SECTION 3

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 depending on frosts and seasonal effects. In the cooler areas of southern Queensland, planting can occur into July.

Early planting 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.

The major determination of barley profitability is yield. [1] To maximise yield, it is important to ensure that the crop has every chance to succeed. [2] Paddock selection and nitrogen management can be the keys to producing malting quality. [3]

3.1 Seed treatments

Seed treatments are applied to control diseases such as smuts, bunts and foliar diseases and to control insects. When applying seed treatments, always read the chemical label and calibrate the applicator. Treat seed with appropriate fungicidal dressing, as smuts and net form of net blotch may be seed-borne.

It is critical that seed treatments are applied evenly and at the right rate. 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.

Seed dressings with systemic insecticides such as imidacloprid have been shown to have a net benefit for aphid control and yield improvement. [4]

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 DAFF (2013) Barley planting disease guide 2013 QLD and NNSW. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/__data/assets/pdf_file/0018/53019/barley-planting-disease-guide.pdf

3 P Matthews, D McCaffery, L Jenkins (2014) Winter crop sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

4 DAFF (2013) Barley planting disease guide 2013 QLD and NNSW. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/__data/assets/pdf_file/0018/53019/barley-planting-disease-guide.pdf

Some seed treatments contain triazole fungicides (triadimenol and triadimefon). These seed treatments can reduce coleoptile length, and the degree of reduction increases as the rate of application increases.

Recent research in barley has shown that the highest registered rate of triadimenol can reduce emergence in barley, and that the reductions are greatest in varieties with short coleoptiles when sown at depths greater than 50 mm. The 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. [5]

3.1.1 Choice of seed or in-furrow treatments

All barley crops should be treated with a product that controls powdery mildew. Also, using imidacloprid for aphid management has become common and will impact on the choice of fungicide delivery, i.e. growers are more likely to use a seed treatment than in-furrow fungicides.

Current seed treatments for the control of net form of net blotch are only effective for seed-borne inoculum and not for stubble-borne inoculum. The level of control of seed-borne infection is also not complete. Where growers think they may have a problem with seed-borne infection, it is recommended they have the seed tested by the cereal pathology group at South Australian Research and Development Institute. [6]

For more information, visit:

http://www.pir.sa.gov.au/__data/assets/pdf_file/0017/86102/Cerealseedtreat2014_Web_Version_.pdf

http://www.grdc.com.au/Resources/Links-Pages/DiseaseLinks#W_Seed_and_in-furrow_fungicides

http://www.apvma.gov.au

3.2 Time of sowing

Sowing too early increases the risk of frost damage; sowing too late will increase protein and screenings. [7] Early planting can also increase the risk of net-blotch infection, which requires a timely fungicide program.

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 it experiences a warm late autumn or warm early winter.
- Later maturing and shorter stature varieties are preferred for early planting to avoid tall lush early growth.
- At flowering, barley can tolerate a frost temperature 1°C lower than wheat.
- A frost of –4°C at head-height during flowering can cause 5–30% yield loss.
- A frost of –5°C or lower at head height can cause 100% yield loss.
- A strongly negative April–May Southern Oscillation Index is a good indicator of late frosts.

More information

http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/02/Barley-agronomy-in-southern-NSW

http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Barley-agronomy-and-varieties

Yield and grain quality response of barley cultivars to four sowing dates –Narrabri 2014, Rick Graham, Guy McMullen. p13

Evaluation of new and potential malt barley varieties – Spring Ridge 2014, Rick Graham, Stephen Morphett, Jim Perfremen, Guy McMullen. p23

5 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

6 H Wallwork (2014) Cereal Seed Treatments 2014, SARDI. http://www.naturalresources.sa.gov.au/files/715d15f9-3801-41f4-b30f-a35d00d1df6a/cereal-seed-treatments-for-2014-gen.pdf

7 P Matthews, D McCaffery, L Jenkins (2014) Winter crop sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

- 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. [8] [9]

Sowing time determines when a crop matures, and ideally flowering and grain-fill should be in the cooler part of spring. Sowing on time maximises the chances of achieving high yields and malting grade. Sowing after mid-June usually limits yield potential and results in smaller grain and higher protein, rendering the grain less likely to be accepted as malting.

