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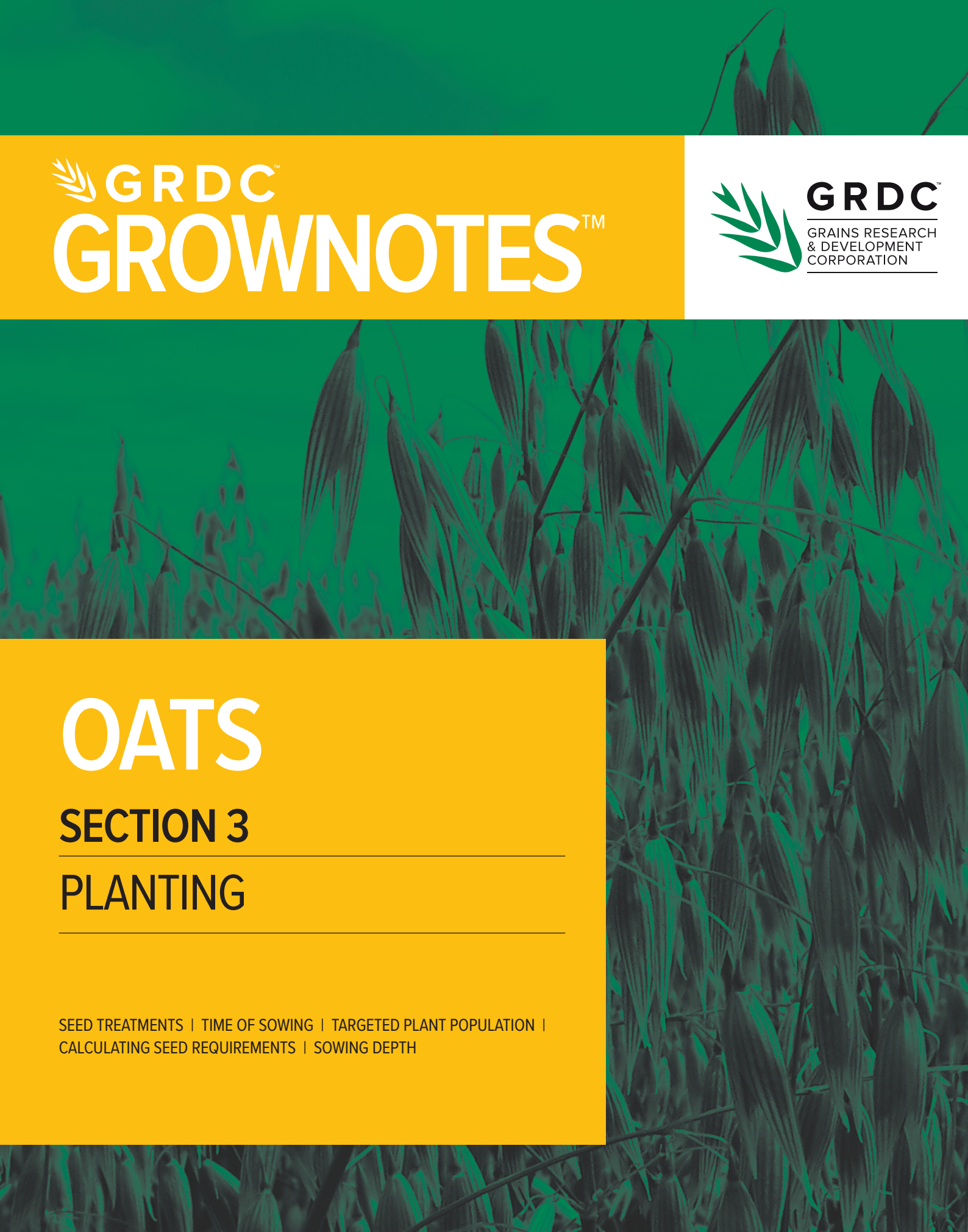

OATS

SECTION 3

PLANTING

SEED TREATMENTS | TIME OF SOWING | TARGETED PLANT POPULATION | CALCULATING SEED REQUIREMENTS | SOWING DEPTH

SECTION 3

Planting

3.1 Seed treatments

Seed dressing and in-furrow fungicides contain active ingredients for the control or suppression of seed-borne diseases and some fungal root rots in cereal crops. Information on fungicide active ingredients that are registered for wheat, barley, oat and triticale crops in Western Australia is provided along with information on control of specific cereal diseases. For details on application rates and other instructions please refer to product labels.

