Annual ryegrass in Bonito and HyTTec Trophy (medium seeding rate) under three herbicide strategies. Photos taken September 11, 2018.

these two herbicide strategies were non-significant.

Data on ryegrass head density revealed greater differences between the management factors investigated. Canola variety had an effect on ryegrass head density. When averaged across the sowing dates and herbicide strategies, ryegrass growing in HyTTec Trophy produced 52 heads/m^2 as compared to 78 heads/m^2 in Bonito (33 per cent reduction).

HyTTec Trophy is a new hybrid triazine tolerant variety from Nuseed, which is known for high early vigour. In contrast, Bonito is an open pollinated canola variety from Nuseed. It is possible these differences in early vigour may have contributed to the significant differences in ryegrass head density between HyTTec Trophy and Bonito. But in a similar trial at Hart in 2018, we were unable to detect differences in ryegrass control in these two canola varieties.

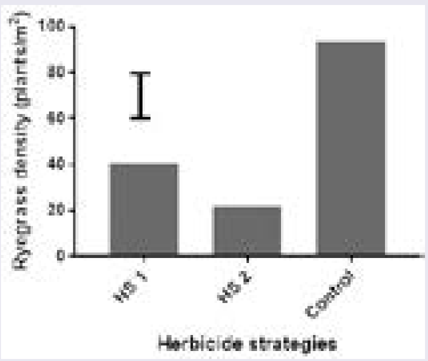
The lack of differences at Hart, could be attributed to seasonal effects (reduced early vigour in general) and a lower ryegrass population.

Herbicide strategies also had a significant effect on ryegrass head density. Ryegrass grown without any selective herbicide treatment (control) produced 128 heads/m^2 as compared to 40 heads/m^2 in HS1 and 29 heads/m^2 in HS2. This works out to 69 per cent reduction in HS1 relative to the control and 78 per cent reduction in HS2.

There was a significant interaction between the time of sowing and the herbicide strategies. This interaction appears to be associated with greater ryegrass head density in time of sowing two, which may be an indication of reduced competitive ability of canola when sown later. But herbicide activity against ryegrass was greater in time of sowing two which may be associated with wetter soil conditions leading to better herbicide uptake and activity (Figure 3). For example, HS2 only had eight ryegrass heads/m^2 in the later time of sowing as compared to 50 heads/m^2 in time of sowing one.

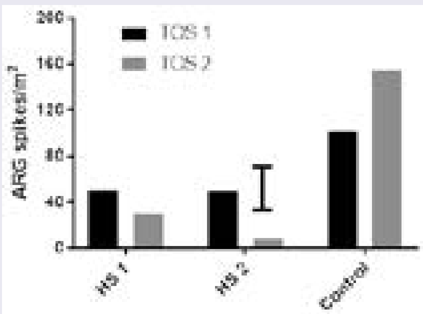
There was also an interaction between time of sowing, variety and herbicide, which was associated with superior weed competitive ability of HyTTec Trophy in time of sowing two. Ryegrass head density

Figure 2: The effect of herbicide strategies on ryegrass plant density



The vertical bar represents LSD (P=0.05).

Figure 3: The interaction between sowing time and herbicide strategies (P<0.001) for ARG head density



The vertical bar represents LSD (P=0.05).

Table 1: The effect of three herbicide strategies on canola grain yield, averaged for both varieties

Herbicide strategy	Canola grain yield (t/ha)
HS1 – Atrazine 2.2 kg/ha IBS + clethodim 500 mL/ha at GS14 of ryegrass	0.85
HS2 – Propyzamide 1 L/ha IBS + atrazine 1.1 kg/ha (at GS12 of ryegrass) + clethodim 0.5 L/ha + Factor 80 g/ha at GS14 of ryegrass	0.76
HS3 – Untreated control	0.39
LSD (P=0.05)	0.08

in Bonito increased from 100 heads/m^2 in time of sowing one to 193 heads/m^2 in time of sowing two.

This highlights poorer competitive ability in later sown conditions. In contrast, ryegrass head density in HyTTec Trophy was similar across both times of sowing (103 heads/m^2 and 114 heads/m^2).

