TEN TIPS FOR EARLY SOWN WHEAT

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VICTORIA
SOUTH AUSTRALIA
SOUTHERN NEW SOUTH WALES

#SowSlowEarly

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Timely operations are key to maximising farm profit and sowing is one of the most time-critical operations. This is because of the yield penalty associated with delayed sowing in most regions. The yield penalty from delayed sowing is due to only a short period in spring (approximately 10 days) during which crops can flower to maximise yields. This is referred to as the 'optimal flowering period' and its timing and length varies with location and climate.

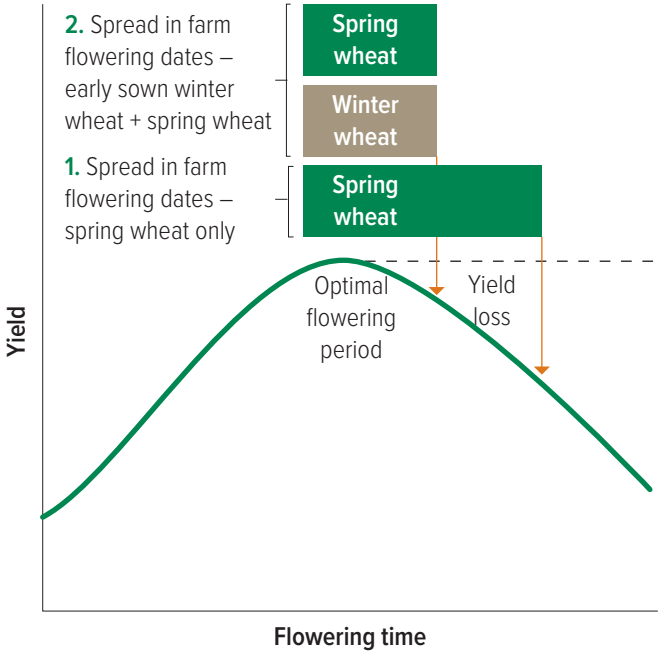
During the optimal flowering period, the combined yield loss from drought, heat, frost and insufficient radiation are, on average, minimised and hence yields are maximised in the long term. In any individual year, these abiotic stresses can still damage crops even when the crop flowers during the optimal period.

Increasing farm sizes and areas cropped, along with declining autumn rainfall, have made it difficult to sow crops at the most appropriate time, and often some paddocks end up flowering outside the optimal period. By starting to sow early with appropriate cultivars (particularly sowing winter cultivars of wheat from early April), the amount of cropped area that flowers during the optimal period can be maximised – along with farm yield (Figure 1). This can also reduce pressure on operators and machinery and improve logistics by spreading out the sowing period.

Achieving optimal flowering can make a big difference to yield and profit and costs very little to achieve. However, there are some challenges with sowing wheat early.

THESE TEN TIPS PROVIDE A GUIDE TO GET THE MOST OUT OF EARLY SOWN WHEAT CROPS.

FIGURE 1
The relationship between wheat flowering time and yield and farm flowering time across a cropping program with only spring wheats (1), and farm flowering time across a cropping program with winter and spring wheats (2).



1 CONSIDER YOUR LOCATION

Optimal flowering periods and the chances of early breaking rains change with location and prevailing climate. It is critical to know when your optimal flowering period is (Table 1) and what sowing dates are required to achieve it with cultivars of different development patterns. Optimal flowering periods can also shift within the landscape based on elevation and frost risk. Aim to have the crop in frost-prone areas flowering later than low-risk areas (for example, seven to 10 days later) by delaying sowing or using a variety with a slower development pattern.

TABLE 1 Optimal flowering dates

Optimal flowering dates (centre of optimal flowering period) simulated using APSIM for different locations across southern NSW, SA and Victoria.

Sowing date required to achieve highest yield flowering date varies with season. The median, upper and lower quartiles of the sowing date show the range in sowing dates that lead to highest yield. Table modified from Flohr BM, Hunt JR, Kirkegaard JA, Evans JR (2017) Water and temperature stress define the optimal flowering period for wheat in south-eastern Australia. Field Crops Research Vol. 209, 108–119.

