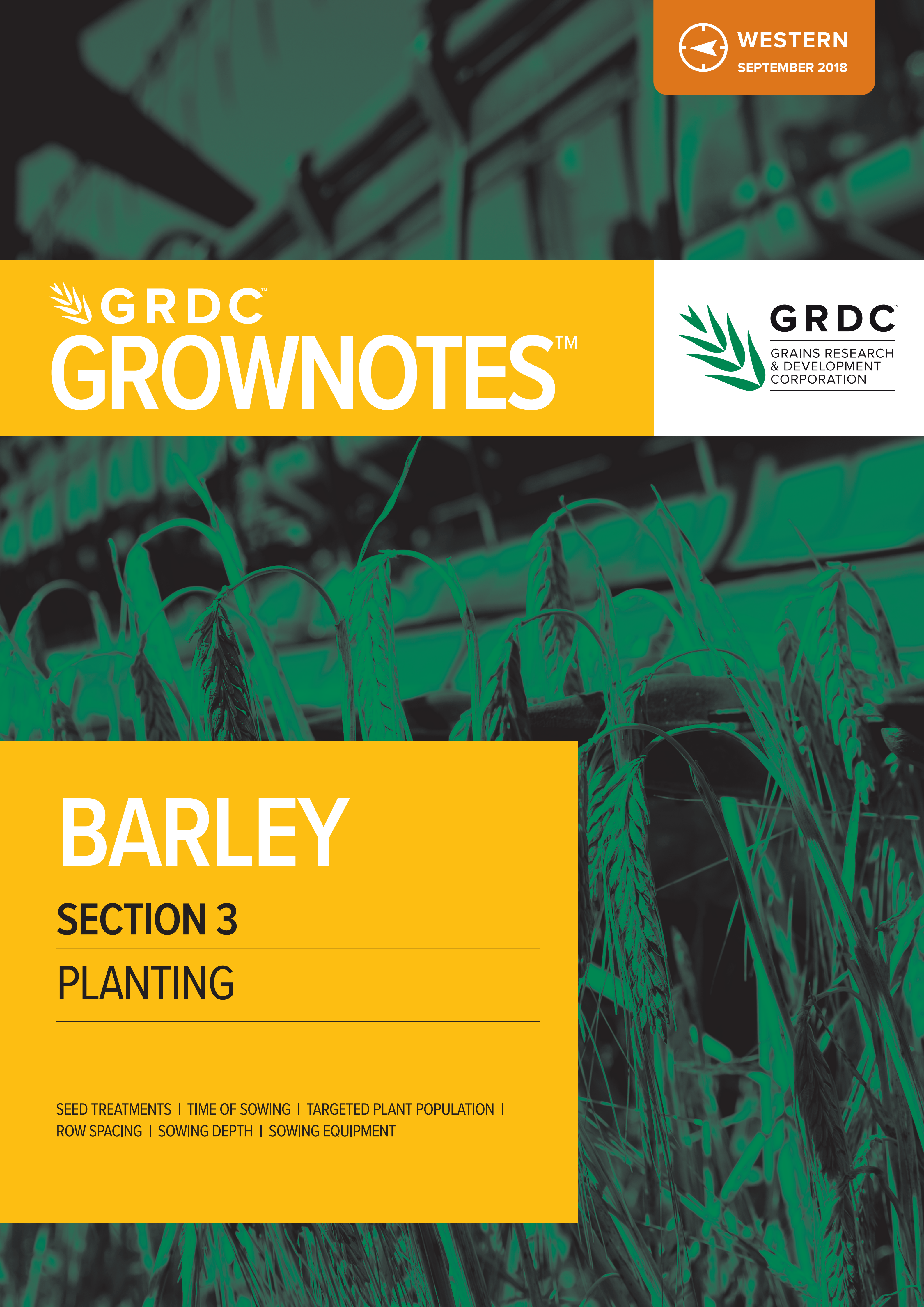

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BARLEY

SECTION 3

PLANTING

SEED TREATMENTS | TIME OF SOWING | TARGETED PLANT POPULATION | ROW SPACING | SOWING DEPTH | SOWING EQUIPMENT

Planting

Barley is very versatile in its planting time and can be planted relatively early in the season. Preferred planting times are from late April to June but this will vary for each region and variety depending on frosts and seasonal effects.

Early planting in late April to early May will generally produce higher yields, larger grain size and lower protein levels, making barley more likely to achieve malting quality. However, early crops are more likely to have exposure to frost, and growers should assess the frost risk for their area prior to sowing. Late plantings will often mature in hot, dry weather, which can reduce grain size, yield and malting quality. [1]

3.1 Seed treatments

It is critical that all barley seed is treated with a seed pickle that controls smuts and bunts as barley can be quite susceptible to smut and the risk of undeliverable grain is high if seed is untreated. Depending on the yield potential and disease risk, growers may also consider more expensive treatments that also control soil-borne diseases such as Rhizoctonia, foliar diseases and insects. When applying seed treatments, always read the chemical label and calibrate the applicator.

It is important that seed treatments are applied evenly. Seed treatments are best used in conjunction with other disease-management options such as crop and paddock rotation, the use of clean seed, and the planting of resistant varieties.