Annual ryegrass seed production

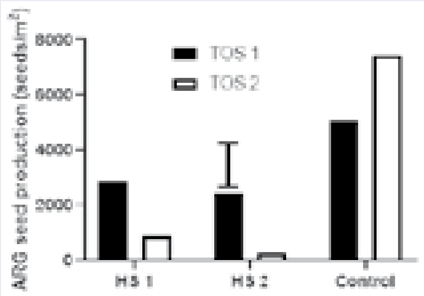
As was the case for ryegrass plant density, delayed sowing had no effect on ryegrass seed production.

But there were significant differences between the two canola varieties in ryegrass seed production. Averaged across the two sowing dates and herbicide treatments, ryegrass produced 3775 seeds/m^2 in Bonito compared to 2564 seeds/m^2 in HyTTec Trophy, a reduction of 32 per cent.

These results clearly highlight the potential for integrating vigorous hybrid varieties of canola for improving weed management.

Ryegrass seed production reflected the trends observed in head density data. There was a significant interaction between the time of sowing and herbicide strategies. Even though ryegrass seed set in the control was lower at the earlier time of sowing, when herbicide treatments were applied, ryegrass seed set was lower in time of sowing two (Figure 4). Greater herbicide activity in time of sowing two is likely to be due to better soil moisture at seeding time.

Figure 4: The effect of interaction between the time of sowing and herbicide treatments for ARG seed production



The vertical bar represents LSD (P=0.05).

Canola grain yield

As expected, canola grain yield was reduced by the two-week delay in sowing dates. Averaged across the sowing dates, seed rates and herbicide treatments, HyTTec Trophy produced 40 per cent greater grain yield than Bonito (0.50 t/ha Vs 0.83 t/ha). Canola seed rate also increased the grain yield – yield increased by 14 per cent as plant density increased from 32 to 44 plants/m^2 and by 19 per cent as density increased to 63 plants/m^2.

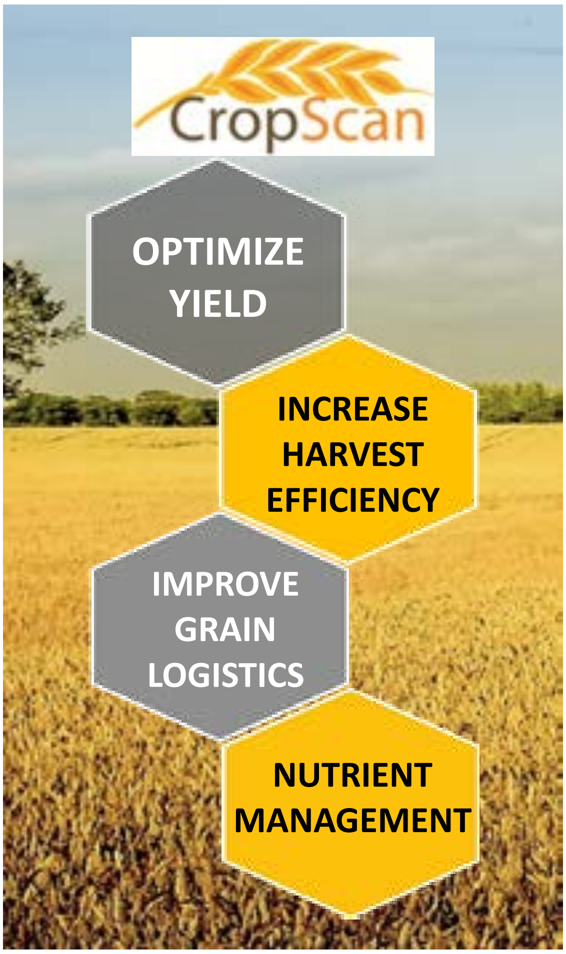
Herbicide strategies had the largest effect on canola yield. Herbicide strategies 1 and 2 produced canola yield of around 0.8 t/ha, which was almost 50 per cent greater than the yield obtained in the control (Table 1). These results highlight the competitive ability of ryegrass against canola, especially in a dry season such as 2018.

Gross margin analysis for the two varieties was undertaken based on grain yields averaged across the sowing dates, seed rates and herbicide treatments.