Aim to sow in the earlier part of the indicated optimum time to achieve the maximum potential yield, particularly in the western parts of the region. Selection of the actual date should allow for soil fertility and the risk of frost damage in particular paddocks. [10]

Sowing time trials in 2014 in North West NSW highlighted the ability of barley varieties to maintain yield across a wide sowing window. The new malt accredited variety GrangeR achieved good yields from early to main season sowing window opportunities, as did Navigator, a longer season domestic malt quality variety, from an early sowing window. Fathom, an early maturing feed grade only variety, performed well in sowing time trials and NVT trials and appears to be an adaptable high yielding variety. [11]

3.3 Targeted plant population

3.3.1 Seeding rates

Seeding rate is the amount (in kg) of seed needed to plant in order to establish the target plant population. To determine seeding rate you need to know the target plant population, the number of seeds per kg, the germination percentage of the seed and the likely field establishment.

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, and to calculate this figure, count the number of seeds in a 20-g sample and multiply by 50. Newer varieties tend to have larger seed and it is important to take note of this when determining planting rate. [12]

Seeding rates that are too high may reduce grain size and increase lodging, especially under irrigation; seeding rates that are too low will reduce yield potential.

Lower rates should be used when there is limited subsoil moisture at sowing, and in drier areas. High seeding rates tend to decrease grain size and increase screenings in barley. [13]

3.3.2 Field establishment

Field establishment refers to the number of viable seeds that produce established plants after planting. This can be affected by factors such as seedbed moisture, disease, soil insects, depth of planting, and the germination percentage of the seed. An

[8] 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

[9] DAFF (2013) Barley planting and disease guide. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/__data/assets/pdf_file/0018/53019/barley-planting-disease-guide.pdf

[10] P Matthews, D McCaffery, L Jenkins (2014) Winter crop sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

[11] Barley agronomy and varieties: https://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/03/Barley-agronomy-and-varieties

[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] P Matthews, D McCaffery, L Jenkins (2014) Winter crop sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

establishment figure of 70% means that for every 10 seeds planted, only 7 will emerge to produce a viable plant.

It is important to check establishment after planting in order to evaluate the effectiveness of the planting technique and make adjustments if necessary.

A guide to likely field establishment, when good quality seed with a laboratory germination ≥90% is planted at a depth of 5–7 cm and emerges without the assistance of post-planting rains, is set out below (Table 1).

Table 1: Likely field establishment (%)

Soil type	No press wheels	Press wheels
Heavy clay	45	60
Brigalow clay	55	70
Red earth	70	80

Table 2: Approximate seeding rates (kg/ha) assuming various germination rates from 60 to 90% from field establishments

Desired population (plants/ha)	60%	70%	80%	90%
700,000	52	45	39	34
900,000	67	57	46	44
1,000,000	74	63	56	49

Use higher sowing rates for grazing crops and very early or late crops.

Planting rates (Table 2) can be calculated for any variety or situation by using the following formula:

Planting rate (kg/ha) = desired population (plants/ha) ÷ (seeds per kg x germination x establishment)

Note: Germination and establishment figures are decimal e.g. 80% = 0.8, 90% = 0.9, etc.

