of the *Clostridium sp.* bacteria from collected tissue samples; this bacteria is a common post-mortem contaminant. Clostridia species that commonly cause diseases such as blackleg and black disease in cattle were not identified and unlikely to be the cause of this case. No venom was detected for tiger, brown, black, death adder or taipan snakes in the blood sample from the heifer, and the blood lead level was within the normal range excluding snake bite and lead toxicity as the cause of death.

Unfortunately, a diagnosis could not be confirmed in this case. Given the history of the property, the location of mortalities, the good body condition of the cattle affected and the rapid progression of clinical signs, the cause of sudden death was most likely exposure to an unidentified plant toxin.

Although the exclusion of the zoonotic notifiable anthrax disease was critical for staff health and safety, the delay in necropsy may have contributed to the inability to determine a definitive diagnosis. This case highlights the application of field based point-of-care tests to rule out zoonotic diseases such as anthrax to enable further investigation on property. The department's regional offices now have access to anthrax exclusion test kits which allow the test to be undertaken immediately on property to avoid a delay in post-mortem and assist with timely diagnosis.

Multiple cutaneous fibropapillomas in Brahman heifers



Figure 3. Papillomavirus lesion on Brahman cattle

A small herd of 30 Brahman crossbred heifers, 7 to 18 months of age, presented with numerous wart-like lesions over their entire bodies including the eyelids, ears, head, vulva and tails. Samples of the lesions presented for histology were hard lesions ranging from small (5mm x 3mm x 2mm) to large (30mm x 20mm x 20mm), with the larger lesions having horn-like projections. The smaller lesions resembled thickened plaques, with fewer horny projections. Histology of several of the lesions revealed typical papillomas (small wart-like lesions).

Bovine papillomas are typically due to infection with one of 13 described bovine papillomaviruses. Bovine papillomavirus 2 in particular is often associated with typical fibropapillomas primarily on the head, neck, dewlap and shoulders of young (< two years of age) cattle. Warts usually shrink and drop off after a few months.

Bovine papillomavirus should not be confused with **Bovine Herpes Virus (BHV-2)** also known as pseudo-lumpy skin disease which also causes skin lesions on young cattle. Nodular skin lesions form and the nodules can easily be removed, leaving a hairless skin patch. BHV-2 generally has a high infection rate which is usually self-limiting. Animals completely recover within a couple of months. It is spread from one animal to another by biting flies.



Figure 4. BHV-2 lesions on Brahman cow

Persistent bovine pestivirus and osteomyelitis in a bull

During annual bull processing, the property manager in the Darwin region noted one two-year-old composite bull with swelling on the left side of its jaw. While the other bulls were in good condition, the affected bull was small for its age and in poor condition. Deemed unsuitable for treatment, the bull was euthanized and a full post-mortem examination was performed.

Cutting in to the hard, bony, swollen lower jawbone revealed a cheesy core. Retained milk teeth were apparent at the first three molar teeth on the left jawbone, with corresponding ulceration of the inside of the cheek and tongue.



Figure 5. Infected jaw bone

Histopathology showed a severe bacterial infection of the jaw bone (**osteomyelitis**) associated with bacteria, *Fusobacterium necrophorum* and *Truperella pyogens*. Two other more common causes of swelling of the mouth and jaw in cattle are lumpy jaw (Actinomycosis) and wooden tongue (Actinobacillus). The term 'actino' indicates that the inflammation caused by these bacteria results in the formation of pus containing colonies of bacteria in the soft tissue or bone.

A positive bovine viral diarrhoea (BVDV) antigen ELISA test revealed the animal was also persistently infected with **bovine pestivirus**.

Faecal parasitology revealed a high faecal egg count of 2060 eggs/gram with larval culture identifying 100% *Haemonchus sp* (**barber's pole worm**). *Haemonchus* can lead to ill-thrift, weight loss, anaemia, weakness and reduced grow rates or death. A narrow spectrum anthelmintic such as Closantel chemical can be used to treat haemonchosis infestation, however a broad spectrum such as a macrocyclic lactone (ML) or Ivermectin-based chemical can be used to prevent worm infestations. Drenching is not usually required for mature adult cattle, however. Heavy infestations of *haemonchus* can occur in weaners, particularly in the Top End and on flood plains. Drenching with a broad spectrum anthelmintic is one strategy which can be used to prevent clinical disease and death.