Based on the yield advantage of HyTTec Trophy over Bonito and taking into account extra costs related to seed purchase and end point royalty, the gross margin for Trophy ($381) was $115 per hectare greater than for Bonito ($267).

As oil content of canola grain was not determined, it is assumed that both varieties had a similar oil percentage.

The authors thank the host grower and Clare SARDI team for assistance with trial management. We also acknowledge the investment from GRDC for the research into 'Cultural management for weed control and maintenance of crop yield' (9175134).



Testing tactics for improving rooting depth and crop yield on sodic soils

By Debbie Gillam, Mingenew Irwin Group

Results at a glance…

- Gypsum is very soluble and a response from gypsum applied to gypsum responsive soils is generally observed in the first year of application.
- Treatments included rates of gypsum with and without ripping.
- There was no increase in soil water observed in any of the treatments in year 1.
- There was no trend in yield or grain quality in response to applied gypsum in year 1 of the project.
- Trials continue in 2019.

Why do the trial?

The area of land directly north of the town of Mingenew is a mix of heavy clays and sandplain. Crop production on both soil types is vastly different. Our host growers who have been farming these soils for a number of years, have observed responses typical of sodicity and believe the problem is more widespread than just their property.

They recently took soil samples to depth – the test results confirmed they have an issue.

Sodic soils have an Exchange Sodium Percentage (ESP) greater than 6 within the root zone and the effect is reduced water infiltration, water storage, seedling emergence, root growth and crop yield.

Over the past decade, the climatic trend in the Northern Agricultural Region (NAR) has been one of less favourable growing seasons and declining rainfall. In this environment growers are aware of the importance of the plant accessing all soil water.

When plant root growth is restricted due to subsoil constraints the plant is not able to access all soil water, and particularly in low rainfall years, this means that yield potential is not realised.

This ongoing project aims to evaluate possible strategies for growing more grain on soils that have been identified as sodic at depth, specifically in the medium-low rainfall environments.

By trialling practices and products over a number of growing seasons, any treatment flaws will be identified.

Soil water levels will be monitored during the research period for changes because a plant that is able to access more stored soil moisture will have increased plant vigour, biomass and yield and result in more profitable cropping systems.

Debbie Gillam.

Some background

Sodicity at depth is a subsoil constraint that restricts root growth and the amount of subsoil moisture the root can access. Like many other subsoil constraints, sodicity can severely restrict plant growth and development and result in lower grower returns from these unproductive sections of their paddocks.

Previous Western Australian research on managing subsoil sodicity has focused on the southern cropping regions of WA.

But our host growers have identified the same issue of subsoil sodicity on their property at Mingenew in the heart of the northern cropping region of the state. There was little crop yield difference in very wet years but in dry years they found that plant growth appeared constrained. Deep soil testing revealed that below 40 cm, the soil was high in sodium and magnesium.

An exchangeable sodium percentage over 6 and an exchangeable magnesium percentage over 25 is described as sodic and this soil was 11 and 25 respectively at 40 cm.

PO Box 6, 54 Midlands Rd
Mingenew WA 6522
E: ceo@mig.org.au
Ph: 08 9928 1645
Website: https://www.mingenewirwingroup.com

Chief Executive Officer: Kathryn Fleay
E: ceo@mig.org.au Mob: 0427 281 007

About MIG: MIG is farmer community driven and covers approximately 300,000 hectares within the Geraldton Port Zone of WA. It is a positive and supportive environment where MIG constantly seek out insightful and stimulating research programs.

We strive to share, adapt and create a space where farmers can openly come together to learn through information and education programs/workshops.

Commercial sponsors: Syngenta, Shire of Mingenew, CBH Group, Rabobank, CSBP, Edwards and Partners, Farm Weekly, Great Northern Rural Services, Bankwest, Mid West Lawyers, Bayer, Precision Soil Tech, Landmark, Pacific Seeds, Shire of Irwin, Elders, Summit Fertilisers, Achmea, BASF, Intergrain, AGT, Pioneer, McIntosh and Son, Grain Growers, Shane Love, Grain Corp, Refuel Australia, Merkanooka Haulage, Great Southern Fuels, AFGRI, Adama.