Example:

Desired plant population of 900,000 plants/ha: Germination = 95% Expected establishment = 85% No. of seeds/kg = 25,000

Planting rate (kg/ha) = 900,000 (plants/ha) ÷ (25,000 x 0.95 x 0.85)

Planting rate = 44.6 kg/ha [14]

3.3.3 Plant population

While barley can produce a large number of tillers, best yields will be achieved with an established plant stand of 800,000–1.2 million plants/ha (80–120 plants/m). Barley can tolerate quite high plant populations without significant yield reductions; however, if plant populations fall below 80 plants/m, yield can be reduced. Lower plant populations can also encourage excess or late tillering, resulting in a less even crop and delayed harvest. Late tillers often have smaller seed, which also affects the quality of the crop. [15]

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 m. Target plant populations vary with yield potential, seasonal conditions and sowing date. Current recommendations for NSW range from 80 to 120 plants/m. When populations fall below 50 plants/m, yield is

[14] 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

[15] 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

affected. At <30 plants/m, the paddock should be resown unless it is undersown with a legume.

Plant into good soil moisture and aim for populations of ≥100 plants/m (1,000,000 plants/ha) . To achieve this, a seeding rates of 40–60 kg/ha is needed. The rate will depend on the number of seeds per kg and estimated establishment rate. For example, for a seed count of 25,000 seeds/kg, you need 40 kg to plant 1 million seeds. Taking into consideration an establishment rate of 80%, it would require 50 kg to be planted.

Plant populations of <800,000 plants/ha are likely to have reduced yield potential and provide less weed competition.

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:

- soil moisture
- sowing date: higher rates with later sowings (tiller capacity is more limited with later sowings)
- seed germination percentage
- seed size
- seedbed conditions
- tillage (e.g. increase sowing rate with no-till)
- double-cropping
- soil fertility (increase sowing rate with increasing yield potential)
- soil type (e.g. crusting)
- field losses (e.g. increase sowing rate if there is a problem with insects)

Appropriate seeding rates are important in barley for both grain yield and grain quality. Trials at Rankins Springs in 2005 showed yield increased with seeding rate up to about 120 plants/m in most varieties, whereas kernel weight decreased with each increase in plant density for all varieties.

Retention also decreased with increases in plant density in all varieties except Buloke⦶, although the decline was only minor in Schooner⦶. The effect of grain shape was evident. Buloke⦶ had the heaviest grains but was intermediate for retention, whereas Baudin⦶ had high retention values and the lowest kernel weights. High seeding rates should be avoided in Gairdner⦶. [16]

3.4 Calculating seed requirements

Select sowing seed carefully for large size and high germination percentage. A germination test can be conducted if in doubt.

The formula for calculating cereal seeding rate is:

1000-grain weight (g) x target plant population (per m) x 100/(establishment% x germination%) = seeding rate (kg/ha)

The formula can be used to calculate sowing rates, taking into account:

- target plant density
- germination percentage (90% = 90 in the formula)
- seed size
- establishment—usually 80%, unless sowing into adverse conditions (80% = 80 in the formula)

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

Tip to calculate 1000-grain weight:

- count out 200 seeds
- weigh to at least 0.1 g
- multiply weight in grams by 5.

For online assistance in calculating seed requirements and other planting decisions, download CropMate from the App Store on iTunes at https://itunes.apple.com/au/app/cropmate-varietychooser/id476014848?mt=8. [17]

More information

How to determine the ultimate row spacing?

3.5 Row spacing

No yield reductions have been recorded for row spacings up to 36 cm. Rows wider than 36 cm have caused minor yield reductions, particularly in good seasons. Wider rows are more predisposed to lodging and will reduce the level of weed smothering due to canopy ground cover. [18]

3.6 Sowing depth

Pay close attention to sowing depth, particularly where direct-drilling is practiced and for varieties with a short coleoptile. The ideal depth is 3–6 cm, but seed should always be sown into moist soil. If dry sowing is being considered, target a sowing depth of 3–4 cm, particularly on a hard-setting or slumping soil to avoid problems with crop emergence.

Barley does not tolerate waterlogging, so good paddock drainage and management are essential for high grain yields. [19]

Sowing depth is the key management factor for uniform rapid emergence and establishment. 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.