There are some risks associated with the use of seed treatments. Research shows that some seed treatments can delay emergence by:

- slowing the rate of germination
- shortening the length of the coleoptile, the first leaf and the sub-crown internode.

Any delay in emergence increases exposure to pre-emergent attack by pests and pathogens or to soil crusting, which may lead to a failure to emerge. The risk of emergence failure is increased when seed is sown too deeply or into a poor seedbed, especially in varieties with shorter coleoptiles. [2]

Reduced coleoptile length

In some situations, certain fungicide seed dressings may reduce coleoptile length, which could lead to 'silly seedling syndrome' (leaves grow under soil surface but don't emerge), particularly if short coleoptile varieties or deep sowing are used. Check chemical labels for this information. Coleoptile shortening may also result from use of dinotroaniline herbicides (trifluralin, pendimethalin, oryzalin). Take care where coleoptile-shortening seed dressings are used together with these herbicides, particularly where it is difficult to obtain good depth control of herbicide incorporation and seed placement. [3]

3.1.1 Seed dressings

Seed dressing and in-furrow fungicides contain one or more active ingredients and are marketed under many different trade names. When choosing seed dressing or in-furrow fungicides, consider the range of diseases that could threaten the crop. Consult product labels for registrations, the Australian regulatory database or InfoPest, or see a list of currently registered active ingredients.

1 DAFF (2012) Barley planting, nutrition, harvesting. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-nutrition-harvesting

2 Industry & Investment NSW Agronomists (2010) Barley growth & development, PROCROP Series, Industry & Investment NSW. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf

3 DAFWA (2016) Seed dressing and in-furrow fungicides for cereals in Western Australia. Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/1794

Reassess the disease risk before seeding by looking at seasonal forecasts, green bridge updates and crop disease forecasts for the local area, all available through the Department of Agriculture and Food, Western Australia (DAFWA).

Powdery mildew

Powdery mildew requuires an integrated approach to management which may include choosing varieties with better resistance levels and foliar applications.

If growing a mildew susceptible variety such as Baudin⁽ᵖ⁾ or Bass⁽ᵖ⁾, consider treating seed with a product that controls powdery mildew. Failure to do so will allow this disease to build up and possibly mutate allowing it to overcome some of the current fungicides that the industry relies on. Powdery mildew is particularly prone to the development of fungicide resistance. [4]

Loose smut

Smut diseases commonly occur at low levels, but without seed dressings they may increase rapidly and cause significant economic losses to growers. [5]

Air-borne spores of barley loose smut infect the embryo of the forming seed so that, when infected seed is sown in the following year, the tillers of the new plant produce heads that contain spores of loose smut instead of grain, reducing crop yields and continuing the disease cycle.

Seed dressings work by preventing the transmission of disease when the infected seed is grown in the following season so that the head can develop normally.

Even when seed infection levels are high, the most effective seed treatments can reduce this to nearly zero. Field trials in 2013 at Gibson and Wongan Hills WA, found all registered products which were tested reduced loose smut, although the effectiveness varied. [6]

Testing in 2013 of numerous Hindmarsh⁽ᵖ⁾ barley crops across Southern and Western Australia (WA) showed loose smut infection. In many cases this occurred in spite of treatment with seed fungicides that should have controlled infection. Hindmarsh⁽ᵖ⁾ it appears, is very susceptible and full label rates and good application is critical to keep infection levels low. Tests are underway at SARDI on infected seed to determine which seed treatments are capable of providing adequate control in Hindmarsh⁽ᵖ⁾. [7]

Since Hindmarsh⁽ᵖ⁾ is such a popular variety in WA, inoculum levels of loose smut are relatively high, so seed of all barley varieties needs to be protected against loose smut every year. [8]

DAFWA Diagnostic Laboratory Services (DDLS) can assess the level of seed infection by testing the embryo for presence of the loose smut fungus in seed.

Barley leaf rust

New active ingredient fluxapyroxad (product Systiva®) is now registered as a seed dressing for the control of barley leaf rust. No in-furrow or seed dressing fungicides are currently registered for barley stem rust.

4 H Wallwork (2014) Cereal disease update and use of fungicides on fertiliser and seed. GRDC Update Papers, 27 February 2014, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/02/Cereal-disease-update-and-use-of-fungicides-on-fertiliser-and-seed

5 DAFWA (2016) Seed dressing and in-furrow fungicides for cereals in Western Australia. Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/1794

6 DAFWA (2014) Seed dressing key to loose smut control in barley. Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/3948

7 H Wallwork (2014) Cereal disease update and use of fungicides on fertiliser and seed. GRDC Update Papers, 27 February 2014, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/02/Cereal-disease-update-and-use-of-fungicides-on-fertiliser-and-seed

8 DAFWA (2014) Seed dressing key to loose smut control in barley. Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/3948

Barley net blotch (net-type and spot-type)

Barley net blotches are more common in medium to high rainfall regions. Net-type and spot-type net blotch can cause more than 30% yield loss in susceptible varieties when grown in previous-season infected stubbles. The primary source of net blotch infection is infected stubbles which spread disease to seedlings but activity against this stubble-borne net blotch has not been demonstrated by many pre-sowing treatments.