At seeding, fungicides can be applied to seed (seed dressing) or applied in soil (coated on compound fertiliser or mixed with liquid fertiliser and applied in-furrow) to be taken up by cereal seedlings. Seed dressing fungicides provide protection from seed-borne diseases, such as smuts and bunts. Some products also suppress or control fungal root rots, such as pythium, rhizoctonia and take-all. Some seed dressing and/or in-furrow products suppress early foliar diseases.

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 threaten your crop. Consult product labels for registrations, the Australian regulatory database or InfoPest, or see a list of currently registered active ingredients by crop at http://apvma.gov.au/ Reassess your disease risk before seeding by looking at seasonal forecasts, green bridge updates and crop disease forecasts for your local area, all available through the Department of Agriculture and Food, Western Australia (DAFWA). [1]

More information

Australian Pesticides and Veterinary Medicines Authority

3.1.1 Cautions about using fungicide seed dressings

Read and follow directions on fungicide labels carefully.

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, such as in sandy soils.

Pickled seed should not be used as animal feed and should not be delivered to CBH. [2]

[1] K Jayasena, C Beard, GJ Thomas, A Hills (2016) Seed dressing and in-furrow fungicides for cereals in Western Australia. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/barley/seed-dressing-and-furrow-fungicides-cereals-western-australia

[2] K Jayasena, C Beard, GJ Thomas, A Hills (2016) Seed dressing and in-furrow fungicides for cereals in Western Australia. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/barley/seed-dressing-and-furrow-fungicides-cereals-western-australia?page=0%2C2#smartpaging_toc_p2_s7_h2

*Table 1: Seed dressing fungicides registered for use on oats in WA – 2016 (Source: DAFWA)**

Seed dressing active ingredient (fungicide/insecticide). Rate of product/100 kg/seed	Smut (covered and loose)	Product examples by trade names
Carboxin + cypermethrina	75/125-250g or mL	Vitaflo®C, Advance® , Vitavax® 750C
Carboxin + thiram	250-500mL	Vitavax® 200FF
Difenoconazole + Metalaxyl-M	-	Dividend® M (discontinued)
Difenoconazole + Metalaxyl-M + sedaxane	180mL	VibranceTM
Fluquinconazole	-	Jockey® Stayer, Maxiflo®, Quantum®, Quantum® Pro
Flutriafol + cypermethrina	-	Vincit® C, Pinnacle® 25, Veteran® C, Vibrant® 25C, Allsow®, Armour® C, Pinnacle®100, V-Flow, Arrow® C
Flutriafol + imidacloprid	400mL	Veteran®Plus
Flutriafol (with zinc)	400mL	Vincit® Zinc
Ipconazole + cypermethrina	100mL	Rancona® C
Ipconazole + metalaxyl	80mL	Rancona® Dimension
Penflufen	-	EverGol® Prime
Prothioconazole + tebuconazole	15mL	Raxil® Pro
Tebuconazole + imidacloprid	400mL (200mL)	Hombre® (discontinued), Proguard® Plusb, Hombre® Ultrab
Tebuconazole+ cypermethrina or triflumurona	100g or mL	Raxil® T, Proguard® T, Tebuconazole 25C or T, Blaster® 25C, Tebby-C®, Veto® 25C or T, SeedUp®, Tebu- C® 25
Triadimenol+ imidacloprid	400mL	Proleaf® Plusb, Zorro®b (discontinued), Foliarflo® plusb, Imid-Triadimenol 4Farmers
Triadimenol + cypermethrina or triflumurona	100-150g or mL	Proleaf® C or T, Foliarflo® C or T, Phoenix® C, Tridim® C, Vanguard® 150C, Seedpik® 150 C, Triadimenol 150C (Syngenta)/+ (4 Farmers), Baytan® T, GoSeed®
Triticonazole4 + cypermethrina	100mL	Premis® Protect, TitanTM, Premis Pro C®, Triticonazole 200 4Farmers

