GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

AGRICULTURE VICTORIA

A guide for farmers in using seasonal forecasts in South Eastern Australia

- **Case studies of growers**
- **Our key climate drivers**
- **Wetter vs drier patterns explained**
- **The latest insights and tips**

A guide for farmers in using seasonal forecasts in South Eastern Australia
Case studies of growers and other useful information on using seasonal climate forecasts in south eastern Australia
A joint initiative of the GRDC/Agriculture Victoria Using seasonal forecast information and tools to manage risk and increase profitability in the Southern Region project
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If you would like to receive this publication in an accessible format, such as large print or audio, telephone (03) 52264831 or email Liz.hamilton@ecodev.vic.gov.au
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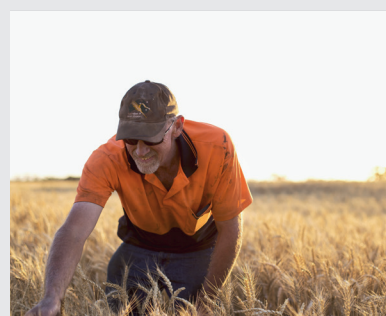**CASE STUDY ONE**

Bending with the seasons in Mallee country

CASE STUDY TWO

A mix of tools to make the best of the good years and ride out the tough ones

About the GRDC's Using Seasonal Forecasts Project

Recognising the importance of year to year climate variability as a major source of risk to grain grower profitability, the GRDC are investing in the *Using seasonal forecast information and tools to manage risk and increase profitability in the Southern Region project*. This applied project is working with the south eastern Australian grains industry to improve how we communicate and use imperfect, though improving, seasonal climate forecast information.

GRDC Grower Relations Manager – South, Darren Arney, says "Many growers and their advisers are aware of seasonal climate forecasts but are unsure how to best use the information in decision making. We want to address this challenge by encouraging the most effective use and uptake of the latest climate information to improve profit and risk management for our grain growers."

The project has three main components

1

Extending 'The Break' suite of seasonal forecast products to cover the whole GRDC southern region. This includes climate outlook newsletters, videos and webinars for each of South Australian, Victorian and Tasmanian growers.

2

Working closely with over 20 advisors from South Australia, Victoria and Tasmania through workshops and follow-up discussions to explore if and how seasonal climate forecasts can be better incorporated into the management of grain farms.

3

Creation of this publication of case studies and advice for GRDC Southern region growers and advisors on making the best use of seasonal forecast information to better target crop inputs, manage risk and increase profitability.

Seasonal climate forecasts (SCF) can play an important role in the farm decision making process, especially in years that sit outside the 'average'. Examples of where and when seasonal forecasts can be particularly useful to grain growers are outlined in the articles and case studies that follow.

The information presented in this booklet draws on the knowledge and experiences of grain farmers, advisors and researchers around how and when seasonal forecasts can aid you in making decisions about your farm enterprise.

The project is being led by Graeme Anderson and Dale Grey from Agriculture Victoria. In addition to overall project management, they lead the extension of the successful '*The Break*' suite of communication products across the Southern region.

Words of Wisdom

Key messages about using Seasonal Forecasts;
a selection of quotes overheard by Graeme Anderson

"Make decisions on what's knowable first. After that forecasts are a useful ten percenter"

"Just like forecasts for markets, the economy, prices – seasonal forecasts can't predict the future. But, used carefully with background commentary from a trusted source – forecasts can help you map out your scenarios"

"All options are possible at any time, but some seasons a pattern can change the odds of what's more likely"

"Beware the language of forecasters. 'Neutral' doesn't mean average rainfall, it means that there's a third chance of receiving either average, drier or wetter"

"A 70% chance of wetter than normal is the same as 30% chance of drier – so be careful you understand the probabilities and the language of any forecast"

"Seasonal forecasts tend to be worth paying more attention to in those years when a key climate driver is in an active phase"

"Best to squint your eyes when looking at a seasonal forecast maps…..it's the 'vibe' you're looking for, such as is there more or less moisture floating about this year"

"The commentary that sits behind the forecast is the key bit - it's about the background conditions"

"All forecasts are wrong, but some are useful!"

"Forecasts tend to make more sense when you know about the key climate drivers that were behind your district's big dry and wet periods"

"Climate change will turn up one month and one season at a time, so seasonal forecasting just becomes more important"

"Seasonal forecasts might only be of value or have a stronger signal every second or third year"

"All models have value – best to get a few opinions to get the overall vibe"

"If they do a hundred climate model runs for the next 3 months, when 80 runs are drier and 20 runs wetter, that's where the 80% chance of drier than median figure comes from"

Insights into Seasonal Forecasting

An interview with Dale Grey, Seasonal Risk Agronomist (Agriculture Victoria)
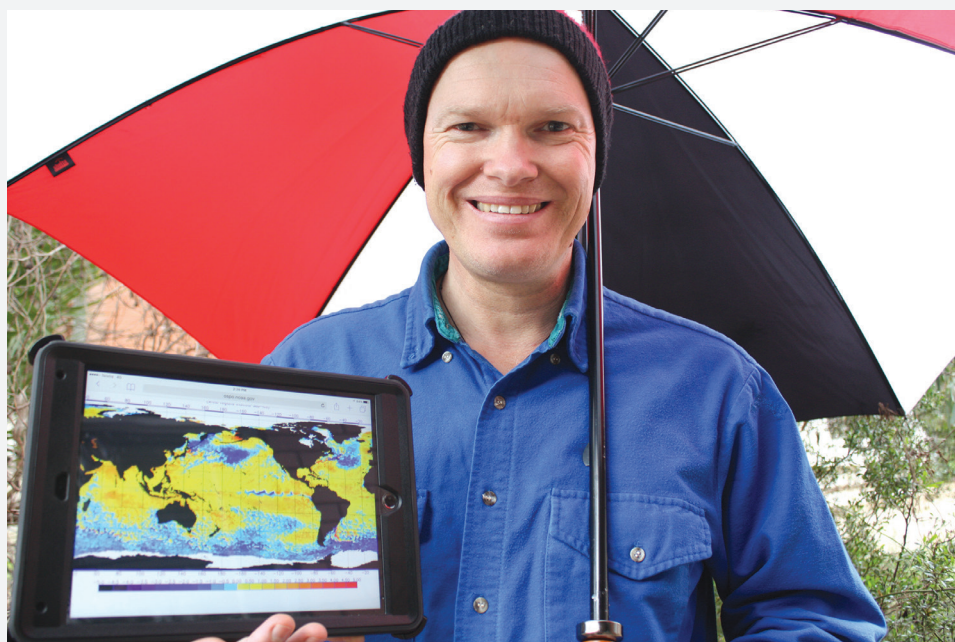

Image: *Dale Grey, Editor of "The Break"*

Q. What is that makes you more confident about a Seasonal Forecast? What are the signals you look out for?

The first thing to consider is the time of the year. I'm never very confident about using longer term forecasts during autumn because that's where the predictability barrier is, but I certainly start to become more confident in forecasts when we get into winter; the July forecast for August-October is when I have greatest confidence in forecasts. I don't place much confidence in summer forecasts. Exceptions to these times can occur when fully functioning climate drivers occur very early or late in the season.

Secondly, if the models are predicting wetter or drier, are they also predicting a reason why this might be happening such as a major climate driver like El Niño or La Niña or a signal from the Indian Ocean Dipole? In other words, is there a known physical reason as to what might be causing a drier or wetter forecast.

Thirdly, is there actually evidence of indicators such as ocean or cloud changes month by month, that you can see 'things' are actually happening or changing in the direction of the forecast? A seasonal forecast is one thing but if you can see evidence that a forecast is actually starting to play out, then that can be a situation where you can have more confidence in that forecast.

Q. What's neutral mean?

Neutral doesn't mean average. Frustratingly, there are two uses of the term 'neutral' - if referring to a 'neutral' ocean, that infers that the ocean is behaving in its historically 'average' or 'normal' state (i.e. not in an El Niño or IOD positive state).