Current projects:

- North South Beef Alliance
- GRDC Yardstick Demonstrations
- GRDC Sodic Soils
- GRDC West Midlands Group Ripper Gauge
- GRDC Liebe Group Legume Demonstrations
- DPIRD Internet of Things Project
- State NRM Feral Pest Control Program
- MLA Dung Beetle Project
- GRDC Barley Grass Project
- Pasture Legumes Research Project
- Range of MIG variety demonstrations (wheat, barley, lupins and canola)

Table 1: Soil analysis 2018 – each plot will be sampled annually in the same position throughout the period of the trial

Plot no.	Soil Type	10 cm						20 cm	30 cm	40 cm	50 cm
		pH	P	K	Total N	ESP	EMP	pH	pH	pH	pH
1	Clay	5.5	26	391	14	2.3	13.0	5.6	5.7	5.9	6.4
2	Clay	5.5	31	280	22	2.5	14.8	5.7	6	6.5	6.7
3	Clay	5.9	25	327	11	1.2	11.3	5.7	6.0	6.2	6.3
4	Clay	5.8	26	451	24	1.3	10.8	5.6	6.0	6.0	6.3
5	Clay	5.5	28	398	12	2.4	12.4	5.6	5.9	6.1	6.3
6	Clay	5.7	23	414	20	2.5	12.3	6.0	6.0	6.2	6.2
7	Clay	6.2	27	320	19	2.5	11.8	5.9	5.9	6.0	6.1
8	Clay	5.6	28	314	15	4.0	15.7	5.5	5.9	6.1	6.4
9	Clay	5.6	38	391	15	2.2	12.4	5.8	6.1	6.4	6.8
10	Clay	6	40	365	23	2.4	12.8	6.8	7.0	7.1	7.3
11	Clay	6.6	30	344	20	2.0	14.5	6.6	6.5	6.3	6.6
12	Clay	6.2	21	335	11	1.7	13.3	6.5	6.7	7.2	7.1
13	Clay	6.8	34	357	18	6.0	15.3	6.6	6.8	6.8	7.0
14	Clay	5.8	35	361	17	1.7	14.1	5.7	5.8	5.8	6.4
15	Loamy clay	6.1	28	367	16	1.5	11.6	6.6	6.8	7.2	7.4
16	Clay	7.2	29	382	17	1.8	14.3	7.3	7.4	7.5	7.8
17	Clay	6.6	25	333	19	1.6	11.9	6.7	6.7	7.5	7.5

Notes: ESP = Exchangeable Sodium Percentage; EMP = Exchangeable Magnesium Percentage; P = Phosphorus; and, K = Potassium.

Table 2: ESP, EMP and pH at depth, 2018

Depth	pH CaCL2	ESP	EMP
0–20 cm	5.7	3	16
20–40 cm	5.9	5	18
40–60 cm	6.3	11	24
60–80 cm	6.9	15	26
80–100 cm	7.3	17	26
100–120 cm	7.9	21	27

Notes: ESP over 6 defines sodic soil and affects root growth; EMP over 25 defines magnesic soil and affects root growth; Each individual plot will be tested for ESP and EMP at depth in 2019; Soil pH was high at this site (over 5.5) and Aluminium is not present at detectable levels.

How was it done?

This trial was developed to investigate practices and products that have the potential to ameliorate the sodic soil and increase the plants' ability to access stored soil moisture and continue growing.

The practices used in 2018 included deep ripping to a depth of 20 cm and the application and incorporation of solid gypsum.

The treatments included the application of four rates of fine gypsum to develop a response curve.

Soil water levels were also monitored.

The 11 treatments were:

- Control (nil gypsum, nil ripping)
- 0 gypsum
- 0 gypsum ripped
- 1 tonne/ha gypsum
- 1 tonne/ha gypsum ripped
- 3 tonnes/ha gypsum
- 3 tonnes/ha gypsum ripped
- 5 tonnes/ha gypsum
- 5 tonnes/ha gypsum ripped
- 7 tonnes/ha gypsum
- 7 tonnes/ha gypsum ripped

For the trial layout the treatments were randomised, and every third plot was a control. Rates of gypsum were set at 1, 3, 5 and 7 tonnes per hectare so that a response curve could be formed.