Infection with bovine pestivirus can compromise an animal's immune system and lead to dental abnormalities, which in this case likely led to the high worm burden and severe progression of the dental infection to infection of the bone in this bull.

Ironwood toxicity in a goat

Sudden death in a pregnant nanny goat was investigated in the Darwin rural area. Two goats had been purchased from another property and were held in a small paddock with the existing goat herd overnight. The owner found one of the introduced goats dead the next morning. Post mortem examination revealed the pregnant goat was in good condition. There was haemorrhaging of the heart muscle and multiple ironwood leaves in the rumen. The veterinary laboratory excluded bluetongue virus, acute melioidosis and other bacterial infection.

Leaves from the ironwood tree contain diterpenoid alkaloids and ingestion of only a few leaves can cause toxicity in goats and cattle. Young trees are particularly attractive to hungry and introduced grazing stock. Young ironwood trees were identified in the holding paddock, and removal and exclusion fencing has prevented further losses. Hungry introduced stock should be held in a yard and fed good quality hay before release into a paddock containing

ironwood trees to minimise risk of **ironwood toxicity**.



Figure 6. Ironwood tree (*Erythrophloeum chlorostachys*)

Three day sickness

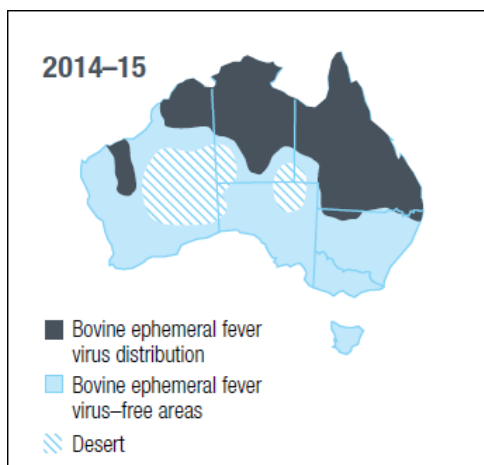


Figure 7. Three day sickness distribution (Source: Animal Health Australia)

Mosquitoes and biting midges can spread the viral disease known as three day sickness, or bovine ephemeral fever, to cattle and occasionally buffalo. Stock are often sick for three days, hence the name 'three day sickness'.

The disease occurs in northern Australia and along the eastern seaboard south and can extend to the New South Wales–Victoria border. Animals can be affected in the wet and dry season, but colder temperatures usually restrict the vector. There were outbreaks in July 2016 on properties in the Darwin region.

Three day sickness is more likely to occur in:

- young stock, because once infected they generally have lifelong immunity
- stock that live in northern areas of Australia
- areas that have had big wet seasons, especially if it follows several dry years as the disease may then affect older stock that have not been exposed to three day sickness.

Clinical signs of three day sickness

Clinical signs that would lead producers to suspect three day sickness include the following:

- lagging behind the mob at muster
- depression

- lameness, muscle stiffness, shivering, twitching, droopy ears
- drooling saliva, watery eyes, runny nose
- recumbency
- reduced water and food intake
- abortion.

Note: Heavier and older animals are more severely affected because long periods of recumbency leads to muscle damage. Contact your private or government veterinarians or livestock biosecurity officer to report the sick animals and arrange collection of blood samples for diagnosis at Berrimah Veterinary Laboratory.



Figure 8. Three day sickness

Treatment of three day sickness

Stock affected by three day sickness will generally recover within three to four days. Stock should be supplied with feed, water and shade until they recover and are to be positioned so they are resting on their brisket to prevent lung infections. Heavy animals should be rotated from side-to-side to prevent paralysis and pneumonia. Anti-inflammatory medications can assist with symptoms.