However, when we refer to a 'neutral' forecast it's tempting to think that neutral means average but that's not the case. Neutral means anything is possible. For example, models may be run 100 times and from all these model outputs a neutral forecast says that one third of the models are indicating a drier forecast, one third came out average and one third came out with a wetter forecast. In other words, there is no strong signal in any direction pointing wetter, average or drier– that's the official term for the meaning of a 'neutral' forecast. Neutral means plan for anything.

Q. Do you have a favourite seasonal forecast model or prefer to scan them all to check the vibe?

Because I've been looking at seasonal forecast models for the last 11 years, I do have my favourites that have won my 'Brownlow' count over the years. They are usually the ECMWF, the BoM and the UK Met office models that have been the best performers over the last 10 years. But in saying that they have all, at times, performed poorly so I don't have rose coloured glasses on when I'm looking at any of the models.

Q. *Do some of the models perform better at predicting say, IOD or ENSO than others?*

Yes. ECMWF model is generally a bit better for predicting what's happening with the Indian Ocean Dipole. Some models are better at ENSO whilst others are better at predicting both. However, my experience suggests that you'd be mad to put all your eggs in one basket and just look at the one model because that could be the year that that particular model doesn't perform well or pick anything. For example, if six models are forecasting drier and your one 'favoured' model contradicts these six then you wouldn't stick with that one model just because it is usually the more reliable one. Better to consider the overall 'vibe'. That's why I provide an analysis of a range of models in *The Fast Break* indicating what the range of models are predicting. When you can see half or more of the models swinging a certain way then that tells me something.

If a forecast says we have 50% chance of above or below average rainfall – does that mean we are most likely to get average?

No. It's all about probability. If a model says a 50% chance of above average (median) rainfall then there is a matching percentage of getting the opposite of that, i.e. 50% chance of getting below average rainfall. It's frustrating because there are no absolutes in climate modelling, or any future prediction for that matter. It's all about probabilities.

Some useful links for that rainy day:

Where's the rain expected for the next 7 days?
www.bom.gov.au/jsp/watl/rainfall/

The next 7 days (model forecast) – just hit the play button and see what the next week might play out
www.bom.gov.au/australia/charts/viewer/index.shtml

BoM product showing how much soil moisture is about
www.bom.gov.au/water/landscape/

The BoM seasonal outlooks, which now have a monthly video snapshot as well as 1 to 3 months outlooks for rainfall and temperatures
www.bom.gov.au/climate/ahead/

CliMate app – useful tool to look up your nearest local long term rainfall station data and then ask questions like "How often we do we get autumn breaks with 50mm over 2 weeks in March-May?
www.climateapp.net.au/

Introduction to using Seasonal Forecasting

Graeme Anderson, Climate Specialist, Agriculture Victoria

> *Q: How often do you get your average rainfall?*
>
> About once every five years!
>
> *Q: Is there a way to find out if this year will be wetter or drier?*
>
> There is. But you need to know the climate drivers specific for your district, how and when they affected your rainfall in the past, and what mood they are in this coming season.

❝ It's worth knowing the "mood" your key climate drivers are in! ❞

Farmers do a great job at managing seasonal variability, mainly because we have no other choice. Profitable farms employ a range of tactics and strategies to manage variability, with clear trigger points for decisions at key points of the production year. As always, focus on what's under your control and measurable at the time of your decision. After that, seasonal climate forecasts (SCF) can be a useful five or ten percenter. However, they are getting better, with bigger computers, more live data fed from the oceans and atmosphere, and a better understanding of which climate drivers affects our region and when.

These four key climate drivers outlined below have their fingerprints all over our wetter and drier winter/spring seasons in the GRDC southern region. While they are linked and usually affect one another, here is a quick summary of what each driver does.

Image: *Graeme Anderson*
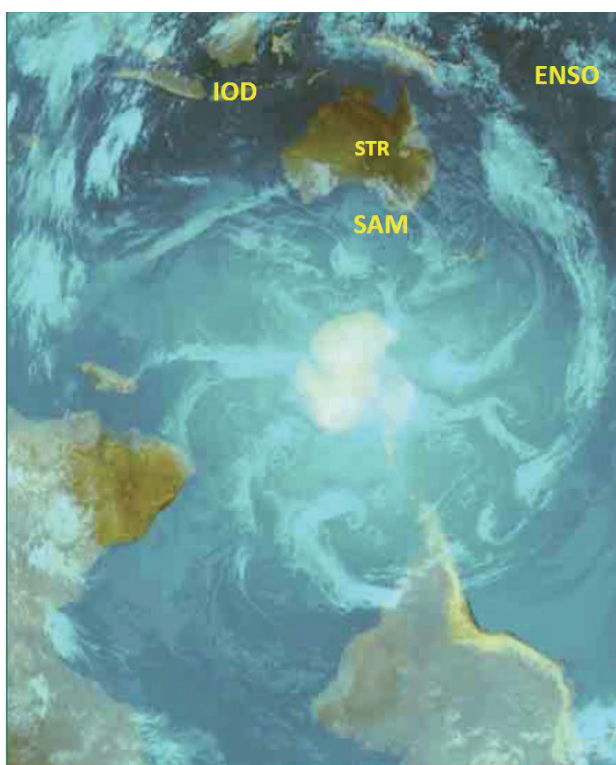
Key climate influencers southeast Aust rainfall:

- **ENSO** – Pacific Ocean moisture source
- **IOD** – Indian Ocean moisture source
- **SAM** – the fronts….
- **STR** – the highs…..

Key drivers of our seasonal variability – always have been and always will be! (BOM, CSIRO etc)

How climate phases change rainfall odds in South Eastern Australia

So, how have these climate drivers affected THIS region in the past?

The four pie graphs show what has happened to Keith (SA) August-October rainfall in previous years (since 1907) when there was an El Niño, La Niña or Indian Ocean Dipole event.
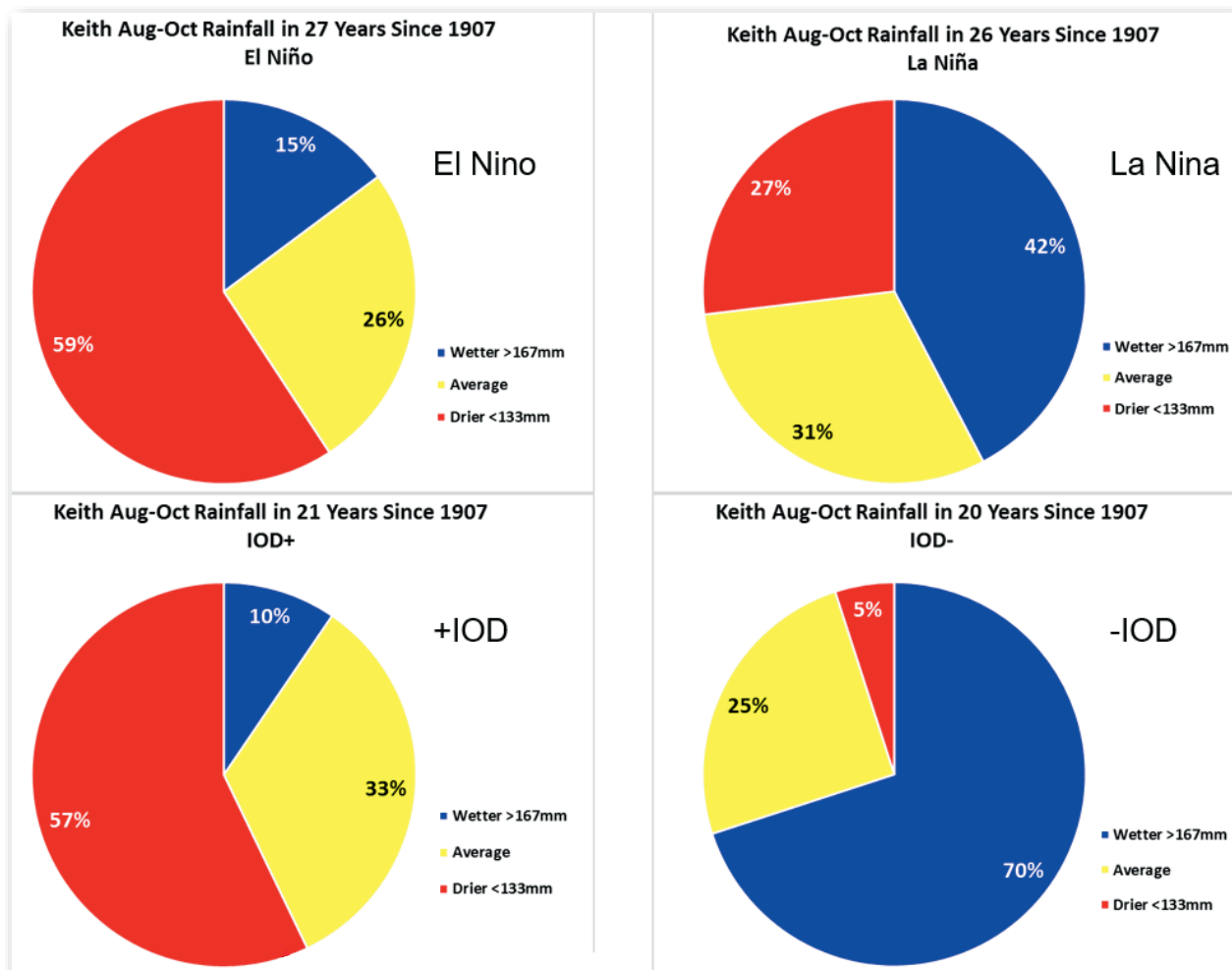
Source: *Dale Grey*