The area received summer rainfall in February, 2018 but the Tilco ripper used in the trial was not available until April and the profile had partially dried out. This meant that the surface was left cloddy when the ripping was eventually done.

This did hinder the seeding process and we think

A Nufab ripper was used for incorporating gypsum in the first year of the MIG sodic soils trial.

Table 3: Harvest data from Year 1 of the sodic subsoils trial (2018)

Treatment	Plants/m²	Yield t/ha	Protein %	Weight kg/hl	Screenings %	Input cost $/ha	ROI $/ha
Control	68	3.25	10.7	76.8	4.37	0	APW1 1209
0 gypsum	61	3.39	11.2	76.9	4.20	0	APW1 1262
0 gypsum ripped	39	2.86	11.6	77.4	5.11	50	AUH2 986
1 tonne/ha gypsum	89	3.31	10.1	79.3	2.49	49	ASW1 1108
1 tonne/ha gypsum, ripped	47	3.11	10.3	78.2	4.17	99	ASW1 990
3 tonnes/ha gypsum	69	3.19	9.9	77.1	3.56	127	AGP1 981
3 tonnes/ha gypsum, ripped	80	2.96	11.2	77.2	5.34	177	AGP1 852
5 tonnes/ha gypsum	102	3.37	10.9	78.2	3.53	205	APW1 1047
5 tonnes/ha gypsum, ripped	40	2.60	12.2	77.0	5.91	255	AUH2 686
7 tonnes/ha gypsum	93	3.21	10.1	79.0	3.01	283	ASW1 841
7 tonnes/ha gypsum, ripped	41	2.67	10.8	77.5	5.29	333	AGP1 595

Notes: Control is nil gypsum, nil rip (this is the same as the 0 gypsum except the control was put in every third plot to maintain a consistent comparison treatment throughout the trial).
ROI = Return on treatment after input costs removed; Deep Ripping Cost: $50/ha; Gypsum cost: $25/t; Gypsum application cost: $10/ha; and, Freight: $14 (Estimate from pit to Mingenew)

there will be more results to see in the second and third year of this trial.

The seeding bar was set on 254 mm spacings and the ripper spacing was 600 mm.

The trial was sown with Cobra wheat and 35 kg per hectare MAPSZC and 30 kg per hectare urea at seeding.

Nitrogen fertiliser was applied post emergent:

- 40 kg/ha urea, June 26
- 50 kg/ha urea, July 31
- 65 L/ha MAXAMFlo, August 13

Fortunately the 2018 season turned out to be a year with average rainfall in the Mingenew region and all treatments had a moderate to good crop emergence.

Soil moisture assessments and plant counts were carried out across the 11 treatments.

The gypsum used came from Cliffhead Gypsum and had a composition of 85 per cent gypsum and 15 per cent lime.

What happened?

See Tables 1, 2 and 3 for a summary of the results gathered in the first year of this trial.

Gypsum is highly soluble, and we expected to see some results in the first year following application. There was no response to gypsum detected but the reasons for that could be associated with two factors:

- The quick dry finish to the 2018 season did remove some yield potential from the plots; and,
- The trial was ripped when the soil profile was drying leaving it uneven.

For these reasons we think differences may not be observed until the second or third year.

The soil moisture profile was full in July and each treatment was tested to 80 cm depth to observe any differences in soil moisture.

There was no trend or observational differences noted – all treatments held similar soil moisture at similar depths at this time (see photo).

Ongoing research

The established trial will now be monitored for two more seasons. The plan is to be able to develop a response curve to gypsum on this soil type to assist growers in their decision making around the subsoil constraint sodicity.

Treatments in the trial include all the rates of gypsum ripped and un-ripped. We acknowledge the ripping has caused some issues in the first year, but it is expected it will be beneficial in the long term.

In year 2 we will again measure soil water to observe any difference in treatments and crop yield.

We will also soil test for sulphur to see where the gypsum is in the profile.

Sodic soils research in the Northern Agricultural Region is relatively new. So MIG will be working closely and comparing results with researchers in the southern cropping areas of WA where there is a longer history of sodic subsoils management.

Acknowledgements:

Many thanks to the McTaggart family for their work in setting up, seeding and harvesting the trial.