Prevention of three day sickness

The only prevention strategy available for three day sickness is vaccination. To achieve immunity to three day sickness, stock need to receive two doses of the vaccine. The second dose should be given two to four weeks after the initial dose. Immunity is not achieved if stock receive only one dose. This vaccine can be sourced only through a veterinarian.

More information

Northern Territory Department of Primary Industry and Fisheries AgNote: *Three Day Sickness or Ephemeral Fever*:: http://www.nt.gov.au/d/Content/File/p/Anim_Dis/640.pdf

Meat and Livestock Australia. 2016. *Three day sickness*: <http://www.mla.com.au/research-and-development/animal-health-welfare-and-biosecurity/diseases/infectious/three-day-sickness/>

<https://www.zoetis.com.au/diseases/bovine-ephemeral-fever.aspx>

Equine pleuropneumonia—a travel sickness

Transportation of horses over long distances is a common event in the Northern Territory and is the most common factor that predisposes horses to pleuropneumonia, also known as 'travel sickness', or 'transport sickness.'

Horses normally breathe in small numbers of bacteria; healthy animals expel these bacteria rapidly. Respiratory tract disease develops when the number of bacteria entering the lung is greater than normal defence mechanisms can deal with, or the respiratory defences are not working properly.

Removal of bacteria needs to be rapid as the bacteria can multiply and the infection may spread from the airways in to the lung tissue. Infection of lung tissue, (pneumonia), is associated with general illness; the animal shows an increased temperature, loss of appetite and depression. Lung dysfunction causes an

increased rate or depth of breathing, coughing and a rapid involvement of the chest wall lining. The horse may show pain and further respiratory distress due to accumulation of large amounts of fluid within the chest cavity. This is difficult to treat as many antibiotics are either inactivated by large amounts of accumulated pus, or do not penetrate lung tissue well.

Taking preventative measures is a far better option!

Note that these bacteria are not spread from one horse to another, that is, the disease is not contagious, but is caused by the horse's own bacteria waiting for an opportunity to cause disease—so called 'opportunistic pathogens' which are found in all horses

Predisposing factors:

- **head restraint**—the single most important factor predisposing to pleuropneumonia associated with transport, is head restraint in an elevated position. It has been shown that this factor alone can lead to pleuropneumonia.
Severe contamination of the lower airways can occur after as few as six hours of head restraint in an elevated position. As a result, every effort must be made to restrain horses in a manner that enables them to lower their heads during and after transportation

Cross-tying at racetracks may also have the same adverse effect on the lower respiratory tract and would only exacerbate any adverse effects of long distant transportation that may have occurred
- **dehydration**—many horses will not eat adequate amounts of feed during a long distant trip and are even less likely to drink adequate amounts of water. In addition, allowing horses to eat during a journey with heads tied up could conceivably increase the risk of aspiration. An 'average' 450 kg horse in hot conditions may increase its consumption of water to 60 litres
- **air pollutants**—inadequate ventilation within transport vehicles, ammonia, and the inhalation of exhaust gases and road dust may also impair mucociliary clearance.

Recommendations to help prevent pleuropneumonia:

- **minimise lower respiratory tract contamination**—it has been shown that accumulated bacteria and secretions from within the airways was not removed when the horse's head was periodically lowered by feeding or watering from the ground level for 30-minute periods each six hours. **Therefore, for long distant transportation, breaking the journey up into 12 hour stages, the recommendation is that there are 8-12 hour breaks between stages**
- **feeding horses from ground level** is preferable to feeding them from raised feeding containers
- **avoid cross-tying or transporting horses for long periods immediately following exercise.** A journey of as few as 2–4 hours, immediately after strenuous exercise, could cause problems
- **prevent extension of bacterial infection from the airways into the lungs.** This is unavoidable if horses have their heads elevated for more than 12 hours during transportation.

More information:

Leadon, D.P (1999) *Equine Pleuropneumonia*: <https://rirdc.infoservices.com.au/items/99-073>