Note:
Red = Drier tercile years Decile 1-3
Blue = Wetter tercile years Decile 8-10
Yellow = Average tercile years

For all years since 1877, a third of years occur in each category (tercile). However, these graphs show how the odds changed during previous El Niño, La Niña or IOD events.

Seasonal forecasts can offer insights into the spring ahead. It might be that only every 2 or 3 years is there a clear or strong climate signal, but it's still worth tuning in to given how critical spring is for crop yield. Every farming system has key periods when seasonal conditions and major decisions need to occur. At any point we are able to know our stored soil moisture to depth (rain in the bank), plus we now have BoM seven-day rainfall forecasts plus one to three month seasonal outlooks which can help get a feel for mapping out the options and backup plans for the season ahead.

Note: These graphs showing how previous climate phases have affected winter-spring rainfall will be available soon for multiple locations across the south eastern Australia region at the *Forecasts for Profit* website.

Climate drivers that affect South Eastern Australia

ENSO – (El-Niño/Southern Oscillation) refers to sources of rain bearing moisture that comes from the tropical Pacific Ocean. Historically El Niño years send us less moisture, increasing the chance of drier springs. La Niña years (like 2010) send us more moisture and eastern Australia tends be have increased chance of average or wetter springs. Farmers can track what ENSO is up to to see what the outlook is for each spring – June-August is a good time to look at how things are set up for spring rainfall. The SOI (Southern Oscillation Index) is a measure of the pressure difference between Darwin and Tahiti. In El Niño years, the pressure is higher over the Darwin/Australia region and lower at Tahiti in the Pacific (SOI negative), which is not helpful for the flow of tropical moisture towards Australia. Recent events/seasons include El Niño (2015, 2009, 2006, 2002, 1997, 1994) and La Niña (2011, 2010, 2007, 2000, 1999, 1998).
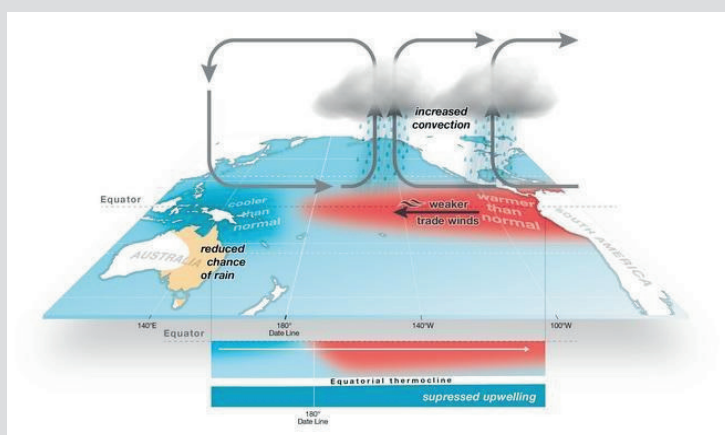
During the El Niño phase warm waters head towards South America and trade winds are weakened. This results in less atmospheric moisture available for rain in Australia. In the past, El Niño years have been correlated with an increased chance of drier springs.
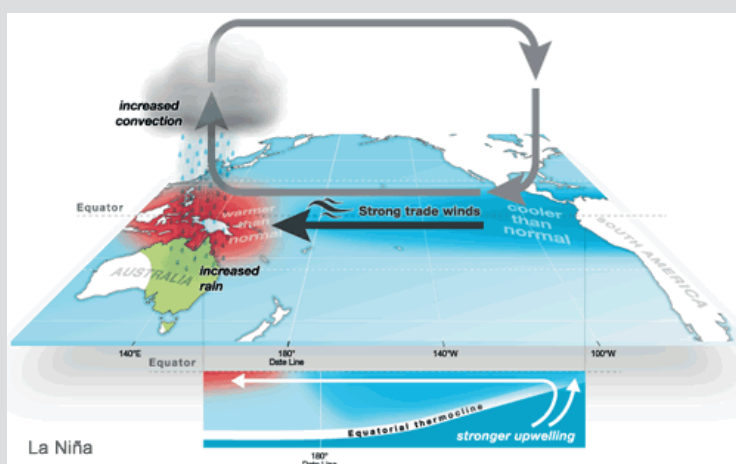

Historically, La Niña years deliver more moisture to Australia, because warm waters gather closer to our east coast. Combined with increasing trade winds this provides more moisture in the atmosphere and directs it towards eastern Australia. In the past La Niña years have been correlated with an increased chance of wetter springs.
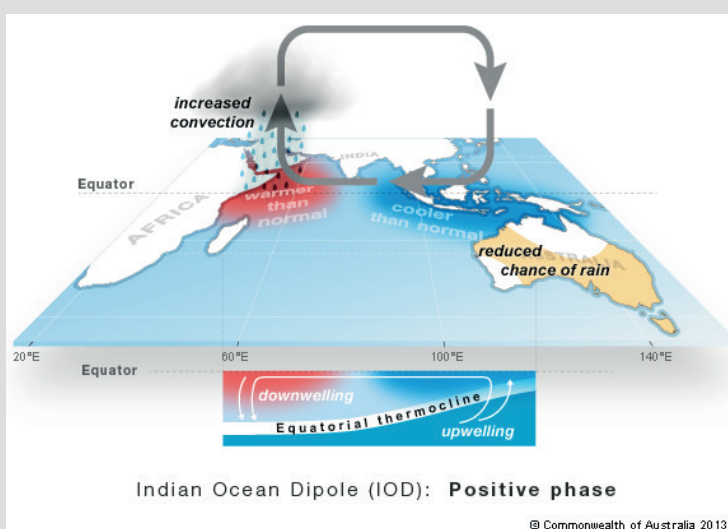
Images: *Courtesy of BoM*

IOD – (Indian Ocean Dipole) refers to the supportive role played by the Indian Ocean and northwest cloud-bands and triggers coming from the tropical Indian Ocean region off the coast of northwest Australia. Much of GRDC southern region spring rainfall shows a strong correlation with drier years when IOD is drier phase (+ve), and wetter springs are more likely during IOD (-ve) phases when extra moisture flows and rainfall triggers get sent down to us via northwest cloud bands which drop out their moisture when they hit our cold air down south. Recent events/seasons include IOD +ve/drier (2018, 2015, 2012, 2011, 2006, 2004, 1997, 1994) and IOD -ve/wetter (2016, 2010, 1992).

When the Indian Ocean is warmer in the east than it is in the west we have an IOD negative event. This means that more moisture is available closer to Australia, and can be delivered to SE Australia through northwest cloud bands. Typically IOD negative events have been associated with wetter seasons in SE Australia.