Crop emergence is reduced with deeper sowing. The coleoptile may stop growing before it reaches the soil surface, and the first leaf then emerges from the coleoptile while it is still below the soil surface. As the leaf is not adapted to pushing through soil, it usually buckles and crumples, failing to emerge and eventually dying. [20]

A few tips to take into account include:

- Avoid the shorter coleoptile (dwarf) varieties.
- Avoid seed dressings that contain triadimenol as these can shorten the coleoptile and make emerging from depth more difficult.
- Try to minimise the amount of soil placed back over the top of the planting furrow.
- Ensure that the seed planted has good germination and vigour. [21]

17 P Matthews, D McCaffery, L Jenkins (2014) Winter crop sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

18 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

19 P Matthews, D McCaffery, L Jenkins (2014) Winter crop sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

20 Industry & Investment NSW agronomists (2010) Barley growth & development, PROCROP Series, Industry & Investment NSW.

21 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

3.7 Sowing equipment

During the shift from conventional farming systems to no-till farming systems, the effective use of herbicides has become increasingly important. A well-planned herbicide strategy can mean the difference between making no-till work or not. Over the past 5–6 years, it has become apparent that the rapid change in farming systems has overtaken farmer knowledge on how to use many herbicides in conservation farming systems. Older, more traditional herbicides that were designed for use in cultivated systems can still be used very effectively in no-till systems; however, they are usually used in a different manner. In addition, many herbicide labels (especially older type or generic herbicides) still have the same content on the label today as they did 10–15 years ago. Some products with generic counterparts even have totally different label claims for the same active ingredient. This creates many issues for farmers and agronomists wanting to use these herbicides in modern no-till farming systems.

Residual herbicides at sowing are very effective at controlling a wide range of weeds, both in-crop and well into the following summer.

Some residual herbicides also have valuable knockdown properties. This is very useful because knockdown herbicide options prior to sowing are limited for hard-to-kill weeds.

Knowing the chemistry and mode of action of each herbicide is paramount to enable the best combination of crop safety and weed control. Heavy rainfall just after sowing when combined with certain soils can lead to crop damage.

Some herbicides are mobile with soil water, while others are less mobile.

Mobility can also change with time for particular herbicides. For example, with Boxer Gold®, the longer it is allowed to bind to soil particles, the less chance there is of the herbicide becoming mobile in the soil. Other herbicides such as Logran® are mobile regardless of binding period.

The incorporated by sowing (IBS) application technique seems to be the safest way of using most residual herbicides, as the seed furrow is left free of high concentrations of herbicide. The soil from that furrow is thrown on the inter-row, where it is needed the most. 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 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, residual herbicide incorporation is variable between seeders. There are therefore no rules of thumb for sowing speed, row spacing and soil throw. You must check each machine in each paddock.

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.

A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

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. [22]

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

See more at: http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2011/03/Options-for-using-more-residual-herbicides-in-northern-notill-systems

http://www.grdc.com.au/Media-Centre/Media-News/North/2011/06/~/media/4CA071540A0F4E28AE0FF786D8BCB1DA.pdf

3.7.1 Using pre-emergent herbicides with different seeding equipment

In recent years, seeders have changed dramatically in their design, aiming to maximise trash flow and seed placement uniformity while minimising soil disturbance. This has led to an increased uptake of knife-point and press-wheel seeders and more recently disc seeders.

Each seeder will create a different environment for an establishing crop, and it is essential to understand this before using pre-emergent herbicides.

It is also essential to understand how this environment may change with IBS or PSPE incorporation methods. In general, there is a great deal of difference achieved for crop safety between seeders in IBS systems, and less difference in PSPE application methods. The PSPE technique relies on uniform seeding depth and flatter seedbeds without pronounced furrows. This section focuses on the IBS method of incorporation, as typically this method is preferred in conservation-farming systems.

Pre-emergent herbicides that are incorporated by sowing rely on the sowing process to ensure that the herbicide is incorporated effectively and that the seed is placed into a micro-environment that allows safe and effective germination. In all cases, the ideal situation is using a knife point or disc followed by a press wheel. Press wheels are essential as they provide the seed with good soil contact, and minimise the amount of herbicide-treated soil from the inter-row being dragged into the seed furrow. They also allow seeders to pass through stubble without the machine becoming choked with trash. The key is to understand that all seeding gear is different which, in turn, creates varying seedbed conditions.