Until recently, seed dressings were only registered to control seedborne net-type net blotch, however, seed infection is not considered an important part of the spread of this disease in WA. A new active ingredient fluxapyroxad (product Systiva®) is now registered for both seed borne and stubble borne inoculum of both spot-type net blotch and net-type net blotch. [9]

Rhizoctonia

Rhizoctonia bare-patch is a problem across WA's wheat and barley growing areas and is estimated to reduce WA cereal yields by 1–5% annually at a cost of $27 M. Current management practices in WA are combinations of crop rotation, below seed cultivation along with a fungicide seed-dressing and adequate nutrition. In 2013, new fungicide options became available for application on seed, including Vibrance® and EverGol® Prime and more recently Systiva® has been registered for rhizoctonia. In DAFWA and SARDI field trials, these new seed treatments increased yield by 5% on average in wheat and barley. [10]

3.1.2 Correct seed application is important

Auger and applicator calibration are important to avoid incorrect seed treatment and poor disease control. Incorrect seed treatment may reduce coleoptile lengths or cause other phytotoxic effects on the germinating seedling (over-treated seed). Three steps in the correct application of a seed dressing are to:

- Calibrate the auger grain output: tonnes per hour = weight of a sample (kg) x 3.6 / time (seconds)
- Use a constant auger flow rate during the dressing operation
- Match the amount of seed dressing that is delivered to the auger flow rate.

For example, if the auger is delivering grain at 20 t/hr and the dressing rate is 4 L/t seed, 80 L of dressing will need to be applied per hour or 1.333 L/min. Measure to calibrate the applicator and adjust as required to achieve this rate. [11]

MORE INFORMATION

DAFWA (2016) Controlling barley loose smut in 2016.

FAQ

3.2 Time of sowing

Early sowing will generally produce higher yields, larger grain size and lower protein levels making malt varieties more likely to achieve malt quality. However, early crops are more likely to have exposure to frost and growers should assess the frost risk for their area prior to sowing. Late plantings will often mature in hot dry weather which can reduce grain size, yield and malting quality.

Factors to consider with regard to planting time include:

- Sowing at the right time is critical for optimising grain yield and can also influence grain quality
- Early planting may increase the frost risk, but early-planted crops have the highest yield potential and are more likely to make malting quality
- Planting too early can result in the crop running quickly to head if there is experiences a warm late autumn or warm early winter

9 DAFWA (2016) Seed dressing and in-furrow fungicides for cereals in Western Australia. Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/1794

10 D Hüberli, et al. (2014) Liquid banding of fungicide increases yields of cereals in paddocks with rhizoctonia bare-patch. North Mallee Farm Improvement Group Crop Updates 2014, http://researchrepository.murdoch.edu.au/id/eprint/21390

11 DAFWA (2016) Controlling barley loose smut in 2016. Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/3906

- Later maturing and shorter stature varieties are preferred for early planting to avoid tall lush early growth
- At flowering, barley can tolerate a frost better than wheat (approx. 2°C) because most of the flowering occurs in the boot
- Recent experience has shown that barley is most susceptible to frost during grain fill
- Hot and dry weather during spring can reduce the grain-fill period and affect yield and grain size, particularly if night temperatures do not fall below 15°C
- Later planting and later flowering generally result in declining yield potential due to higher temperatures and moisture stress during flowering [12]

Variable autumn/winter rainfall can delay the ability to sow in the optimum sowing window due to insufficient moisture for seed germination near the soil surface. Growers are increasingly sowing early for timeliness of operation, and are willing to risk sowing into dry topsoil and wait for rain rather than sow deep into a moisture band and risk losses in establishment and early vigour. [13]

MORE INFORMATION

GRDC (2013) Final report: Dry Seeding into crop residues in the WA Wheat-Belt.

Effect of delayed sowing

Research in WA in 2012–13 revealed the general impact of delayed sowing on malt and food varieties was to decrease early biomass, plant height, lodging risk, and grain yield whilst increasing screenings, grain protein concentration and grain brightness.

Delayed sowing (3–4 weeks) increased the risk of delivering feed grade barley, primarily due to high screenings and high grain protein.

In the study, delayed seeding occasionally influenced the response to seed rate, but there was no evidence to suggest the target density should be changed if the target seeding date is delayed by 3–4 weeks. [14]

Sowing date responses

Development or time to flower in barley is controlled by temperature and daylength. Barley is known as a 'long day' plant, as its development is often inhibited under shorter days (daylength less than 16 hours). Cultivars differ in their response to sowing date because of differences in the duration of their basic vegetative phase and their daylength length sensitivity.

Basic vegetative period (BVP) is the minimum number of leaves formed on the mainstem when a plant has had its vernalisation response satisfied and is grown in a daylength above 16 h. BVP modifies the plant's response to temperature and daylength.

Daylength sensitivity (DLS) is a measure of the sensitivity of a cultivar to daylength and reflects the responsiveness of a cultivar to a change in sowing date. DLS insensitive cultivars will form the same number of leaves on the mainstem, regardless of sowing date. The final leaf number on DLS sensitive cultivars, however, will differ due to sowing date.