Indian Ocean Dipole (IOD): **Negative phase**

@ Commonwealth of Australia 2013.
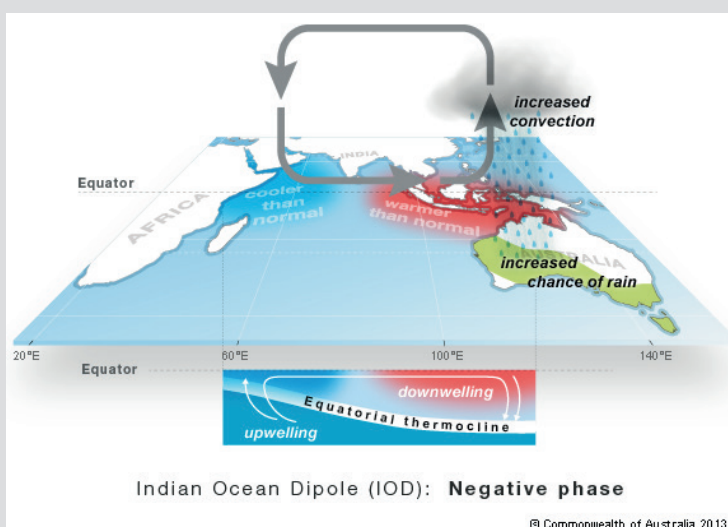
A positive IOD occurs when the Indian Ocean is warmer in the west (near the coast of Kenya) than it is in the east (near Sumatra). This reduces tropical moisture availability for SE Australia, and can make for a drier spring.

Images: *Courtesy of BoM*

Indian Ocean Dipole (IOD): **Positive phase**

@ Commonwealth of Australia 2013.

Climate drivers that affect South Eastern Australia

SAM – (Southern Annular Mode) refers to belts of westerly winds that circulate around the southern ocean, and can influence the strength of frontal activity and rain triggers that gets to the GRDC southern region. More regular or stronger fronts leads to wetter winters. When SAM is in positive phase, fronts sit a lot further polewards, which can lead to drier winters. However in summer, the same SAM positive phase can assist with some summer rainfall events along eastern parts of Victoria and southern NSW. In recent decades SAM has spent more time further south which partly explains reduced winter rainfall in parts of GRDC southern region.
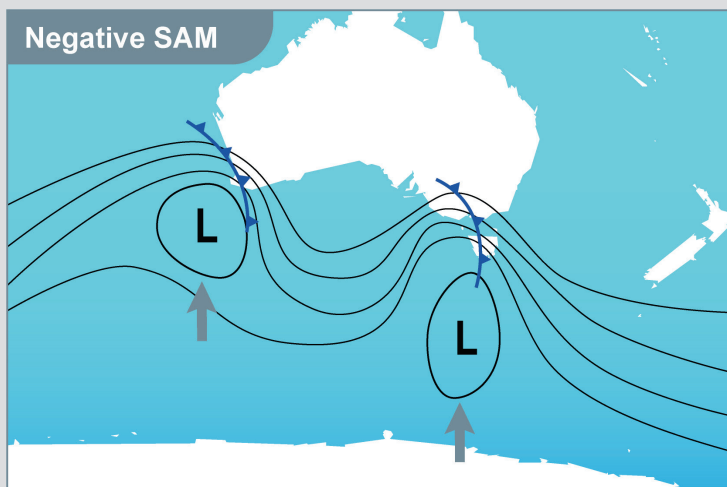
Negative SAM

When the westerly wind belt expands, more (or stronger) fronts can come closer to southern Australia. Negative SAM increases the likelihood of above average winter rainfall in SE Australia.
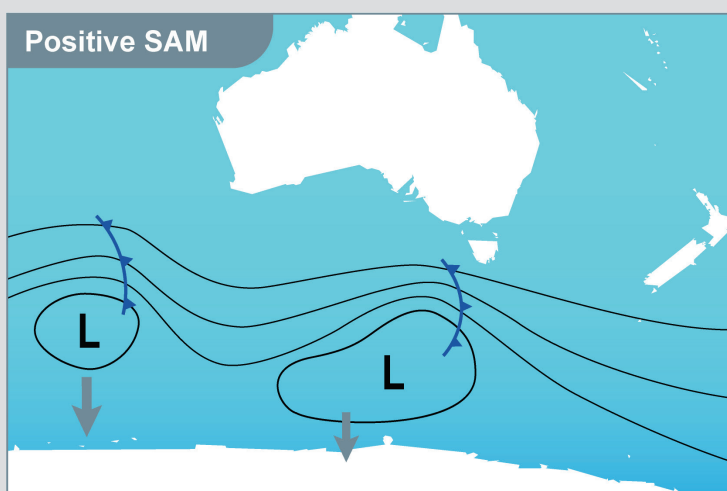
Positive SAM

When the belt of westerly winds contracts around Antarctica less (or weaker) rain producing fronts move across southern Australia. This is called the positive SAM phase and decreases the chance of rainfall (from fronts) during winter.

Images: *Agriculture Victoria*

STR – (Sub-Tropical Ridge) is a natural high pressure belt that sits across southern parts of Australia and can influence the location and strength of high pressure systems. Farmers know that seasons with stronger or more frequent blocking high pressure systems over southeast Australia don't tend to produce the regular rainfall that we would like. In recent decades the pressure pattern during the growing season has been measured as being a bit stronger, which meteorologists blame for the less reliable autumns rains in parts of southeast Australia. It also sets up the weather pattern that can bring cold/dry air from near Antarctica over parts of our region which can increase the incidence of frosts.

STR

H

Typical winter position of STR

Typical summer position of STR

H

■ Range of movement of Sub-tropical Ridge
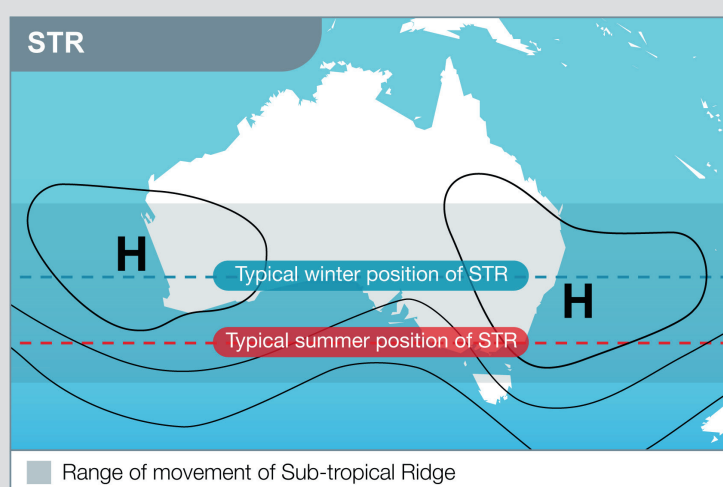
Images: *Agriculture Victoria*

Typically in winter the STR moves north, allowing fronts to pass over southern Australia. In summer, the STR typically moves south, blocking the passage of fronts which is part of the reason why SE Australia experiences rain bearing cold fronts during winter. The strength of the high pressure systems also affect rainfall. Higher pressure means less rainfall.

Did you know that:

The wet spring and end to 2010 was wetter due to both ENSO (strong La Niña) and IOD (IOD -ve = wetter) sending more moisture down this way.

The 2006 drought was the result of a combination of ENSO (El Niño - drier) and IOD +ve (drier). The bigger droughts often occur when both are in their dry phase.

The 2015 dry spring was also the result of ENSO (El Niño - drier) and IOD +ve (drier) teaming up again at their drier end of the scale.

The wetter 2016 winter spring was thanks to a negative phase (IOD -ve = wetter) of the Indian Ocean Dipole, which helped herd extra moisture to the GRDC southern region via northwest cloud bands.

Why forecasters look closely at Sea Surface Temperatures – a dry versus wet pattern

Graeme Anderson, Climate Specialist, Agriculture Victoria

The winter-spring seasonal rainfall variability in southeast Australia is strongly influenced by Sea Surface Temperatures (SST), especially along the equator and to the north of Australia. To see the contrast, below is the 2006 dry pattern (El Niño plus IOD+ve) and the 2010 wet pattern (La Niña plus IOD-ve).

COMPARE THE PAIR!