*Updated 21 January 2016 . This information is a guide only. Chemical labels should be read and rates should be checked before using fungicides. Mention of trade names does not imply endorsement of any company's products. Symbols used refer to footnotes. No in-furrow fungicides are currently registered for use on oats in WA.

Note: 1) Blank indicates that product is not registered for use in the disease specified; 2) ® Registered trademark; 3) Triticonazole4 products Real® 200C and Caesar® are not registered for use in oats. 4) *Fluquinconazole* based products at higher rate suppress take all disease. 5) No in-furrow fungicides are currently registered for oats. 7) No fungicide seed dressings are registered for foliar diseases in oats.

Insecticides:

1)Cypermethrin and triflumuron compounds (insecticides) are effective against insect pests of stored grain. 2)Hombre® Ultra (@ 200 mL/100kg seed), Proguard® Plus, Zorro®, Proleaf® Plus and Foliarflo® Plus are also registered for aphid control and the prevention of the spread of "barley yellow dwarf virus" (BYDV) in cereal crops.

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Department of Agriculture and Food WA https://www.agric.wa.gov.au/sites/gateway/files/OATS.pdf

3.2 Time of sowing

Seed at the optimum sowing date for growing season length and variety maturity to maximise yield and reduce the risk of downgrading the quality of both grain and hay.

In most regions of Western Australia, the ideal time to flower (flowering window) is in September. For areas around and north of the Great Eastern Highway (Beverley, Wongan Hills and Chapman Valley), the flowering window is the whole of September. For the Great Southern (Katanning, Mt Barker and Newdegate), the flowering window ranges from mid September to early October.

Flowering too early will mean maximum growth and yield will not be achieved, and risk of frost damage and weather staining is increased. Flowering too late increases the risk

of running out of soil moisture and filling grain at higher than optimum temperatures leading to lower yields and higher screenings. [3]

3.2.1 Early sowing

Sowing as early as possible with a later maturing variety will:

- Give the crop the opportunity to give the highest possible yield
- Reduce grain protein content - one month delay in sowing date can increase protein by about 1%
- Increase the severity of foliar diseases - choose varieties with good disease resistance ratings
- Produce taller crops in good growing condition which may lodge

Early sowing (May) results in higher hay yields compared to late (June) sowing, however if early maturing varieties are sown there is a greater risk of rainfall on the cut hay.

3.2.2 Late sowing

Sowing late in the program with an early maturing variety:

- Will give lower yields with higher protein because flower and grain fill will be later in spring when moisture is likely to be limiting and temperatures high
- Foliar diseases, lodging and shedding will be less severe
- Hay quality will be reduced [4]

With the wide range of oat varieties available, it is possible to choose a variety suitable for sowing in the beginning of autumn. However, not all varieties can be sown this early and are suitable for sowing as late as early winter, although this may vary in southern Australia. Avoid early sowings of leaf rust susceptible varieties and varieties sensitive to very warm soils. [5]

3.3 Targeted plant population

Establishment of optimum plant population is essential to achieve the maximum possible yield. The desired number of plants per square metre is mainly dependent on yield potential but also can improve crop competitiveness against herbicide resistant ryegrass.