Many thanks also to Neil Hebbiton from Cliff Head Gypsum for supplying and transporting the gypsum and Nufab for use of their Tilco demonstration ripper for the trial.

This research was conducted with investment from GRDC through the project *Tactics for Improving Rooting Depth and Crop Yield on Sodic Soils*, Ref: 9176012.

Soil moisture profile samples were taken at various depths up to 80 cm.

Weather certificates: Affordable risk management for not so rainy days

By Peter McMeekin

IN recent decades, numerous weather and climate-related natural disasters have impacted agriculture across the globe. This has repeatedly demonstrated how vulnerable the industry is to extreme episodic events. Some research suggests that up to 70 per cent of agricultural risk is related to weather.

Given this recent history – and widespread expectations that the frequency and intensity of such events will increase – it is becoming even more important for farmers to proactively manage weather and climate risks in order to farm sustainably.

Local variables such as latitude, elevation, and proximity to water also have a significant influence on the weather and climate at individual locations. It is often reported that Australian farmers operate in one of the riskiest climatic environments on the planet.

While farming faces many sources of risk, the unpredictability of Australian weather is probably the most difficult of them to manage. And any decrease in income at the farm level has a downstream flow on effect to the entire rural economy.

Some farmers already apply a variety of strategies to help reduce the impact of weather uncertainties. These include farming in multiple locations to spread the exposure geographically, minimum tillage and chemical fallow practices to conserve moisture, diversifying crop types and varieties, spreading the planting period to minimise frost risk, seeking alternative sources of income, and purchasing crop insurance.

There is no greater reminder of the threat to domestic agriculture than the drought experienced in the eastern states of Australia last season. Grain production was impacted to such an extent that the east coast turned from a net exporter to a net importer of grain to satisfy domestic demand. That drought is yet to break in many regions and is threatening to severely impact production again in 2019.

Affordable and simple risk management

So how can grain growers manage the most significant risk to their business? One weather risk management tool increasing in popularity in Australian agriculture are weather certificates (sometimes called weather derivatives).

They are relatively simple products that hedge against the risk of weather-related losses. They are based on an index representing a single variable, such as temperature or rainfall.

They are basically financial options that can be used to transfer some of the risks associated with weather variability away from the grain producer and local community and onto financial organisations that specialise in managing and trading risk and have the balance sheet capacity to absorb any loss.

Grain weather certificates allows the buyer to establish their weather risk versus their input investment and potential returns relative to the growing season. They can provide income protection against weather conditions such as a dry season, a wet season, temperature extremes such as frost at flowering, extreme heat at critical stages of crop growth, hail or excessive rainfall at harvest.

One of the big advantages of weather certificates is that they can be tailored to meet the individual growers' risks and requirements in the course of a season.

Weather certificates can help manage the risk of abnormally dry or wet conditions at specified dates and locations.

Conversely, crop insurance is a generic product that doesn't consider individual needs or geographic anomalies. Insurance tends to cover low-probability, catastrophic weather whereas derivatives can cover the buyer for higher-probability region-specific events.

How weather certificates work

In a grain farm context, these certificates can be used to cover various weather-related scenarios.

For example, a grower may want to financially protect their business against an abnormally dry season. The weather certificate would payout if the in-crop rainfall was below a pre-specified amount over a pre-specified time period.

On the flip side, a farmer may wish to protect against the possibility of quality downgrading at harvest due to rain. The weather derivative would payout if rainfall was above a pre-specified amount over a pre-specified time period.

And unlike crop insurance, no demonstration of loss is required, and no assessment needs to be made. Once the event has occurred, payout of a weather certificate is automatic.

These payout 'trigger points' are based on a weather index derived from readings at the Bureau of Meteorology weather station nominated when the weather certificate is purchased. This is usually the weather station closest to the grower's property, as long as there is sufficient historical data to establish an index.

In recent years the cost of weather certificates has also been decreasing – relative to crop insurance – as the use of them increases across a variety of Australian industries. It is generally between 7.5 and 10 per cent of the value the buyer wishes to protect. The price will vary slightly by region depending on the likelihood of the nominated event occurring.

With the incidence of extreme weather events increasing and margins getting squeezed by rising input costs, farmers need to look at all options available to decrease exposure to the most significant risk they face each season.