Spring 2006 SST Anomaly
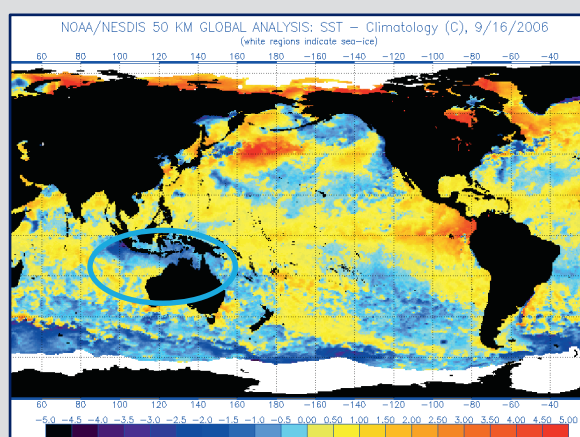
Cooler (blue) SST's to the north of Australia are usually associated with less cloud and moisture in our region. Source NOAA www.ospo.noaa.gov/Products/ocean/sst/anomaly

Spring 2010 SST Anomaly
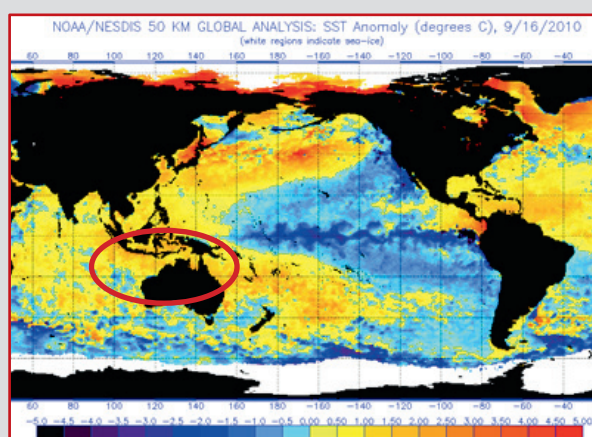
Warmer (orange) SST's to the north of Australia are usually associated with cloud and moisture in our region. Source NOAA www.ospo.noaa.gov/Products/ocean/sst/anomaly
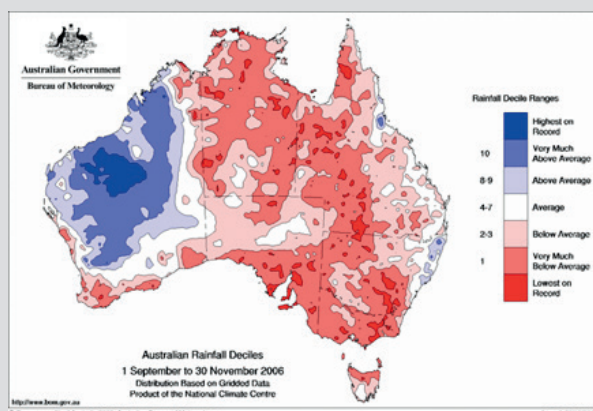
2006 Spring rainfall deciles. Cooler SST's meant less cloud and moisture for making rainfall in southeast Australia

2010 Spring rainfall deciles. Warmer SST's meant more cloud and moisture to feed into our weather patterns

Images: *Courtesy of BoM*

CASE STUDY ONE
Bending with the seasons in Mallee country

Image: *Bronwyn and Geoff Hunt* **Photo:** Clarisa Collis

Property :
Merriwa Pastoral Company

Owners :
Bronwyn and Geoff Hunt, Karen, Bill and John Fenton

Location :
Normanville, Victoria

Farm Size :
1484 hectares (1436ha cropping)

Enterprises
Cropping, dorper sheep

Average Annual Rainfall :
342mm

Soil Types :
Duplex, clay loam over clay
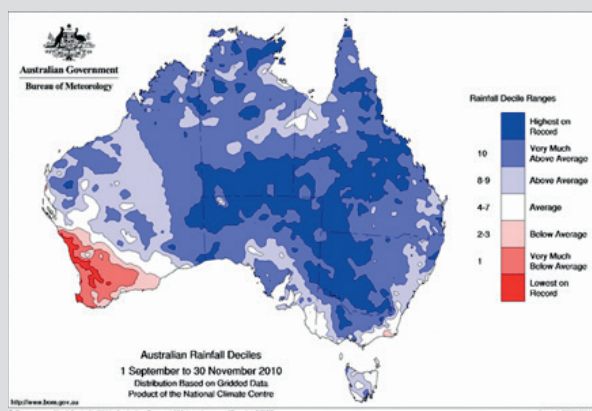
Soil pH :
8 to 8.5

Typical Crops Grown :
Wheat, barley, canola, lentils, oaten, hay, field pea hay

AUTHOR
Clarisa Collis

> " With climate change, rainfall is moving out of the growing season so we receive more summer rainfall and less spring rainfall now "

Facing seasonal and climatic variability with resilience and adaptability, one Mallee farming couple 'bend' their approach to crop management based on increasingly sophisticated seasonal forecasting and soil moisture data in north-west Victoria.

There, in this semi-arid region, Normanville growers Bronwyn and Geoff Hunt sharpen their farm business acumen using seasonal knowledge, tools and information drawn from the past, present and future of their 1484 ha property.

As such, the Hunts look to lessons learnt from past cropping seasons and paddock history; up-to-date data collected by a deep soil moisture probe and weather station installed on their property; and information from short and long-term seasonal forecasts. They also look to the findings of on-farm soil core sampling and a web-based decision support tool - Yield Prophet® - that estimates crop yield potential based on predicted rainfall and their soil core test results.

Using this suite of tools, the Hunts say they 'lean' rather than 'confidently step' towards management tactics to help shield their grains operation from a changing climate and variable seasonal conditions, including shifting, and sometimes harsh, weather patterns.
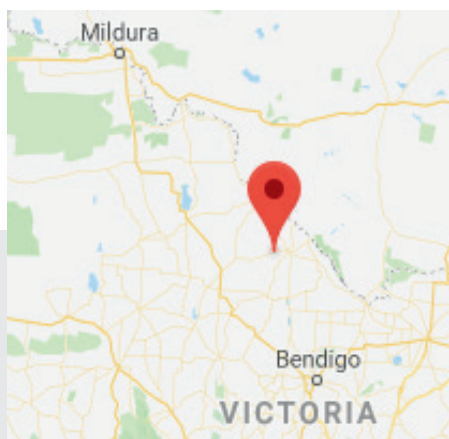
To this end, they routinely measure seasonal forecast information against on-farm soil moisture and nutrient information as part of an overarching strategy that aims to match crop inputs to growing season conditions and ultimately, maximise farm business profitability.

Turning to 'reliable sources', they refer to subscription-based seasonal forecast commentary, *The Break*, produced by Agriculture Victoria seasonal risk agronomist, Dale Grey. *The Break* provides a range of seasonal forecast summary newsletters, comparing forecast models and soil moisture data for three to six months. They also rely on deep soil moisture probe data and commentary released by Agriculture Victoria seasonal risk agronomist Dale Boyd who manages a Victoria-wide network of probes on growers' properties.

The Bureau of Meteorology (BoM) is another trusted source for the Hunts, particularly in terms of its local and state seasonal forecasts, Indian Ocean Dipole and Southern Oscillation Index monitoring, Australian weather watch radar and wind forecasts, available via Agriculture Victoria as well.

Tracking their strategy through the southern growing season, the couple say: "If the seasonal outlook for April and May indicates there is a 70 per cent possibility of drier than average conditions, we might change our farm management approach at the paddock level."

However, these seasonal outlook predictions are also carefully considered against the farm backdrop of soil moisture and nutrient availability. For example, when data from their soil core sampling and deep soil moisture probe shows subsoil moisture is depleted, the Hunts may opt to reduce the farm's canola cropping area. However, when the data shows that the soil moisture profile is at least half full, they may decide to increase the farm area planted to this thirsty, deep-rooted oilseed, known to forage for moisture a metre beneath the soil surface. Soil moisture information is also used to identify their wettest paddocks on which they sow canola.

In contrast to this seasonally-flexible approach to their canola country, the farm area sown to wheat and barley remains fixed because these hardier cereals have proven relatively adaptable to variable seasonal conditions.

