



NORTHERN

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GRDC™ GROWNOTES™



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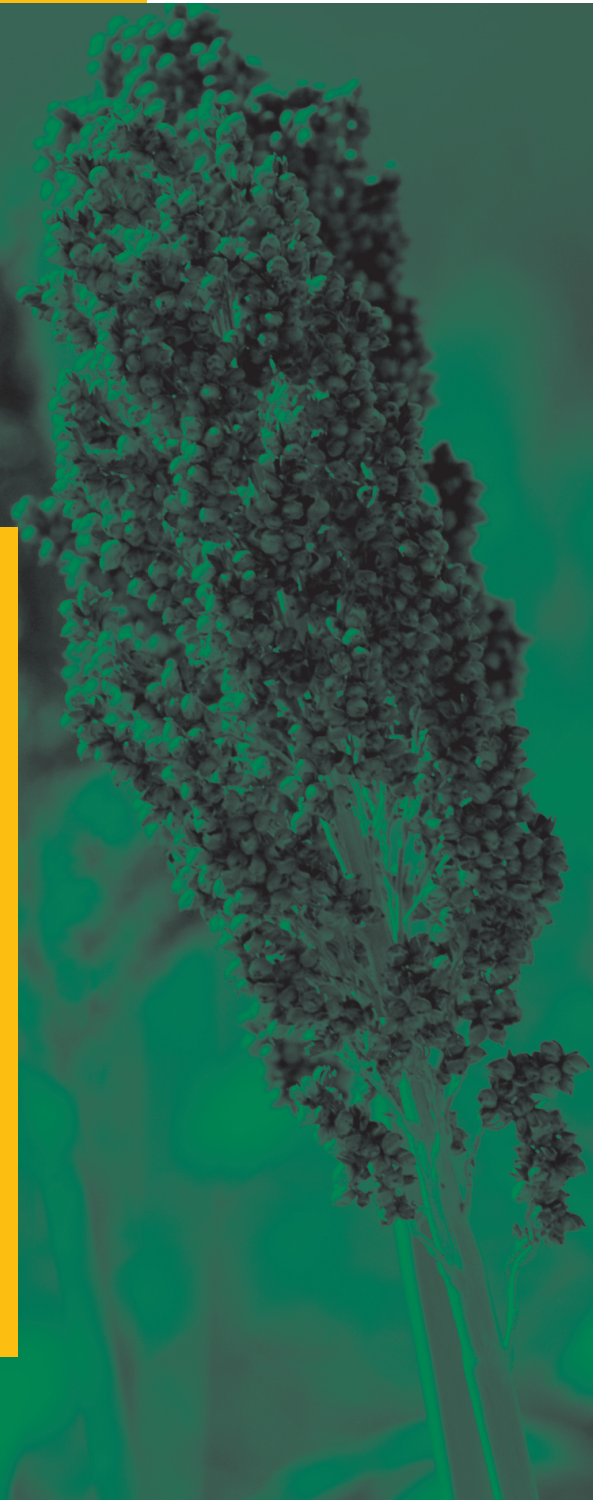
GRAINS RESEARCH
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CORPORATION

SORGHUM

SECTION 14

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SECTION 14 SORGHUM

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<http://link.springer.com/article/10.1007%2FBF02206901>

<http://www.regional.org.au/au/asa/1982/contributed/irrigation-water-use/p-11.htm>

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Environmental issues

14.1 Waterlogging and flooding issues

Grain sorghum is a very water-efficient crop and is more tolerant of heat and moisture stress than is maize. Sorghum is capable of very high Water Use Efficiency, but under cooler environments with good water supply, maize will produce more grain per mm of crop potential evapotranspiration. Sorghum crop water use index ranges between 10 and 25 kg/mm, depending on the level and timing of stress and management. With careful management and today's hybrids, 25 kg/mm is possible.¹

14.1.1 Irrigation rules of thumb

For maximum yields, the available water in the active root-zone should not drop below 50% storage capacity. At peak use, sorghum will use ~80–95 mm of water in a 1-day period.

Under flood, furrow or border-check irrigation, 12-h irrigation shifts will be ideal. If watering time is prolonged and waterlogged conditions result for >24 h at each irrigation, yield losses of up to 50% have been recorded compared with non-waterlogged areas. The rule-of-thumb is 0.2 t/ha.day of waterlogging lost.²

14.1.2 Stage of development

Researchers have investigated the effect of waterlogging on sorghum and sunflower in relation to stage of development (sunflowers: 6-leaf, buds-visible, anthesis; sorghum: 5-leaf, initiation, anthesis) and duration of waterlogging (3, 6 and 9 days) under glasshouse conditions.

Additionally, the potential adaptation of the two crops was observed by waterlogging some plants at all three growth stages.