Vernalisation response (VRN) is a measure of the responsiveness of a cultivar to a certain number of 'cold' hours needed to initiate its development. All barley cultivars currently grown in WA are spring types and as such have little or no vernalisation requirement.

La Trobe⌽/Hindmarsh⌽ is a dominant barley cultivar in WA due to its good agronomic adaptation to most locations and sowing dates due to a phenology based on a short BVP and a high DLS. It has however been demonstrated that varieties with medium BVP and moderate DLS or with long BVP and mild DLS are better suited to earlier

12 DAFF (2012) Barley planting, nutrition and harvesting. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-nutrition-harvesting

13 Hart Field Site Group Inc. (2013) The 2013 Hart Trial Results, http://www.hartfieldsite.org.au/media/2013%20TRIAL%20RESULTS/2013_Hart_Trial_Results_Book.pdf

14 B Paynter, A Hills, R Malik. (2016) How much is the seed rate (changing from 50 to 400 plants/m^2) response of barley influenced by date of seeding? GRDC Grains Research Updates, 29 February–1 March 2016, http://www.giwa.org.au/2016researchupdates

MORE INFORMATION

2017 Barley variety guide for Western Australia.

DAFWA (2016) Frost: tools & support.

GRDC, (2016) Managing Frost Risk. GRDC Publications

DAFWA (2016) East-west orientation for improved crop competition.

GRDC (2016) East West Sowing. Driving Agronomy Podcast.

UWA (2014) Sow west young man.

sowing opportunities than La Trobe⁽ᴰ⁾. Varieties with short BVP and high or very high DLS have adapted to both early and late sowing dates.

There is a lot of interest in early sowing (before 05 May) but there is very little data to support decisions on which barley cultivar to sow. An understanding of the duration to flowering is useful in determining the risks of frost and heat stress as well how different cultivars respond to early sowing versus later sowing. [15]

Frost risk

Frost damage to crops late in the growing season has been identified as a major constraint impacting on grower productivity and profitability in WA's central and southern grainbelt.

Growers are facing increased risk of grain losses from more severe, frequent, prolonged and/or unseasonal frost events, and a widening of the frost event window in late winter and spring. [16]

Frost management strategies include:

- thermal imaging, which has identified a 3–4°C difference in minimum temperatures between paddocks, guiding where frost sensitive varieties are planted
- planting frost-prone paddocks last to help avoid the high-risk frost period
- using paddock records to monitor frost history
- managing frost risk by growing more hay, pasture or oats on high risk paddocks
- reducing inputs in high risk paddocks to limit financial and agronomic exposure. [17]

In addition, identifying and compiling zones and/or maps that show the range of frost susceptibility of paddocks will enable growers to adopt diverse or alternative agronomic practices to spread production and financial risk.

New tools to spatially assess frost risk and pinpoint crop damage rapidly and accurately are being tested to improve understanding of frost and fine-tune farm-scale responses. Data generated from these sources in paddock zoning and planning, along with other precision agricultural data such as topographic, electro-magnetic and yield maps; temperature monitors; and the grower's own experiences will help to manage frost. [18]

For more information, see Section 14.1: Frost.

Orientation

Switching the orientation of crop planting to east–west can more effectively 'shade out' weeds in the inter-row than using a north–south orientation. In southern Australia, if crops are sown east–west, at a right angle to the sunlight direction, the sun's rays hit the crop row and shade the weeds in the inter-row.

Trials indicate that sowing in this direction means 10–20% less sunlight hits the inter-row during winter, reducing soil temperature and significantly suppressing weed growth, biomass and seed set.

There was not a significant yield difference in the crops sown east–west compared to north–south at these sites, but weed burdens were much lower. [19]

15 B. Paynter (2015) Seasonal and genetic differences in the phenology (duration to awn emergence) of barley when sown in late April through to early July. WA Agribusiness Crop Updates, 24–25 February 2015, http://www.giwa.org.au/pdfs/CR_2015/Paynter_Blakely_Seasonal_and_genetic_differences_henology_of_barley_when_sown_in_late_April_FINAL.pdf

16 GRDC (2016) Managing Frost Risk. Case studies of growers in Western Australia. GRDC, https://grdc.com.au/resources-and-publications/all-publications/publications/2016/07/rcsn-kwinanaeast-managingfrostrisk-casestudies

17 GRDC (2014) Frost management high on western cropping agenda. Ground Cover, Issue 109, https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/GCS109

18 GRDC (2016) Managing Frost Risk. Case studies of growers in Western Australia. GRDC, https://grdc.com.au/resources-and-publications/all-publications/publications/2016/07/rcsn-kwinanaeast-managingfrostrisk-casestudies

19 GRDC (2016) Getting the right angle on crop competition. Ground Cover, Issue 125, https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-125-NovemberDecember-2016/Getting-the-right-angle-on-crop-competition

3.3 Targeted plant population

Plant population is influenced by seeding rate, row spacing and emergence percentage. Emergence percentage is calculated as the number of seedlings (counted at the second leaf stage) divided by the number of seeds sown per square metre. Target plant populations vary with yield potential, seasonal conditions and sowing date.