Sowing Time

To help minimise the unpredictable longer-term risk of heat shock later in the growing season, the Hunts now early sow their wheat, lentils and canola in April, instead of May, and their barley in May, instead of June. Such an approach can increase the unpredictable risk of frost damage, though the Hunts see this as less of a risk than heat shock.

"We sow earlier to help minimise losses from heat shock, particularly during the sensitive flowering phase, and to help avoid the effect of hot weather towards the end of the season. We can't avoid both these seasonal challenges, but we can manage risk for them."

An added benefit of earlier sowing is that it helps to buffer their grains operation from shifting weather patterns in a changing climate – a development reflected in seasonal forecasts, historical rainfall data and their own farm records.

"With climate change, rainfall is moving out of the growing season so we receive more summer rainfall and less spring rainfall now. Some late-sown Mallee crops were not harvested as a consequence of the dry conditions in the 2018 growing season."

Moisture Measurement

The Hunts say their management decisions early in the growing season, especially those at sowing, are mainly informed by soil core sampling. They collect six soil cores from each paddock, at increments of zero to 10 centimetres (cm); 10 to 40cm; 40 to 70cm; and 70cm to one metre in the soil profile. These soil core test results, collected in March just before April-sowing, are then entered into the Yield Prophet® decision-support tool and reality checked against measurements from the deep soil moisture probe.

The Hunts also closely monitor the BOM's Indian Ocean Dipole (IOD) outlook because they have found these climate phases, typically starting in May or June, have a strong influence on their farm's growing season rainfall.

Accompanied by a weather station, sensors in the capacitance probe record subsoil moisture from a fixed location on their property at 10cm increments from a depth of 30cm to one metre in the soil profile. The data, which can be accessed by other growers, is then sent via the mobile phone network to a server for storage, analysis and interpretation using graphing software.

The Hunts prefer their early-season crop management decisions to be guided by known soil moisture parameters because there is a limit to how much they can rely on seasonal forecasts due to the spatial variability of rainfall that fluctuates from farm-to-farm and district-to-district.

"For instance, we received 22 millimetres (mm) of rain on our farm, while the neighbouring property received just 10 mm from the same weather event. The BoM's local weather watch radar and Agriculture Victoria information sources have highlighted, quite dramatically, how patchy the rainfall is in this area." Nevertheless, they describe seasonal forecasts as an "important, but approximate guide" that increasingly influence their farm business management decisions as the growing season progresses. For example, acknowledging moisture and nitrogen as their main yield-drivers, they consult seasonal forecasts, in conjunction with Yield Prophet®, soil core testing and probe measurements to help inform their approach to crop nutrition later in the growing season. To minimise the potential for applied nitrogen losses in a "risky production area", the Hunts generally apply nitrogen fertiliser to cereals as late as possible, just before the end of tillering in late July or early August.

During the prolonged dry conditions in 2018, the Hunts decided not to apply any extra nitrogen to their cropping program; a decision, partly based on the outlook for drier than average conditions that saw them secure better gross margins from moisture-stressed grain and hay enterprises. In contrast, during the 2017 season, they applied about 100 kilograms of urea per hectare to cereals to optimise the productivity and profitability of that year's bumper crops.

The Hunts also closely monitor the BoM's Indian Ocean Dipole (IOD) outlook because they have found these climate phases, typically starting in May or June, have a strong influence on their farm's growing season rainfall. More specifically, a negative IOD phase tends to result in above average rainfall in winter and spring, which provides a cue for the Hunts to consider applying more nitrogen just before the end of tillering. BoM wind forecast maps indicating wind direction and average speed, are one more tool the Hunts use to help guide their herbicide, insecticide and fungicide spraying operations.

The availability of Agriculture Victoria's seasonal forecasting tools and information, previously limited to growers in Victoria, are now being extended to growers across the southern grains region in South Australia and Tasmania as part of a new GRDC-invested research project.

A mix of tools to make the best of the good years and ride out the tough ones

Property :
Sandalwood

Owners :
Barry and Kristina Mudge

Location :
Upper North of South Australia

Farm Size :
1600 hectares (1200ha cropping)

Enterprises
Cropping, prime lambs

Average Annual Rainfall :
330mm

Soil Types :
Loamy Mallee, stoney red-brown earths and desert loams

Soil pH :
6.8 to 8

Typical Crops Grown :
Wheat, barley, lentils, vetch pastures

AUTHOR
Barry Mudge

Image: *Barry Mudge*   **Photo:** Claire Magliulo

> "Used cleverly, Seasonal Climate Forecasts may sometimes enable us to be at least more comfortable with the many climate sensitive decisions that we need to make in the course of our farming careers"

Barry and his wife, Kristina, operate a 1600 hectare mixed farming property in the Upper North of South Australia. Rainfall is highly variable but the annual average is around 330 mm (220mm growing season). Barry considers the variability in rainfall an asset which needs to be managed to maximise profitability over the range of seasons.

"The facts are that in these low rainfall environments, we can either be farming in some of the most productive country in the state, or some of the worst, depending on how the season turns out. The challenge is to maximise the benefits of the good years and just learn to ride out the poorer seasons."

So the focus needs to be on good agronomy and maximising water use efficiency. At the same time, Barry believes that seasonal forecasts have a role to play, but he remains cautious about putting too much emphasis on them. He has used seasonal forecasts in various ways over a lot of years but points to the need to be realistic in what they are telling us.

"We are very fortunate in Australia to have comprehensive climate records dating back at least 100 years. This provides us with an excellent starting point in understanding what the variability of our seasons looks like - all a seasonal outlook forecast does is potentially alter the probabilities of the various outcomes occurring… and, unfortunately, history shows that the reliability of seasonal forecasts is not particularly high."

A key time of the year for decision making is when crops are established; usually in late April or early May. Several years ago, Barry developed a simple index to provide guidance on expectations for the season which was then used to guide planting intentions. While seasonal forecast information was included in the index, it remained a relatively minor influence. "Generally, the information that we know about the season, such as stored soil water, crop establishment opportunities and other agronomic factors remain more critical to the decision than a forecast whose reliability is marginal at best."

If seasonal forecasts are going to be considered, Barry reckons that we firstly should focus on the level of skill sitting behind the forecast, and this can obviously vary both at different times of the year and between different years. "I get annoyed when I see a forecast that hasn't got at least some reference to skill, or past reliability. As an example, anyone can forecast the winner of the Melbourne Cup but history shows that not many people actually get it right".

While Barry believes his planting index was useful in getting an early feel for the season, he has been disappointed with the reliability of the early season forecasts. "From my observations, rarely do we get any useful information in our district from seasonal forecasts prior to June. This is a great pity as this could be incredibly valuable. But as we progress into winter and spring, we can get some years where there are clear indications of

" A little bit of analysis of the range of possibilities and how a seasonal outlook forecast could change these is usually a worthwhile exercise "

trends. This might only occur, perhaps 50% of the time but it can prove useful in adjusting fertiliser levels or planning fungicide applications".

Barry's main message when using seasonal outlook forecast information is to make sure that any influence they may have on decision making is soundly based. "Too often we tend to allow forecasts to subjectively invade our sub-conscious and affect our decision making. A little bit of analysis of the range of possibilities and how a seasonal outlook forecast could change these is usually a worthwhile exercise".

An example of this occurred in 2018. Towards the end of his sowing program, Barry had the choice between continuing to plant lentils (seen as relatively risky in his low rainfall environment) or planting vetch for grazing (seen as less risky). Some analysis showed that only in very dry years would the vetch be the better proposition and a seasonal forecast would need to be showing extreme dryness with a high level of underlying skill to support the argument to plant vetch.

Given the uncertainties inherent in the climate, Barry considers it unlikely that reliability of seasonal forecasts will ever reach the stage when they become the 'Holy Grail'. "We accept that we farm in a highly unreliable and climatically variable region. Seasonal outlook forecasts will not change this. But used cleverly, they may sometimes enable us to be at least more comfortable with the many climate sensitive decisions that we need to make in the course of our farming careers".