Waterlogging of sorghum plants suppressed normal tillering but had little effect on dry weight of the main stem. Late tillering was stimulated by waterlogging. Reductions in leaf area occurred at all stages of development in response to waterlogging, with these effects being more marked at initiation. Similarly, yield was most reduced by the initiation waterlogging, largely a result of reduced seed number.

In neither species was there a clear relationship between duration of waterlogging and subsequent reduction in growth and yield. With respect to yield, stage of development seemed to be of greater importance than the duration of waterlogging. The growth and yield of multiple-waterlogged sunflowers was less affected by the anthesis treatment than that in plants experiencing a single waterlogging, suggesting that some form of adaptation was induced. By contrast, no such response was seen in sorghum.³

¹ T Philp, G Harris. Irrigated sorghum—best practice. WATERpak—a guide for irrigation management in cotton and grain farming systems. pp. 298–304. Cotton CRC, guide http://www.moreprofitperdrop.com.au/wp-content/uploads/2013/10/WATERpak-4_2-Irrigated-Sorghum-best-practice.pdf

² T Philp, G Harris. Irrigated sorghum—best practice. WATERpak—a guide for irrigation management in cotton and grain farming systems. pp. 298–304. Cotton CRC, http://www.moreprofitperdrop.com.au/wp-content/uploads/2013/10/WATERpak-4_2-Irrigated-Sorghum-best-practice.pdf

³ P Orchard, RS Jessop (1984) The response of sorghum and sunflower to short-term sunflower. Plant and Soil 81, 199–132, <http://link.springer.com/article/10.1007%2FBF02206901>

14.1.3 Denitrification

Denitrification is a process where bacteria convert plant-available soil nitrate (NO₃⁻) into nitrogen (N) gases that are lost from the soil. In normal, aerated soils, bacteria break down organic matter in the presence of oxygen to produce carbon dioxide (CO₂), water and energy. But in very wet or waterlogged soils, oxygen is rapidly depleted, so bacteria use nitrate instead of oxygen for respiration.

Soil doesn't have to be under water to have low oxygen availability. This can occur in any soil where internal drainage is restricted; for example, soil with a high clay content that drains slowly, or sandy soil over an impervious layer that impedes drainage. It can be influenced by factors such as the amount of rain, duration of rain, how wet the soil profile was, and capacity for the soil to drain internally.⁴

Key points

- Loss of soil nitrate via denitrification is usually minimal, unless soils are waterlogged.
- Denitrification, a naturally occurring process, happens when bacteria convert soil nitrate into nitrogen (N) gases that are lost from the soil. It occurs in soils nearing saturation because oxygen becomes increasingly limited.
- Bacteria need a supply of soil nitrate and readily available organic matter for denitrification to proceed. Denitrification rates are faster at hotter temperatures and in alkaline, rather than acidic, soils.
- Soil nitrate comes from mineralisation of soil organic matter, decomposition of crop residues (especially nitrogen-fixing legumes), and addition of N fertiliser.
- The source of the nitrate determines when denitrification losses may occur. For instance, in N-fertilised summer crops such as sorghum, losses can be large if heavy rains waterlog the soil during hot conditions soon after planting.
- The best way to tell how much nitrate remains in the soil profile after an extended wet period is to have it soil cored and tested for nitrate. Denitrification is extremely variable, so growers need to test wetter areas separately from drier ones.
- Limiting future denitrification losses is difficult. However, growers can reduce the potential for denitrification by using split applications of N fertiliser, enhanced-efficiency fertilisers, growing short-season 'cover crops', improving paddock drainage, or planting in raised planting beds.⁵

14.2 Frost

Sorghum is a subtropical grass, so is susceptible to cold weather during its growth. Frosts (ground temperature <0°C) at any time will cause damage. Occasional frosts have occurred in late October on the eastern sectors of the northern grainbelt, killing plant tillers and delaying their development. Entire crop mortality is very rare.

Frosts also have a detrimental impact at the end of the season (June–August) for any crops still attempting to fill grain, typically if they have been planted very late or if they have been left to regrow. Overall, industry losses incurred as a result of frost are negligible.

For information on the effect of temperature on seed set, see GrowNotes Sorghum 3. Planting.

For information on long-fallow disorder, see GrowNotes Sorghum 1. Planning and paddock preparation.

MORE INFORMATION

GRDC Tips and Tactics: [Managing frost risk - Northern Southern and Western Regions](#)

MORE INFORMATION

<https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/GCS109>

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⁴ GRDC (2014) Denitrification, GRDC Fact Sheet, <http://www.grdc.com.au/GRDC-FS-N-Denitrification>

⁵ GRDC (2014) Denitrification, GRDC Fact Sheet, <http://www.grdc.com.au/GRDC-FS-N-Denitrification>