NEW SOUTH WALES

Location	Optimal flowering date (mean flowering date for highest yield)	Germination date to achieve highest yield of a fast spring cultivar such as Scepter[◊]		
		25th percentile	Median	75th percentile
Nyngan	27 August	30 April	2 May	7 May
Dubbo	18 September	7 May	11 May	15 May
Condobolin	15 September	2 May	7 May	10 May
Bogan Gate	21 September	8 May	13 May	17 May
Merriwagga	31 August	25 April	27 April	29 April
Temora	3 October	6 May	13 May	18 May
Cootamundra	12 October	13 May	20 May	24 May
Urana	23 September	4 May	8 May	12 May
Mathoura	18 September	30 April	3 May	6 May

SOUTH AUSTRALIA

Location	Optimal flowering date (mean flowering date for highest yield)	Germination date to achieve highest yield of a fast spring cultivar such as Scepter[◊]		
		25th percentile	Median	75th percentile
Minnipa	25 August	30 April	6 May	6 May
Lock	9 September	7 May	13 May	15 May
Cleve	13 September	15 May	20 May	24 May
Hart	24 September	8 May	13 May	18 May
Saddleworth	17 September	10 May	15 May	17 May
Waikerie	25 August	23 April	27 April	29 April
Cummins	18 September	19 May	24 May	27 May
Lameroo	7 September	29 April	2 May	6 May
Maitland	1 October	29 May	5 June	10 June
Bordertown	7 October	23 May	29 May	3 June

VICTORIA

Location	Optimal flowering date (mean flowering date for highest yield)	Germination date to achieve highest yield of a fast spring cultivar such as Scepter[◊]		
		25th percentile	Median	75th percentile
Walpeup	11 September	1 May	4 May	10 May
Swan Hill	15 September	2 May	6 May	9 May
Hopetoun	8 September	5 May	10 May	14 May
Kerang	15 September	29 April	3 May	5 May
Yarrawonga	28 September	2 May	8 May	13 May
Charlton	23 September	6 May	7 May	10 May
Longerenong	7 October	12 May	16 May	25 May
Inverleigh	22 October	11 June	15 June	24 June

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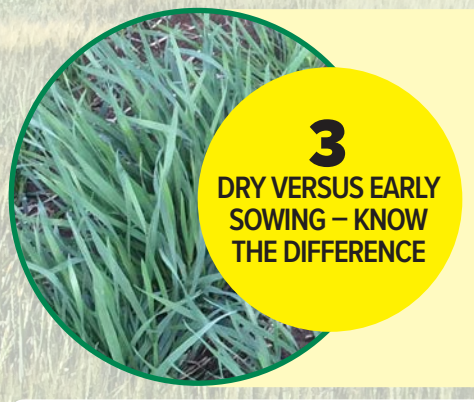
2 PADDOCK SELECTION

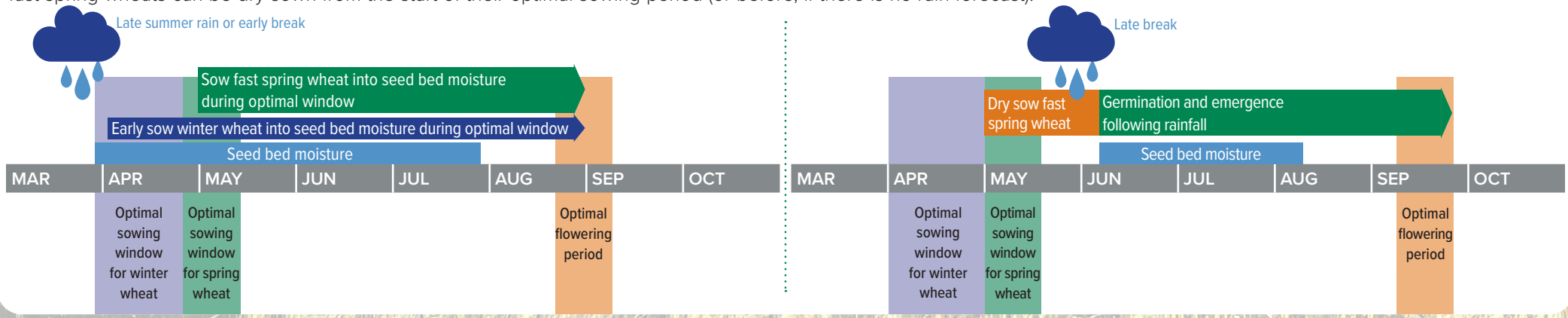
Early sown wheat crops perform best in paddocks with few weeds and low levels of root diseases such as Crown rot and Take-all. Aim to sow early following break crops or long fallow with low weed or disease burdens. Keep summer fallows free of weeds and volunteers that host diseases as well as virus vectors. Use robust packages of pre-emergent herbicides if the paddock is under pressure from grass weeds (see *New insights in integrated weed management and new herbicides* on the GRDC website at www.grdc.com.au/newinsightsIWM.