CASE STUDY THREE
Seasonal forecast helping to reduce the risks

Property :
Tea Tree Glen

Owners :
Tony and
Michele
Andrews

Location :
Nalyappa,
South
Australia

Farm Size :
800 hectares
cropping

Enterprises
Cropping

**Average
Annual
Rainfall :**
400mm

Soil Types :
Red clay to
sandy loam

**Typical Crops
Grown :**
Wheat, barley,
field peas

AUTHOR
Rachael
Oxborrow

Image: *Tony Andrews*   **Photo:** Rachael Oxborrow

" I've definitely made more money out of the changes I
made this year by listening to the forecast information "

Heeding the signals coming from seasonal forecast information has saved Yorke Peninsula grower Tony Andrews from large areas of potentially failed crop in 2018.

A dry start plus a drier outlook for the season before he began sowing prompted Tony to reduce the area he committed to field peas in his 800 hectare program. He reduced his pea plantings from 243ha to 174ha and filled the gap with barley. This was despite knowing he was planting barley in a paddock with a high weed burden that would require more management and spray applications over summer. The decision has proved a wise one.

"It has been a very disappointing year for peas and in the end I was harvesting for seed and cost recovery," he said. "Barley has been the opposite and we've had average yields and good quality with some malting grade coming through. "If I had put the other paddock into peas, I would have had a cleaner paddock now for next year but at the same time I would have had to reap another near failure.

Tony says a dry forecast would usually prompt him to 'lean' towards hardy varieties and maximise his barley plantings, while a wet forecast could allow him to favour field peas and chase potential higher returns.

"I've definitely made more money out of the changes I made this year by listening to the forecast information."

In-season rainfall has been less than half the historical average for 2017 and 2018 at the Nalyappa property and risk reduction has been a priority to ensure the farm remains profitable. Over time Tony and his wife Michele have grown in confidence in adjusting their plans based on forecast outlooks as they have experienced seasons and conditions consistent with the forecasts.

Tony says he now plans to be flexible where possible knowing it could prevent disappointing seasons. He says a dry forecast would usually prompt him to 'lean' towards hardy varieties and maximise his barley plantings, while a wet forecast could allow him to favour field peas and chase potential higher returns.

"I'm always planning my cropping program for an average to above average season, but when I see dry forecasts come through I usually alter my plans," says Tony. "This year they were dead right and the fact that I've had success with following forecasts helps me trust them as a source of advice in the future."

Tony and Michele have been monitoring seasonal forecasts for around four years and have

welcomed the expansion of GRDC investment with Agriculture Victoria to extend the subscription-based forecast service *The Break* to South Australia.

"Even with some good experience with my decisions around seasonal forecasts, I'm always mindful of what is actually happening in the short term and the decades of cropping experience in my family. I think more and more people are using seasonal forecasting as a part of their cropping operation. While some may take it more seriously than others, we know farming can be a gamble and anything that reduces our risk is definitely worth my time," says Tony.

Decisions around spraying and fertiliser application also involve seasonal forecasting consultation for Tony, who says spring is a key time for cost management if a dry period is predicted. He monitors evidence of disease or pest damage and is usually inclined to spray less often or not at all if problems are within threshold levels in a dry period.

"If the forecast indicates favourable spring conditions and you see the peas podding up nicely, they're worth the extra fungicide and insecticide," says Tony. "I've always held the view with peas and chickpeas especially, that you don't waste too much money on fertiliser with them, but you definitely focus on fungicide and insecticide as that will do more good in spring. In a wet year you will often observe more bugs in your crops but in a dry year there is usually much less pest activity. This means in a dry year you can monitor activity and potentially spray less often and save on repeat applications."

CASE STUDY FOUR

Seasonal tools frame big-picture vision

Image: *Wayne Thomas, Youanmite*   **Photo:** Clarisa Collis

Owners :
Wayne and
Therese
Thomas

Location :
Youanmite,
Victoria

Farm Size :
1540 hectares
(1500
cropping)

Enterprises
Cropping

Average Annual Rainfall :
450mm

Soil Types :
Sandy loam
over clay

Soil pH :
5 to 6

Typical Crops Grown :
Wheat, canola,
oats, vetch,
faba beans

AUTHOR :
Clarisa Collis

"Each tool only assists with part of the overall picture, so we use a suite of tools to build the most accurate picture of our farm business risk profile"

Northern Victorian grower Wayne Thomas was busy loading wheaten and vetch hay onto dusty trucks in the dry heat when GroundCover visited his family's 1540-hectare property at Youanmite, about 25 kilometres south-west of Yarrawonga.

Triggering this on-farm activity was the forecast for a soaking the following day, heralding a brief reprieve from the prolonged dry conditions during the 2018 growing season on the Thomas family's farm.

Wayne's risk management response to protect high-value hay from potential weather damage highlights the influence of increasingly sophisticated seasonal forecasting in helping to shield cropping operations from a changing climate and variable seasonal conditions.

However, seasonal forecasting is one of many tools the second generation grower uses to frame a big picture vision of the climatic and seasonal landscape that guides his approach to risk management across cereal, oilseed and legume crops grown for grain and hay.

"Each tool only assists with part of the overall picture, so we use a suite of tools to build the most accurate picture of our farm business risk profile," he says.

For Wayne, these tools fit into the past, present and future of the farm's cropping
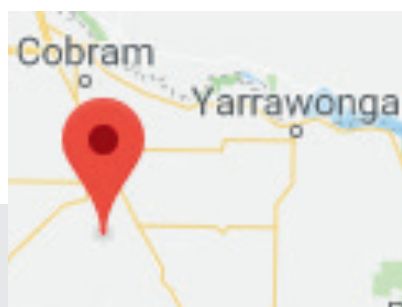
" Based on past experience, paddock data and seasonal forecasting, we know how much moisture crops need to fill grain. If there's no moisture left in the soil profile and the seasonal outlook is hot and dry in September, it's often safer to cut at-risk crops for hay than hang out for rain "

program; wheat, canola, oats, vetch and faba beans. They range from first-hand seasonal experience and paddock records to up-to-date soil moisture and weather data collected on-farm to seasonal and climatic forecasts, and a web-based decision support tool. For example, Wayne analyses data collected by a deep soil moisture probe and weather station installed on his property by Agriculture Victoria to help determine the yield potential of crops based on plant-available subsoil moisture and on-farm weather conditions.

From a fixed paddock location, the weather station records climatic information, such as in-crop temperature and received rainfall, while sensors in the capacitance probe record subsoil moisture at 10 centimeter (cm) increments from a depth of 30cm to one metre in the soil profile.

In the dry 2018 growing season, Wayne used data sourced from both the weather station and moisture probe on his property to help inform a key decision in farm business management - the decision to cut some wheat, canola, oats and vetch for hay instead of harvesting these crops for grain.

He says the weather station showed paddock temperatures, which plummeted from minus 1.3 down to minus 6.2°C between 1am and 7am on 29 August, caused severe stem frost that saw cereal and oilseed crops 'frozen in time'.

"We'd never experienced frost like that before - in the past we've only had partial stem frost. Some of our wheat and oats didn't grow another centimetre," Wayne says. The arrested crop development was reflected in the probe data that showed his frost-damaged wheat had stopped drawing moisture from the subsoil, suggesting it had stopped growing.

This frost impact on the Thomas family's farm was also observed by Agriculture Victoria seasonal risk agronomist, Dale Boyd, who manages a

Victoria-wide network of probes and weather stations on growers' properties and releases commentary based on the data collected.

Wayne's inspection and monitoring of crops showed the severe frost damage was not limited to 350 hectares of wheat. It caused major damage to most of the farm's 600 ha of canola and 250 ha of oats as well. Wayne says lessons learnt from frost damage in past cropping seasons, plus in-crop examination, confirmed losses were less severe where crops were sown into legume stubbles. This he attributes to the increased plant-available soil moisture following legume crops compared with cereals, and the dry conditions known to exacerbate frost-damage.

Apart from frost losses, other considerations that influenced Wayne's decision to cut about two thirds of his crops for hay were short and long-term seasonal and climate forecasts, released by Agriculture Victoria. To this end, he relies on seasonal forecast commentary, *The Break*, produced by Agriculture Victoria seasonal risk agronomist, Dale Grey. *The Break* provides a range of seasonal forecast summary newsletters, comparing forecast models, including Bureau of Meteorology (BoM) models, and soil moisture data for three to six months.