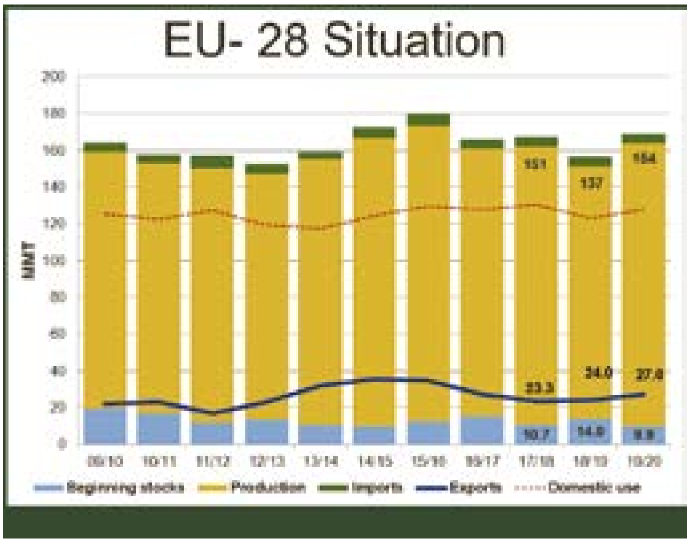
Call your local Grain Brokers Australia representative on 1300 946 544 to discuss your grain marketing needs. ■

First look at 2019–20 sees another record world wheat crop

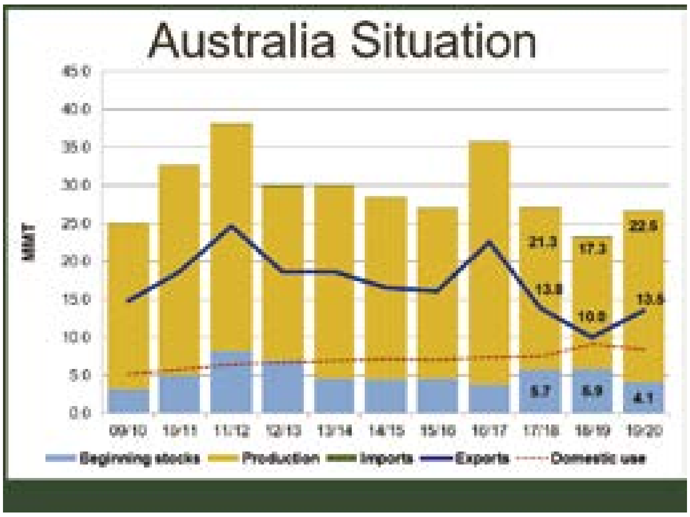
By Claire Hutchins, US Wheat Associates Market Analyst

IN mid-May the USDA issued its first set of forecasts for 2019–20 in its World Agricultural Supply and Demand Estimates report. USDA expects global wheat production at a new record of 777 million tonnes (mt). This is a production level exceeding expected use again as major global suppliers rebound from last year's unfavourable growing conditions.

Droughts in the European Union (EU) and Australia last year cut production in both regions to 5-year and 10-year lows, respectively. Growing conditions in both regions are more favourable now and USDA expects total EU wheat production to rebound 12 per cent from last year to 154 mt.



Australian wheat production is expected by the USDA to reach 22.5 mt, up 23 per cent year-over-year but still three per cent below the five-year average of 23.3 mt.



USDA's initial forecast for Russian production shows a 6 per cent increase over last year's 72 mt to 77 mt in 2019–20 and a small decline in export volume. Notably, SovEcon, a Russian consultancy, pegs 2019–20 Russian wheat production closer to 83 mt, seven per cent higher than USDA's official estimate and 15 per cent higher than last year's total production, if realised.

The global scene

World beginning stocks of 275 mt – paired with the forecast for increased production – bring total supply in the new marketing year to a record 1052 mt. USDA says large supplies in 2019–20 will be met by increased global demand for feed wheat and food consumption.

USDA forecasts total global domestic consumption will reach a record 759 mt in 2019–20, compared to 738 mt the year prior. Global trade, at 285 mt, is 4 per cent higher than last year and five per cent higher than the five-year average of 176 mt.