Barley is able to compensate for lower than ideal plant populations, to some degree, by increasing tiller numbers. However, targeting plant population at sowing makes the most efficient use of water and nutrients. To reach a target plant population for the environment and seasonal conditions, adjust sowing rates to allow for:

- yield potential—use higher rates with increased yield potential
- soil moisture—use higher rates if dry sowing or marginal moisture
- sowing date
- seed germination percentage
- seed size
- seedbed condition [20]

3.3.1 Seeding rate

Seeding rate is the amount (in kg) of seed needed to plant in order to establish the target plant population.

The recommended number of established plants per m^2 for food and malt varieties is 120 plants/m^2 for Baudin⁽ᴾ⁾, Commander⁽ᴾ⁾, Granger⁽ᴾ⁾ and Scope CL⁽ᴾ⁾, which are quite sensitive to establishment density. Bass⁽ᴾ⁾, Flinders⁽ᴾ⁾, Hindmarsh⁽ᴾ⁾ and La Trobe⁽ᴾ⁾ are more flexible in their target density and can be sown at between 150–180 plants/m^2, however sowing less plants may reduce profit. All feed barley varieties should be sown at more than 180 plants/m^2.

The number of seed per kg will vary depending on variety and the season in which the seed was produced. This varies from season to season.

Lower rates should be used when there is limited subsoil moisture at sowing, and in drier areas. In these areas high seeding rates tend to decrease grain size and increase screenings in barley.

Research by the DAFWA barley agronomy team found that increasing the seed rate of barley will significantly decrease the quality of barley crops in medium to high rainfall areas.

The target seed rate in kilograms per hectare differs between varieties due to kernel weight and response to increasing plant density.

In 2013, surveys carried out by the research team found just 15% of growers counted the number of established plants per metre to determine the plant density in their paddocks and potential yield from this density. In order to optimise production growers should count their establishment (per m^2) to know if they are hitting their targets. [21]

3.3.2 Calculating sowing rate

Sowing rate can be calculated by knowing the seed weight, germination percentage and the required plant density. For example: barley seed with a seed weight of 4.5 gm/100 seeds, germination percentage of 95 per cent and a required plant density of 170 plants/m^2 = 4.5 x (10/95) x 170 = 80.5 kg/ha. [22]

MORE INFORMATION

DAFWA (2016) What is the optimum seed rate for your barley variety?

Paynter, Blakely et al - How much is the seed rate response: http://www.giwa.org.au/_literature_209962/Paynter,_Blakely_et_al_-_How_much_is_the_seed_rate_response

Paynter, Blakely et al - How much does seed rate influence barley's performance: http://www.giwa.org.au/_literature_210322/Paynter,_Blakely_et_al_-How_much_does_seed_rate_influence_barley%E2%80%99s_performance

20 Industry & Investment NSW Agronomists (2010) Barley growth & development, PROCROP Series, Industry & Investment NSW. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf

21 DAFWA (2016) What is the optimum seed rate for your barley variety? Department of Agriculture and Food, Western Australia, https://agric.wa.gov.au/n/5375

22 Agriculture Victoria (2012) Growing wheat. Note: AG0548, http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-wheat

Crop establishment

Establishment in the field can be affected by a number of factors such as:

- seedbed moisture
- germination and vigour of the seed
- seed treatments and herbicides reducing coleoptile length
- seed–soil contact
- high temperatures
- disease
- soil insects and soilborne diseases
- depth of planting (may be inaccurate or variable).

The impact of poor establishment and seedling vigour will be lessened if seedbed requirements are matched to machinery capabilities and seed quality. [23]

3.3.3 Plant population

To check the plant population in a cereal crop.

Cut to size a 1-m length of steel rod or wooden stick. While the crop is still young, preferably no later than day 20 after sowing (to identify individual plants easily), place the 1-m rule along a row and count the number of plants along this row. Do this 10 times at different locations to get a representative count, and calculate the average.

An establishment rate of 70% means that for every 10 seeds planted, only seven will emerge to produce a plant. A planting rate to achieve 700,000–1,000,000 plants/ha is normally in the range 30–50 kg seed/ha. [24]

Research update

The target establishment densities for sowing malt barley in WA are 120 to 150 plants/m^2.

A GRDC-funded study by DAFWA in 2013–14 evaluated 12 barley varieties for their response to four different seed rates (50, 100, 200 and 400 plants/m^2) at eight locations (Wongan Hills, Merredin, Cunderdin, York, Katanning, Kojonup-W, Wittenoom Hills and Grass Patch).

The study found sowing more than 300 plants/m^2 did not cause a grain yield penalty.

On average increasing the seed rate from:

- 50 plants/m^2 (20 to 30 kg/ha) to 100 plants/m^2 (45 to 65 kg/ha) increased grain yield by 10 ± 1%
- 100 plants/m^2 to 200 plants/m^2 (90 to 130 kg/ha) increased it by a further 4 ± 1%
- 200 plants/m^2 to 400 plants/m^2 (seed rate of 205 to 295 kg/ha) resulted in another 1 ± 1% yield gain.