The short and long-term outlook in early September 2018 for continuing dry conditions saw Wayne cut some wheat and vetch for hay, even though it escaped frost damage, to help 'salvage profitability' from these moisture-stressed crops. "Based on past experience, paddock data and seasonal forecasting, we know how much moisture crops need to fill grain. If there's no moisture left in the soil profile and the seasonal outlook is hot and dry in September, it's often safer to cut at-risk crops for hay than hang out for rain," he says.

Chasing the 'most profitable, low risk' management option, he adds that forecast information is carefully measured against the backdrop of long-term yield averages, and crop dry matter cuts that ranged from 1.7 to 2.5 tonnes/ha last year.

CASE STUDY FOUR continued

In the low rainfall 2018 growing season, no nitrogen fertiliser was applied to the farm's stubble-sown cereals – a move that saw him secure better gross margins from parched crops, showing low yield potential

Wayne also fine tunes his crop area and inputs to match predicted seasonal conditions.

For instance, where seasonal climate models forecast low decile conditions, in which rainfall is ranked for each calendar year, and the probe on his property shows depleted subsoil moisture, Wayne might replace part of his wheat or canola area with less thirsty vetch or oaten hay enterprises. "We don't dramatically change our area planted to different crops in a dry season, but we may pull 100 ha of wheat or canola from our program," Wayne says.

And he might adjust his nitrogen fertiliser application rates based on seasonal and climatic predictions of a dry season as well. For example, in a high rainfall season, Wayne usually applies 30 to 50 kilograms of nitrogen/ha to help maximise grain productivity and profitability where cereals, with high yield potential, are sown into legume stubbles. However, in the low rainfall 2018 growing season, no nitrogen fertiliser was applied to the farm's stubble-sown cereals – a move that saw him secure better gross margins from parched crops, showing low yield potential.

Wayne's seasonal risk management toolbox also comprises the web-based decision support tool, Yield Prophet®, used to estimate crop yield potential based on predicted rainfall and soil core testing, plus BoM Indian Ocean Dipole outlooks known to influence on-farm rainfall.

CASE STUDY FIVE

Forecast knowledge is power in the low rainfall zone

Property :
Wootoona

Owners :
Bernard,
Susan and Ben
Carn

Location :
Quorn and
Umberatana
Station, South
Australia

Farm Size :
12,000
hectares
(1000ha
arable)
and 57,000
hectares

Livestock:
7000 Merino
sheep and 80
cattle

**Average An-
nual Rainfall :**
220mm to
300mm

Soil Types :
Red clay

**Typical Crops
Grown :**
Wheat and
barley

AUTHOR :
Rachael
Oxborrow

Image: *Bernard and Susan Carn*   **Photo:** *John Kruger*

> " I see so much value in listening to seasonal forecasts to help guide our decisions and quite often the changes we make on advice from those forecasts deliver the best outcome "

Destocking, reducing cropping area and opportunity summer planting after considering seasonal forecast advice are measures the Carn family have taken to reduce financial risk over the past decade. They farm in marginal country just south of Quorn in South Australia and seasonal forecast information is just one of the decision making tools they need to plan their seasons.

Susan, husband Bernard and son Ben run 12,000 hectares (ha) in the Flinders Ranges at Quorn and also manage 57,000 ha in the North-east pastoral area on Umberatana Station. At present they run around 7000 merino sheep, 80 cattle and crop wheat and barley.

"I see so much value in listening to seasonal forecasts to help guide our decisions and quite often the changes we make on advice from those forecasts deliver the best outcome," Susan says.

"In 2018 we were three quarters of the way through what we had planned to plant and stopped.

I sat down and had a look at the dry winter/spring forecast and thought no, I'm really not liking this, particularly as we didn't have much subsoil moisture." Susan says she made the suggestion to her husband to stop seeding and it has turned out to be the right call.

"We didn't harvest anything this year (2018), it was all fed to our sheep ages ago," she says. "After seeing the forecast, the writing was on the wall. "I also questioned how many sheep we had and whether it was sustainable to keep this many."

As the season progressed and the seasonal forecasts were shown to be accurate, the Carns significantly destocked both their Quorn and Umberatana properties and have lambs in their feedlot.

Susan says she has seen rainfall patterns change significantly over the past few decades and this has prompted them to trial certain measures to protect their income, stock and land against dry year forecasts. This includes putting sheep lick feeders in most grazing paddocks, using available barley on hand to supplement ewes and introducing lambs to grain to prevent over-grazing.

"That's really made a difference in our lambing percentage and our ewes are looking so much better," she says. "This normally works really well, but this year has been horrible and we've used all our barley and didn't grow any new seed so we've had to buy in a lot of seed to keep us going."

Susan says consulting seasonal forecasting as a part of farm planning requires an attitude of flexibility and willingness to trial various options. Susan's interest in weather forecasts and climate outlooks started when she noticed their seasons were changing and wanted to understand what was happening. She has participated in several South Australia Research and Development Institute (SARDI)

climate-risk courses, became a Climate Champion Program participant and takes note of Agriculture Victoria's *The Break* service which expanded to South Australia and Tasmania in 2018.

"In an ideal world I would know in March or April what is happening for the cropping season but that is usually the most unreliable time for seasonal forecasting," Susan says. "My husband and son's idea is you need to plant at least something and take the chance for it to pay off, but I am much more cautious."

Summer planting in response to a wet summer forecast is something the Carns have also explored and this has previously given them summer feed for livestock that lasted well into autumn. Susan says this measure has the potential to help in the future and is an example of being flexible in response to forecast information.

"One year we got two inches in early summer and I'd heard that someone had tried putting in a barley crop in summer and it actually paid off," she says. "This is a great option if we don't have a lot of feed. Bernard had just finished harvest and then he started sowing in a paddock by the main road in November. I'm sure people wondered what on earth we were doing, but it turned out to be a good move."

The Carns also time their sheep breeding for lambing to occur when there is the best feed available. "I like to know around the end of October what's going to happen as far ahead as I can," Susan says. "This guides us as to when we put our rams in. A forecast with a lot of summer rain would suit an earlier lambing in autumn, but a dry summer forecast would suit a late autumn or winter lambing to try for more feed to be available in wetter months."

Summer planting in response to a wet summer forecast is something the Carns have also explored and this has previously given them summer feed for livestock that lasted well into autumn.

Useful Resources and Contacts

To subscribe to the latest monthly seasonal forecast summaries for Victoria, South Australia and Tasmania via *The Break* just head to **https://forecasts4profit.com.au**

You can also find all the links to the websites, climate tools and models that are used and featured in *The Break* updates **https://forecasts4profit.com.au/Global-Forecast-Models**

The Australian Bureau of Meteorology (BoM) have valuable information for farmers:

BoM Seasonal Climate Outlook – Rainfall and Temperature for next one to three months
http://www.bom.gov.au/climate/outlooks

BoM Seasonal Climate Video Summaries:
http://www.bom.gov.au/climate/outlooks/#/overview/video

BoM ENSO Wrap-ups – Latest on key climate indicators (El Niño, La Niña, IOD)
http://www.bom.gov.au/climate/enso/

BoM Seasonal Streamflow Forecasts (forecasts for catchment runoff)
http://www.bom.gov.au/water/ssf/

BoM/AWRA Root Zone Soil Moisture (actual & relative to normal maps showing model estimations of soil moisture reserves)
http://www.bom.gov.au/water/landscape/

Your local rainfall history - CliMATE tool!

A great tool developed by the National Managing Climate Variability Program. Take a look at your local rainfall history plus how rainfall is tracking this year compared to past years.

(Desktop or Phone App) – Can load longer term local rainfall data from your nearest station

https://climateapp.net.au/

CONTACTS

For more information about the For more information about the '*Using seasonal forecasts project*', contact project leader, Graeme Anderson, Climate Specialist, Agriculture Victoria E: Graeme.anderson@ecodev.vic.gov.au, Dale Grey, Seasonal Agronomist, Agriculture Victoria, E: Dale.grey@ecodev.vic.gov.au, or for South Australian specific information contact Peter Hayman, Principal Scientist, Climate Applications at SARDI. E: peter.hayman@sa.gov.au

The 'Using Seasonal Forecasts' project is brought to you by GRDC and partners.