FAQ The recommended plant density is 240 plants per square metre (m^2) for both grain and hay oats. [6]

Stem thickness is an important trait for export hay markets and previous DAFWA research has shown that using high seeding rates can reduce stem diameter, with minimal effect on other quality parameters. [7]

Reasons to increase plant density include:

- Hay production - to help plants compete against weeds and to produce finer stems as required for the export market. Target 320 plants/m^2. Finer stems also dry quicker
- Dwarf varieties - plump-grained varieties can be sown at higher density

3 I Pritchard (2014) Oats: Seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C3

4 I Pritchard (2014) Oats: seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C3

5 Pacific Seeds oats agronomy guide 2006-7. https://www.pacificseeds.com.au/images/stories/winter_forage/information/yearbookoatsagronomy2006.pdf

6 I Pritchard (2014) Oats: seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C1

7 M Williams (2015) Oat research to lift options for low rainfall areas. Grains Research and Development Corporation, http://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-114-JanFeb-2015/Oat-research-to-lift-options-for-low-rainfall-areas#sthash.NEFOFBvz.dpuf

More information

Department of Agriculture and Food WA https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C1

Department of Agriculture and Food WA https://www.agric.wa.gov.au/oats-hay-essentials

Pacific Seeds Oats Agronomy Guide https://www.pacificseeds.com.au/images/stories/winter_forage/information/yearbookoatsagronomy2006.pdf

- Seedling emergence and establishment are likely to be reduced
- Plant tillering is expected to be low because of variety or soil fertility effects
- Delays to sowing
- Good rains expected during the season
- Soil fertility and moisture levels are high
- A dry finish is expected
- Likely infestation of insects which may cause seedling mortality
- A high risk of waterlogging (mid-season) - to compensate for a lack of tillering
- Moderate to high grass weed densities are likely - increases competitiveness

Avoid higher plant densities where:

- Plump grain is required for milling quality
- Lodging could be a problem - slightly lower densities can encourage thicker stem growth
- Crops are growing on stored soil moisture and may deplete most of the moisture before the crop matures [8]

3.3.1 Row spacing

In cereal crops that receive adequate moisture, narrow row spacing generally results in higher grain yields than wider rows by promoting ground cover, optimising light interception and by suppressing weed growth.

For crops expected to yield greater than 4 tonnes per hectare (t/ha), rows should be sown no further apart than 25 cm and preferably less than 20 cm. For hay this will give good ground coverage by plants so that the windrow can be held off the ground to improve air circulation and reduce staining. [9]

High seeding rates give rapid growth rates and high forage yields. Use high rates where dense weed populations are expected, when conditions are likely to be wet during winter, in low pH soils, and/or in paddocks with low soil fertility, or if seed quality is substandard.

Seed size varies significantly between oat varieties and season, so it is important to know the 1000 grain weight of the selected variety to calculate the required seeding rate. The seeding rates shown should be used as a guide only and growers should calculate their own seeding rates based on 1000 seed weight, target plant population and seed establishment percentage. [10]

More information

Pacific Seeds Oats Agronomy Guide https://www.pacificseeds.com.au/images/stories/winter_forage/information/yearbookoatsagronomy2006.pdf

Department of Agriculture and Food WA https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C2

3.4 Calculating seed requirements

Calculate seeding based on seed size, target plant population and calculated germination per cent. Work in terms of plants per square metre rather than kilograms per hectare (kg/ha) because grain size and weight varies between crops, varieties and seasons.

To determine the average grain weight, count and weigh 1000 seeds of the graded sample. The seed rate calculation is:

Seed rate (kg/ha) = [Target plant density (plants/m^2) * Average grain weight (mg)] / Expected establishment per cent (%)

[8] I Pritchard (2014) Oats: seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C1

[9] I Pritchard (2014) Oats: seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C2

[10] P Matthews, D McCaffery, L Jenkins (2015) Winter crop variety sowing guide 2015: NSW DPI management guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2015.pdf

More information

Department of Agriculture and Food WA https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C1

Heritage Seeds http://www.heritageseeds.com.au/assets/Uploads/TechSheets2013/Williams-fact-sheet-LO-RES.pdf