3 DRY VERSUS EARLY SOWING – KNOW THE DIFFERENCE

Sowing in early April requires cultivars that develop and flower more slowly to take advantage of early establishment opportunities while still targeting the optimal flowering period. Wheat cultivars that have a cold requirement before they will flower are most suitable for this sowing time (see tip 6). Seed is sown into a moist bed following rain or preceding a convincing forecast of enough rain to allow germination. Dry sowing uses standard fast-developing spring cultivars sown into dry seed beds, usually in late April or May, so that they will establish when breaking rains eventuate. Early sowing of winter wheats when moisture is available and dry sowing are both useful tactics for reducing the logistical pressures at sowing and getting crops to flower during the optimal period. They can be used in tandem but should not be confused (Figure 2). Sowing winter wheats into dry soils in early April may be a risky option, because if it does not rain until June these may not flower in the optimum period and will be lower yielding than spring cultivars. However, this is under further investigation.

FIGURE 2 Early and dry sowing can be used in tandem, depending on the timing of the break, to get as much crop flowering at the optimal time as is possible. In seasons with an early break or late summer rain, early sown winter wheats can be used to open the sowing program. In seasons with a late break, fast spring wheats can be dry sown from the start of their optimal sowing period (or before, if there is no rain forecast).



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4 CONSIDER SEED BED AND STORED SOIL WATER

Germination and growth of early sown crops is supported by a combination of breaking rain and soil water stored from the previous growing season and the summer or long fallow. On most soil types, at least 15 to 20 millimetres of breaking rain are required for consistent germination of early sown crops, even when there is stored soil water at depth.

Provided wheat crops are sown after 1 April, this amount of rain is usually enough to keep plants alive until cooler weather and further rains arrive in winter. Once established, wheat seedlings are quite tolerant of low soil moisture and, if the autumn is warm and dry, shoots may become dehydrated but will regrow once rain arrives (Figure 3). If sowing before 1 April, more breaking rain (>25mm) or access to stored soil water is required to keep crops alive until winter; however, sowing this early is not advised (see tip 5).

FIGURE 3

Winter wheat plants that were established in mid-March with 10mm irrigation were exhibiting extreme moisture stress by early May (a), but plant parts under the soil surface remained green (b).
Plants regenerated and grew following rainfall in late May (c); this photo taken mid-June shows delayed regrowth within the yellow circle where plants were not able to access stored moisture.

PHOTOS: JAMES HUNT, LA TROBE UNIVERSITY

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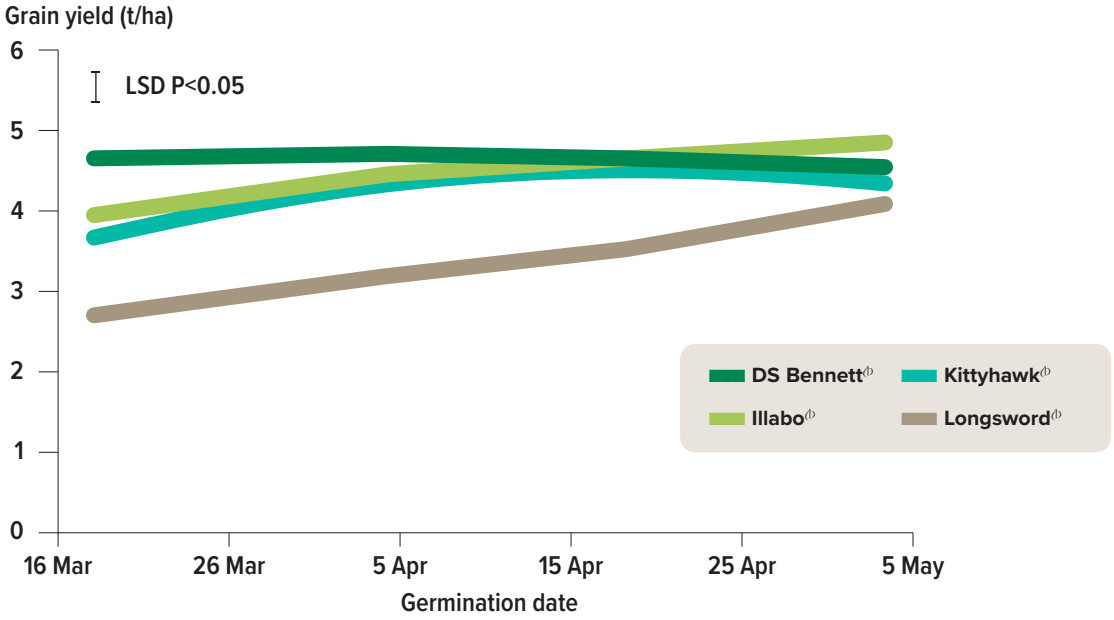
5 DON'T SOW TOO EARLY