In tined seeders, variations include:

- angle of tine entry to the soil
- width and shape of seeding point
- breakout pressure of tine
- depth uniformity across machine
- trash flow ability across machine
- press-wheel size and shape

In disc seeders, variations include:

- ability to penetrate compacted soils
- ability to achieve controlled soil throw onto the inter-row
- angle of disc entry to the soil
- size, shape and width of disc
- seed placement in furrow, i.e. bottom or side
- closing plates or closing wheels that allow consistent closure of the seed slot without returning herbicide treated soil onto the seed

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

- depth gauge wheel placement and size
- press-wheel angle, size and shape

Equally important are other factors not associated with the type of seeding system that also influence seedbed conditions. These include soil type, soil moisture, soil compaction, row spacings, seeding depth and sowing speed.

To ensure adequate soil throw, many people assume 1 km/h for every 1cm of row spacing. This is not correct, and there is no rule for soil throw, row spacing and sowing speed because of the variability discussed previously. The only way to check for adequate soil throw is to check every scenario.

The suitability for pre-emergent herbicides in both tine- and disc-seeding systems has attracted a lot of research over the past few years. Unfortunately, many herbicide labels will not support the use of some pre-emergent herbicides with disc seeders, as there is greater risk of crop damage due to varying machine designs that form very different seedbed conditions.

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.

As shown in Figure 1, this research has also demonstrated that some herbicides and rates of a particular herbicide are better suited to a disc-seeder system than others. This is usually correlated with how a seedling metabolises a particular herbicide if they contact each another. Figure 1 demonstrates that trifluralin at higher rates is definitely not suited to disc-seeding systems, as crop vigour may be adversely affected. [23]

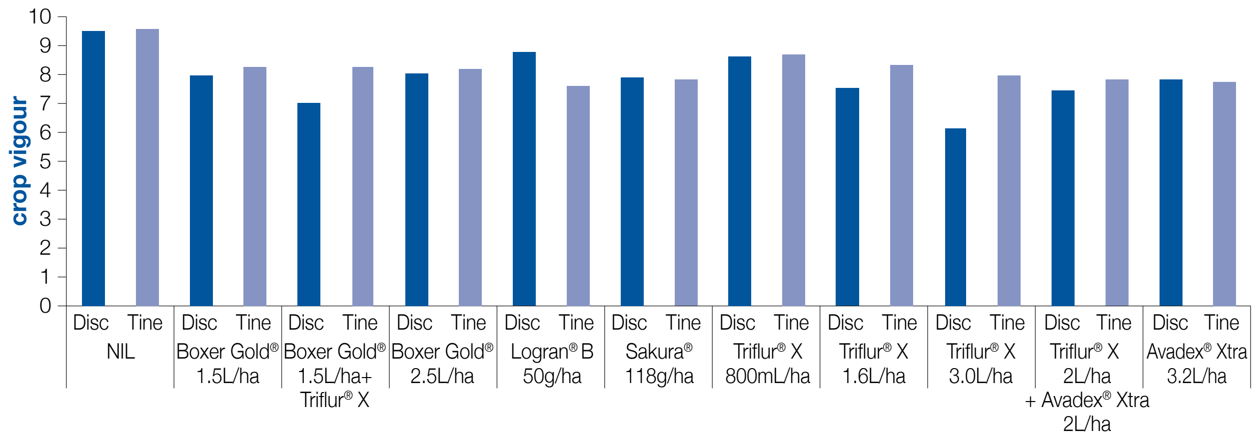

Figure 1: Difference in crop safety between discs and tines across a number of commonly used, pre-emergent herbicides in trials held across southern and central NSW. Various disc and tine seeders were used for these trials. 0, No crop vigour; 10, vigorous crop.

[23] 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