However, sowing barley to establish 50 plants/m^2 (20 to 30 kg/ha) came with a yield penalty of at least 10% compared to sowing more than 100 plants/m^2 (seed rate of >45 kg/ha).

The optimum plant population for grain yield in the study was 137 ± 9 plants/m^2.

Feed barley growers should establish more than 150 plants/m^2, and in paddocks with a high weed burden, aim for target establishment densities above 200 plants/m^2 (90 to 130 kg/ha) depending on seed weight and germination per cent. [25]

23 P Keys, AM Bach (2010) Plant population for Queensland. Department of Agriculture and Fisheries Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/wheat/plant-population

24 NSW DPI District Agronomists (2007) *Wheat growth and development*. PROCROP Series, NSW Department of Primary Industries 2007, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/449367/Procrop-wheat-growth-and-development.pdf http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/449367/Procrop-wheat-growth-and-development.pdf

25 B Paynter, A Hills, R Malik (2016) How much does seed rate (changing from 50 to 400 plants/m^2) influence barley's performance? GRDC Grains Research Updates, 29 February–1 March 2016, http://www.giwa.org.au/2016researchupdates

3.4 Row spacing

The traditional row spacing in much of WA has been 18 cm for cereals, but greater adoption of no-till farming systems has increased interest in wider row spacing such as 30 to 50 cm depending on the crop type and region.

The most appropriate row spacing is a compromise between crop yield, ease of stubble handling, optimising travel speed, managing weed competition and soil throw and achieving effective use of pre-emergent herbicides. Although row spacing is a relatively simple thing to change, the effect on the whole farm system can be complex and can influence yield, time of sowing, machinery, herbicide, and seed and fertiliser costs, as well as the types of crops sown.

The impact of row spacing on cereal yield varies depending on the growing season rainfall, the time of sowing and the potential yield of the crop. The higher the yield potential, the greater the negative impact of wider rows on wheat and barley yields.

Trials with high yielding barley crops, where the average yield was more than 3t/ha (range 2.7 to 3.4 t/ha) found doubling row spacing from 18 to 36 cm and from 25 to 50 cm resulted in yield penalties in the order of 0.7 t/ha. [26]

3.5 Sowing depth

Sowing depth is the key management factor for uniform rapid emergence and establishment. Factors to consider include:

- The ideal depth to sow barley is 20 to 30 mm, depending on the availability of moisture and the variety
- Depth is particularly important in varieties with short coleoptiles
- Sowing depth influences the rate of emergence and the percentage of seedlings that emerge
- Deeper seed placement slows emergence; this is equivalent to sowing later
- Seedlings emerging from greater depth are also weaker and tiller poorly. [27]

IN FOCUS

3.5.1 Barley Varieties Differ in Coleoptile Length and Emergence from Deep Sowing[28]

An ability to establish well under a range of seedbed conditions is desirable in cereal varieties. Moisture-seeking, heavy stubble residues, rain between seeding and emergence and the requirement to avoid soil-applied pre-emergent herbicides can result in the need for plants to establish from a greater than ideal depth. This study measured the emergence of up to twelve Australian barley varieties from three seeding depths in the field in three seasons. The effects of seed size and seed-applied fungicide were also determined.

Deeper seeding reduced the rate and the number of plants which emerged and there were large differences among varieties in final emergence. Emergence was related to coleoptile length and not to plant height. Seed treatment with triadimenol reduced emergence, particularly with deeper seeding, and the size of this reduction differed among varieties. These results emphasise the need to sow varieties that have

26 GRDC (2011) Crop Placement and Row Spacing, Western Region. Fact sheet, https://grdc.com.au/Resources/Factsheets/2011/02/Crop-Placement-and-Row-Spacing-Western-Fact-Sheet

27 Industry & Investment NSW Agronomists (2010) Barley growth & development, PROCROP Series, Industry & Investment NSW. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf

28 Pers comms N A Fettell. Agricultural Research & Advisory Station, Condobolin, University of New England.

short coleoptiles at shallow depths and to take care with seed grading and the use of seed dressings.

Seeding depth responses

An ability to establish well under a range of seedbed conditions is desirable in cereal varieties. Moisture-seeking, heavy stubble residues, rain between seeding and emergence and the need to avoid pre-emergent herbicides can result in the need for plants to emerge from greater than ideal depth.

Twelve barley varieties were sown at three depths (44, 87, and 112 mm of soil above the seed) at Condobolin in Central West NSW in 2008, using seed from a common 2007 site. Seed was graded into three sizes and was untreated except for one lot of medium-size seed which was treated with the higher registered rate of triadimenol. Emergence results are shown in Figure 1.

Deeper sowing reduced emergence in all varieties. At 87 mm, the reduction was greatest in Buloke⏀, Gairdner and Fitzroy (average 57% emergence) and least for Fleet⏀ and Commander⏀ (73%). At 112 mm, there was a similar pattern with Buloke⏀, Gairdner, Fitzroy and Hindmarsh⏀ the poorest (40%) and Fleet⏀ the best (64%). Emergence was related to coleoptile length and not to plant height. Buloke⏀, a tall variety, has a short coleoptile and emerged poorly from depth whereas Baudin⏀, a semi-dwarf variety, emerged well from depth.