In general, the yield of winter wheat starts to decline once sowing moves earlier than 1 April (Figure 4). Unless grazing is the primary intention, sowing earlier in March is not advised because most crops start using too much water while it is still warm, produce excessive vegetative growth, grow too tall, and come under increasing pressure from viruses and root diseases.

Vernalisation in some cultivars can start to break down and stem elongation can start early, exposing crops to the risk of frost damage. It can also be difficult to establish crops before April as soil temperatures are high and the seed bed dries rapidly following rainfall.

FIGURE 4

Mean grain yield for winter wheat cultivars Longsword$^{\Phi}$, DS Bennett$^{\Phi}$, Illabo$^{\Phi}$ and Longreach Kittyhawk$^{\Phi}$ across four times of sowing from high-yielding South Australian and Victorian sites (where Scepter$^{\Phi}$ yielded greater (n=5) than 2.5 t/ha).



Note that the yield of most cultivars declined when sown in mid-March. Figure modified from: Porker K, Hunt J, Harris F, Noack S, Moodie M, Angel K, Straight M, Clarke G, Bruce D, Wallace A, Fettell NA, Brooke G, McMillan H, Haskins B, Brady M, McDonald T, Spriggs B, Buderick S, Warren, D (2019) Management of early sown wheat: matching genotype to environment. In *19th Australian Agronomy Conference, Wagga Wagga*, 25–29 August 2019 (Australian Society of Agronomy).

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6 USE THE RIGHT CULTIVAR FOR THE RIGHT SOWING DATE

Slow-developing cultivars are required for April sowing so they take advantage of the longer growing season and flower during the optimal period. If fast spring wheats are sown in early April, they will flower before the optimum time, accumulate insufficient biomass and be exposed to excessive risk of frost damage.

Most wheat cultivars used in Australia are fast or mid-developing spring wheats (Table 2) in which the development pattern is largely determined by temperature (thermal time). In slow spring cultivars, development is slowed by a requirement for long daylengths (photoperiod) or cool temperatures (weak vernalisation). In contrast, the development of winter cultivars is blocked by a strong vernalisation requirement, meaning that plants must experience cool temperatures (between -1–16°C for a total of 4–8 weeks) before they will flower. This gives winter cultivars a stable flowering time and consistent yield from a wide range of sowing dates (Figure 5).

FIGURE 5

The relationship between germination date and yield for winter and fast spring wheat. The stable flowering time of winter wheat gives it a stable yield over a wide range of sowing dates.

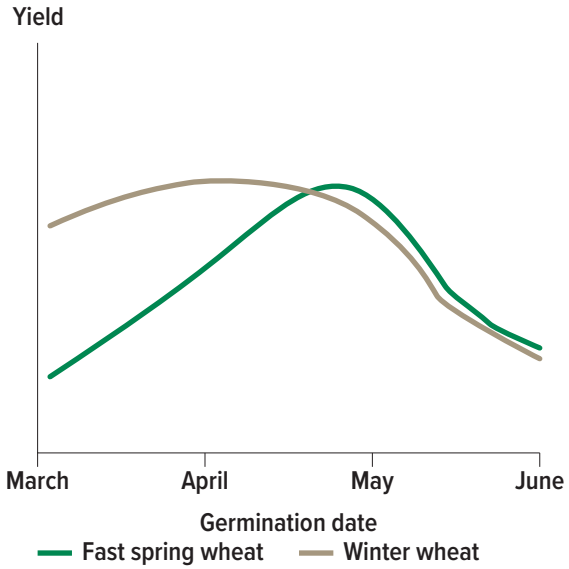


TABLE 2 The development speeds of popular wheat cultivars grown in Australian and their suitability for early sowing.