For example, if the desired plant population is 240 plants/m^2, the average grain weight is 40 milligrams (mg) and expected establishment is 80% the calculation is: 240 * 40 / 80 = 120 kg/ha

Table 2: Examples of seed rates calculated on the basis of target plant population, seed weight and establishment percentage. [11]

Average seed weight (mg)	160 plants/m^2	240 plants/m^2	320 plants/m^2
33	66	99	132
35	70	105	140
37	74	111	148
39	78	117	156

3.5 Sowing depth

Sowing plump seed at the right depth is an important first step towards achieving vigorous, healthy seedlings. Planting should be deep enough to provide uniform coverage of the seed and to help maintain moist conditions for germination.

The recommended depth for most oat varieties is 3-6 centimetres (cm).

Oat seedlings emerge by elongation of the mesocotyl and coleoptile (in wheat and barley it is only through elongation of the coleoptile) so oats can safely be sown deeper than wheat and barley.

Sowing too shallow may:

- Place the seed in dry soil and it may fail to emerge
- Cause shallow crown depth that may cause the plants to lodge when soil is very wet and in high winds
- Plants may be more vulnerable to pre-emergent herbicides such as Diuron or metolachlor

Consequences of deep sowing can include:

- Delayed seedling emergence
- Emerging seedlings that are weaker, limp and easily damaged by wind and insects
- Reduced root development making plants more susceptible to root diseases
- Delayed plant development and tillering
- Reduced competitiveness with emerging weeds

Use press-wheels to compress the soil directly above the seed for even distribution during seeding. When using standard tyned seeders without press-wheels, the seed is often spread through a depth of 2-3 cm with the occasional seed left on the soil surface.

Sowing into water-repellent sands early in the season where the wet soil may be at 5 cm or more necessitates the use of press-wheels to ensure even establishment. The use of press-wheels is also beneficial in creating a furrow to harvest subsequent rainfall into the seed zone.

Coleoptile and mesocotyl length are temperature dependant so early sowing into warmer soils will result in them being longer compared to later sowings in winter. [12]

Direct-drilling of early sown varieties is easier in paddocks cropped the previous year. New paddocks can be direct-drilled early with machinery that gives adequate penetration and minimum soil disturbance following chemical fallow.

[11] I Pritchard (2014) Oats: seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C1

[12] I Pritchard (2014) Oats: seeding and establishment. Department of Agriculture and Food WA, https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C2

More information

NSW Department of Primary Industries http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2015.pdf

Queensland Department of Agriculture and Fisheries https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/oats/planting-information#Planting_depth

Queensland Department of Agriculture and Fisheries https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/61969/forage-oat-variety-guide.pdf

Pacific Seeds Oats Agronomy Guide https://www.pacificseeds.com.au/images/stories/winter_forage/information/yearbookoatsagronomy2006.pdf

Departmernt of Agriculture and Food WA https://www.agric.wa.gov.au/oats/oats-seeding-and-establishment?page=0%2C2

A sowing depth of 3-5 cm is ideal, but oats can be sown as deep as 7 cm if moisture seeking. [13]

Oat seed is best sown at 30-75 mm depth in 18-25 cm row spacing into moist soil in a well prepared seedbed. [14]

Seed should be placed deep enough to give it adequate moisture, but in general should be shallower than 7.5 cm (3 inches) particularly with small seeded varieties. [15] If planting seed at the deeper end of the range (75 mm) you need to consider the risk that furrow fill may result in a deeper than ideal planting depth.

[13] P Matthews, D McCaffery, L Jenkins (2015) Winter crop variety sowing guide 2015: NSW DPI management guide. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/272945/winter-crop-variety-sowing-guide-2015.pdf

[14] Planting and nutrition of oats (2012), Queensland Department of Agriculture and Fisheries 2010-2015, https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/oats/planting-information#Planting_depth

[15] Pacific Seeds oats agronomy guide 2006-7. https://www.pacificseeds.com.au/images/stories/winter_forage/information/yearbookoatsagronomy2006.pdf