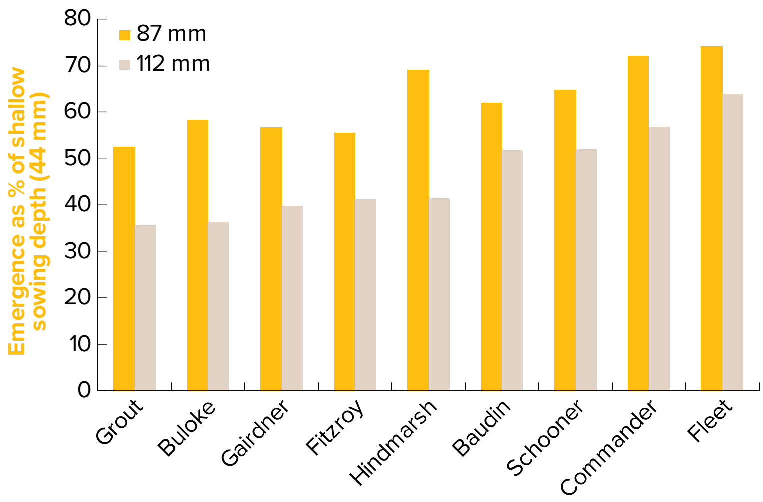

Figure 1: *All barley varieties had greater levels of emergence at 87mm than 112mm however the difference between depths varied between varieties. Plant emergence for medium (87 mm) and deep (112 mm) sowing, as a percentage of the emergence from shallow (44 mm) sowing, 2008.*

Source : UNE

The experiment was repeated in 2009, using seed from a common 2008 site, but without the three seed size treatments. Sowing depths (thickness of soil above the seed) were 52, 77 and 101 mm, and soil moisture content remained high (with no crusting) throughout the establishment period. Emergence results are shown in Figure 2. Deeper sowing reduced emergence in most comparisons, although the reductions were generally less than in 2008, possibly because the sowing depths were closer together. At both 77 and 101 mm, Fleet⏀ showed the least reduction in emergence, followed by Buloke$^{\phi}$, Commander$^{\phi}$ and Schooner. Hindmarsh$^{\phi}$ and Grout showed the poorest emergence, particularly from 101 mm. The variety responses were generally similar to 2008 with the exception of Buloke$^{\phi}$, which performed much better in 2010.

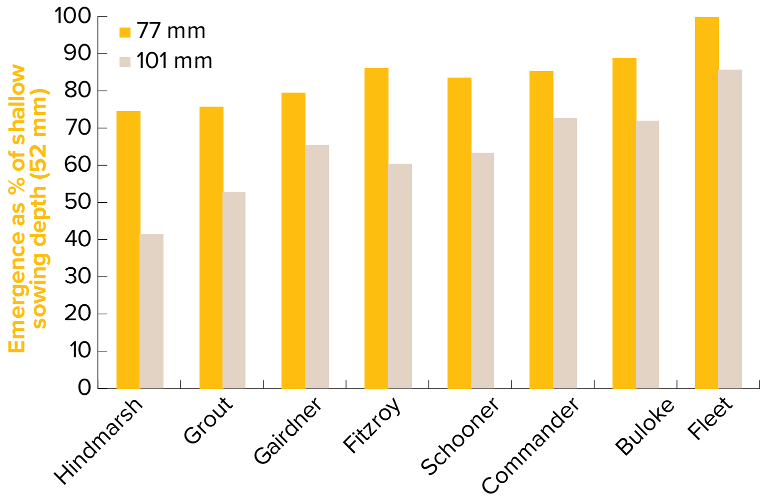

Figure 2: *Plant emergence for medium (77 mm) and deep (101 mm) sowing, as a percentage of the emergence from shallow (52 mm) sowing, 2009.*

Source : UNE

Seed treatment with triadimenol suppressed emergence in all varieties in 2008 (Figure 3), particularly at deeper sowing depths, in line with its known effect of shortening coleoptile length. The effect of triadimenol was greatest where varieties with short coleoptiles were sown at 87 or 112 mm, resulting in emergence values only 20–40% of those for untreated seed.

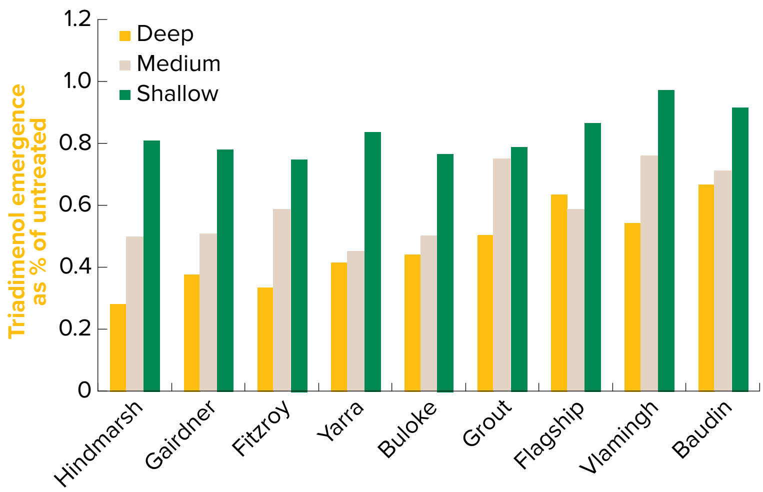

Figure 3: *Plant emergence of triadimenol treated seed as a percentage of the emergence of untreated seed, compared at shallow (44 mm), medium (87 mm) and deep sowing (112 mm) in 2008.*