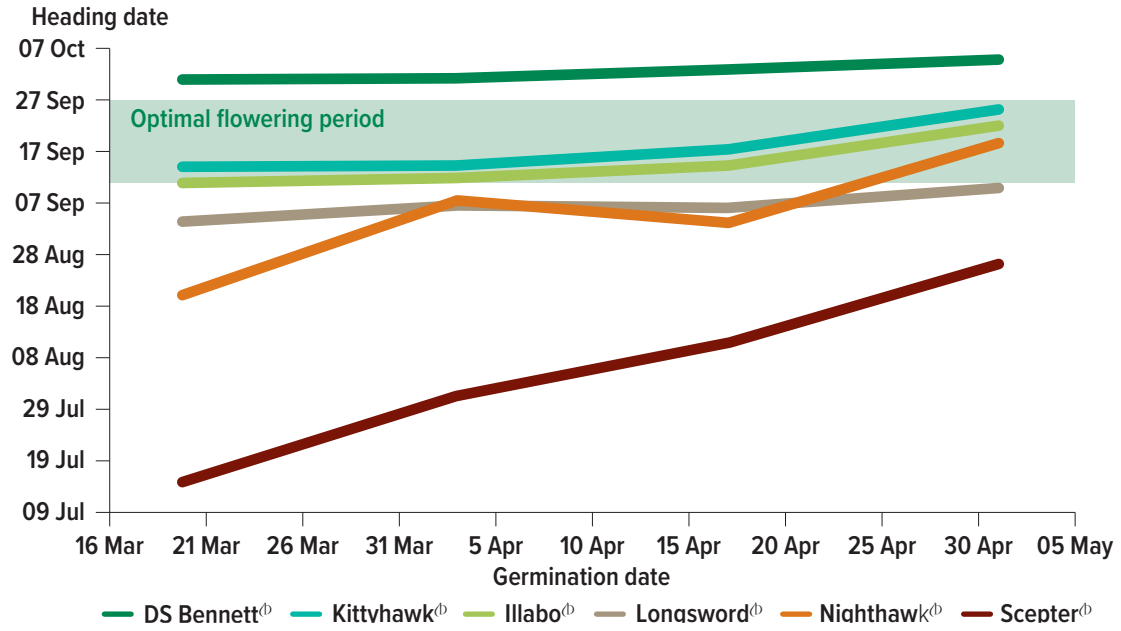
HABIT	DEVELOPMENT SPEED	EXAMPLES	SUITABLE FOR EARLY SOWING?
SPRING	Very fast	Vixen$^{\Phi}$, Emu Rock$^{\Phi}$, Axe$^{\Phi}$, Hatchet CL$^{\Phi}$	No
	Fast	Scepter$^{\Phi}$, Longreach Scout$^{\Phi}$, Beckom$^{\Phi}$, Suntop$^{\Phi}$, Spitfire$^{\Phi}$	No – should be sown after 1 May in most zones in the southern region (see Table 1)
	Mid	RockStar$^{\Phi}$, Longreach Trojan$^{\Phi}$, Catapult$^{\Phi}$, Cutlass$^{\Phi}$, EG$^{\Phi}$, Gregory$^{\Phi}$, Coolah$^{\Phi}$	Yes – up to 10 days earlier than fast spring cultivars
	Slow	Pascal$^{\Phi}$, Bolac$^{\Phi}$, Longreach Lancer$^{\Phi}$	Yes – up to 20 days earlier than fast spring cultivars
	Very slow	Longreach Nighthawk$^{\Phi}$, Forrest$^{\Phi}$	Yes – up to 30 days earlier than fast spring cultivars
WINTER	Fast	Longsword$^{\Phi}$	Yes – in low rainfall environments
	Mid	Kittyhawk$^{\Phi}$, Illabo$^{\Phi}$, EG$^{\Phi}$Wedgetail$^{\Phi}$	Yes – in medium to low rainfall zones
	Slow	DS Bennett$^{\Phi}$	Yes – in medium to high rainfall zones
	Very slow	RGT Accroc, SQP Revenue$^{\Phi}$, Adagio, Manning$^{\Phi}$	Yes – in high rainfall zones

7 USE THE RIGHT WINTER CULTIVAR FOR THE RIGHT ENVIRONMENT

Different winter cultivars are needed for specific locations with different optimal flowering periods, because their flowering time cannot be manipulated with sowing date (Figure 6). Fast winter cultivars are required in warm, low-rainfall environments with relatively early optimal flowering periods (Table 2). Mid-winter cultivars are best suited to medium to low rainfall zones, and slow and very slow winter cultivars in higher rainfall zones with a late flowering window.

FIGURE 6
Different winter cultivars are needed for different flowering time environments.

This graph shows sowing date and heading date for different cultivars at Hart, South Australia, relative to the optimal flowering period in that environment. The slow winter cultivar DS Bennett$^{\phi}$ flowers too late from all times of sowing in this environment. Figure modified from *Emerging management tips for early sown winter wheats*, GRDC website, www.grdc.com.au/tipsforearlysownwinterwheats



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8 PROTECT CROPS FROM VIRUS VECTORS

Early sowing and crop growth in April exposes plants to aphids and mites that may transmit viral diseases. Integrated pest–disease management is often required to prevent yield loss. Make sure summer weeds are managed in paddocks intended for early sowing to remove habitat for the insect vectors. Select cultivars with some level of resistance to viral diseases (for example, DS Bennett(ф) is resistant to barley yellow dwarf virus, Forrest(ф) is resistant to wheat streak mosaic virus. Use registered insecticidal seed dressings (for example, imidacloprid) and follow up with spray applications of registered insecticides after the start of tillering if conditions remain warm and aphids are present.

9 GRAZE EARLY SOWN CROPS IF YOU WANT

Early sown winter wheats can provide excellent forage for livestock with a small penalty in final grain yields (approximately 10 per cent on average) provided soil water is available for early growth. The size of the yield penalty also depends on the timing of livestock removal and the amount of residual biomass.

To minimise the grain yield penalty, growers should remove livestock early (for example, before stem elongation, Z30) and/or not graze as hard (leave more green leaf area). Early sown winter wheats can be grazed but do not need to be grazed in order to maximise yield.

10 ADJUST PLANT DENSITY AND NITROGEN FERTILISER

In general, the yields of early sown crops are unaffected by plant population because they spend a long time in the vegetative phase and can compensate for low density with a large number of tillers. Early sown crops can still achieve potential yield from as few as 30 plants/m^2, but crops with these low plant densities compete poorly with weeds. High plant densities produce more early dry matter, if grazing is expected.

If sowing the crop for grain only, aim for 50 to 100 plants/m^2. If the crop is for grain and grazing, aim for at least 150 plants/m^2. Early sown crops are very efficient at accumulating nitrogen (N). Deferring nitrogen fertiliser applications until after the start of stem elongation can help reduce excessive early growth and water use.

Like low plant density, deferring nitrogen inputs reduces the amount and quality of dry matter available for grazing. If growing crops for grain only, apply nitrogen fertiliser during early stem elongation (Z30–32). If grazing is expected, applying nitrogen at seeding and a total nitrogen supply (soil mineral nitrogen plus fertiliser) of more than 150kg/ha will normally maximise forage yield.

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PUTTING IT ALL TOGETHER

The decision tree (Figure 7) provides summary of the overall management package and a guide on how to get the most out of early sown winter wheat crops.

FIGURE 7
Putting it all together – use this decision tree to select appropriate cultivars.

Where do winter wheats fit in conjunction with spring wheats in south-eastern Australian farming systems?

Enterprise	Mixed farm		Grain only		
System fit	Dual purpose		[1]Sowing window		[2]Manage frost risk
Sowing time **Target density** **N timing**	Late March and early April 150 plants/m² N at sowing		April and early May >50 plants/m² Topdress N @Z31		April >50 plants/m² Topdress N @Z31
Yield environment	<2.5 t/ha	>2.5 t/ha	<2.5 t/ha	>2.5 t/ha	
Cultivar (targeting yield)	Longsword$^{\Phi}$	DS Bennett$^{\Phi}$	Longsword$^{\Phi}$	DS Bennett$^{\Phi}$	DS Bennett$^{\Phi}$
Cultivar (targeting quality)	Illabo$^{\Phi}$	Illabo$^{\Phi}$	Illabo$^{\Phi}$ Nighthawk$^{\Phi}$	Illabo$^{\Phi}$ Nighthawk$^{\Phi}$ Kittyhawk$^{\Phi}$	N/A

1 This will exploit early sowing opportunities and increase the amount of available calendar time for sowing as per Figure 2.

2 Frost risk can be reduced by sowing slow developing winter wheats which will delay stem elongation and flowering without compromising yield through delaying sowing.

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Acknowledgements

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