Source : UNE

Triadimenol also reduced emergence in 2009, but the effect was much smaller than in 2008, particularly with deeper sowing (Figure 4). Averaged over 12 varieties, triadimenol reduced emergence by 11% at the two shallower depths and 19% with deep sowing.

Overall, these results emphasise the need to sow varieties that have short coleoptiles at shallow depths and to take care with seed grading and the use of seed dressings.

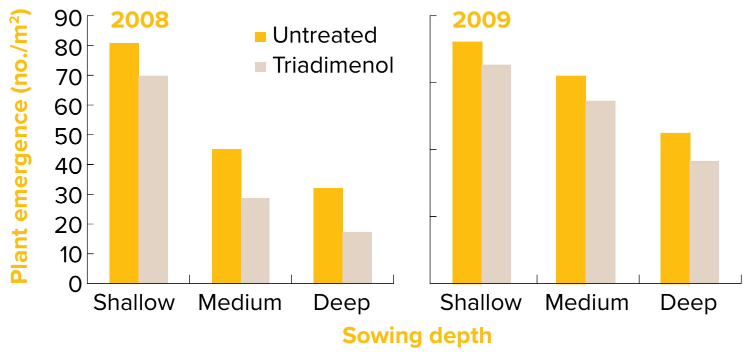

Figure 4: *Plant emergence from untreated and triadimenol-treated seed, averaged over 12 varieties, in 2008 and 2009.*

3.6 Sowing equipment

The incorporated by sowing (IBS) application technique seems to be the safest way of using most residual and pre-emergent herbicides, as the seed furrow is left free of high concentrations of herbicide. The soil from that furrow is thrown on the inter-row. In-furrow weed control is generally achieved by crop competition and/or small amounts of water-soluble herbicides washing into the seed furrow. For this reason, best results in IBS application are when water-soluble herbicides are used either solely or in conjunction with a less-soluble herbicide.

Because of the furrow created by most no-till seeders, post-sowing pre-emergent (PSPE) applications of many herbicides are not ideal and are usually not supported by labels, as the herbicides can concentrate within the seed furrow if washed in by water and/or herbicide-treated soil. For volatile herbicides that need incorporation following application, PSPE is not a viable option.

Tine seeders

Tine seeders vary greatly in their ability to effectively incorporate herbicides. There are many tine shapes, angles of entry into the soil, break-out pressures, row spacings and soil surface conditions. Each of these factors causes variability in soil throw, especially when combined with faster sowing speeds (>8 km/h). Consequently, herbicide incorporation is variable between seeders.

A common rule of thumb is in WA is that tine seeders with knife points and press wheels can operate at 1 km less than the numbers of inches of row spacing (e.g. 8 inch row spacing = 7 km/hr)

Agronomist's view

Disc seeders

Disc machines show similar variability in their ability to incorporate herbicides. Disc angle, number of discs, disc size, disc shape, sowing speed, closer plates and press wheels all have an impact on both soil throw and on herbicide-treated soil returning into the seed furrow. Some discs can throw enough soil for incorporation of herbicides such as trifluralin.

In all cases with tines and discs, crop safety is usually enhanced by applying herbicides IBS rather than PSPE.

Knife points and harrows cause a lot of herbicide-treated soil to return into the seed furrow and are therefore not ideally used in IBS application. Knife points and press wheels do a much better job. [29]

Seeder calibration is important for precise seed placement, and seeders need to be checked regularly during sowing.

Irrespective of the disc seeder, research in southern NSW has clearly shown that a well set-up tine seeder will offer greater crop safety than a well set-up disc seeder. This is mostly because a knife point and press wheel will place more soil on the inter-row, minimising the amount of herbicide-treated soil washing into the seed furrow. Soil throw in tines is also better controlled, resulting in less herbicide-treated soil in a typically wider furrow.

This research has also demonstrated that some herbicides and rates of a particular herbicide are better suited to a disc-seeder system. For example Sakura® and Boxer Gold® are much better suited to disc systems rather than trifluralin. [30]

MORE INFORMATION

[GRDC (2011) Stubble Management. Fact sheet.]

[GRDC (2015) Seeding systems and pre-emergence herbicides. GRDC Update Papers.]

[GRDC (2013) Disc seeders and pre-emergence herbicides. GRDC Update Papers.]

29 B Haskins (2010) Residual herbicides at sowing using disc and tyne no till seeding equipment., GRDC Update Papers.

30 B Haskins (2012) Using pre-emergent herbicide herbicides in conservation farming systems. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/431247/Using-pre-emergent-herbicides-in-conservation-farming-systems.pdf