WHY CHOOSE LONG COLEOPTILE WHEAT VARIETIES

PROJECT PARTNERS

HART
MALLEE SUSTAINABLE FARMING
AIR EP Ag Innovation & Research Eyre Peninsula
BCG SHARED SOLUTIONS
NSS
FarmLink change • adapt • prosper
UNFS Upper North Farming Systems
FACEY GROUP Shaping the Future
CWFS Central West Farming Systems Inc
CORRIGIN Farm Improvement Group
SOUTHERN GROWERS
RIVERINE PLAINS
MURRAY PLAINS FARMERS
Irrigation Farmers Network
SA DROUGHT HUB

Australian Government
Department of Agriculture, Fisheries and Forestry

Future Drought Fund

AgExcellence ALLIANCE

This project received funding from the Australian Government's Future Drought Fund

Key takeaways

- **Long coleoptile wheat varieties are most useful when moisture is out of reach of conventional sowing depth—typically below 6 to 7 centimetres—and surface conditions are too dry or variable for reliable shallow establishment.**
- **Long coleoptile varieties offer little benefit if the soil is dry to 8–10 cm, unless deeper placement helps avoid false starts from small rainfall events.**
- **Soil type should guide where long coleoptile wheat is used. Light to moderate textured soils with subsoil moisture are best suited for deep sowing strategies with longer coleoptile varieties. On heavier soils, unless moisture is clearly available at depth and the soil is soft enough to allow emergence, shallow sowing remains the safer option.**

True long coleoptile wheat varieties carry the Rht18 gene and have been bred to emerge from deeper in the soil than conventional varieties—typically from depths of 8–10 cm or more. While the main reason to choose long coleoptile wheat is to make the most of subsoil moisture, other reasons include dealing with stubble, to improve crop safety with residual herbicides, soil constraints (e.g. sowing below a non-wetting layer), confidence in emergence after soil amelioration, and to start sowing earlier and spread logistics across large programs, without waiting for a traditional break.

Do long coleoptile varieties have to be sown deep?

No. Long coleoptile are not locked into deep sowing; they simply give growers the option to sow deeper when needed.

Can conventional varieties still perform if sown deep?

Conventional wheat varieties such as Calibre$^{\Phi}$ and Sceptre$^{\Phi}$, can sometimes emerge from depths up to 70mm, but reliability drops beyond 60 mm—especially in dry or heavy soils. When pushed deeper, emergence slows, becomes uneven, or fails altogether. While you might get away with sowing deeper in some soils or seasons, it's not a dependable strategy. If deep sowing is likely—whether by design or due to soil movement or variable furrow depth—a long coleoptile variety gives more margin for error and more consistent crop establishment.

See the optimal sowing depth case study for more information.

Practicalities

When sowing long coleoptile varieties, emergence variability is expected even under good conditions. Consistent poor emergence usually points to inadequate soil contact, incorrect sowing depth, or seed quality problems.

Soil moisture

Deep sowing with long coleoptile wheat only works if there's reliable moisture at depth. Check how far down you need to sow to reach soil moisture. If moisture is below 6–7 cm, and the soil above is dry, a long coleoptile variety will give the seedling a better chance of reaching the surface. There must also be moisture below the seed. If the seed absorbs moisture but encounters dry soil beneath, it can stall or die—similar to a false break.

At present, there are no clear thresholds for how much moisture is 'enough'. This is being studied in the GRDC-funded project CSP2212-007RTX (Integrating long coleoptile wheat into Australian farming systems through an integrated understanding of genetics, management and environment).

Right now, the best indicator is still visual and physical assessment—digging and feeling if soil is holding moisture, and observing the colour differences of a potential wetting front.

Reasons to consider long coleoptile wheat	Reasons you may not need or can't use long coleoptile wheat
Sowing early to access subsoil moisture	Sowing after the break into moist topsoil
Sowing below non-wetting sand layer	Soil profile is dry
Sowing below Rhizoctonia	Soil temperature >23°C in the seed zone
Seed needs to be placed >6–7 cm to reach moisture	Moisture is available at the standard sowing depth
Risk of accidental deep placement (e.g. soft soil after amelioration, furrow ridging, stubble loads)	Seeder can't consistently reach required depth without compromising accuracy
Seeder capable of accurate deep placement (8–10 cm)	Flowering time can be managed by variety choice and sowing date alone
You need to start seeding early to spread flowering and reduce frost and heat exposure	
Risk of furrow collapse in lighter-textured soils	

Mace vs long coleoptile mace with Rht18 gene (right) Image: Farmlink (https://farmlink.com.au/long-coleoptile-wheat)

If moisture at depth is uncertain or patchy, it may be safer to shallow sow with a conventional variety.

Temperature

Deep sowing becomes riskier as soil temperatures rise—even when using long coleoptile varieties. Coleoptile elongation is most effective around 15°C and temperatures above 23°C can limit coleoptile elongation. This happens because heat suppresses the hormones that drive elongation. As a result, even long coleoptiles may fail to emerge if sown too deep in warm soils.

Soil strength

Emergence can fail if the seedling cannot push through hard soil above the seed. This is a common issue in heavier soils, where mechanical resistance limits coleoptile growth, even in long coleoptile varieties.

Press wheel pressure plays a role. On sandy soils, moderate pressure helps close the furrow and retain moisture. On heavier soils, too much pressure can over-compact the furrow.

Seed Quality

Deep sowing places greater physical demands on the seed. Pushing through 8–10 cm of soil can deplete energy reserves, sometimes at the expense of seminal root development. These roots are critical for early access to deep moisture and nitrogen.

Larger, well-filled seed helps maintain both emergence and root growth, especially under marginal conditions. Aim for wheat seed with a slotted screen size above 2.5 mm, protein content over 11 %, and germination count above 90 %. Clean and test seed before sowing, and avoid using seed from stressed or low-yielding crops.

Dressings

Seed treatments matter. Some fungicide seed dressings are not recommended for sowing deeper than 50 mm, as they can reduce coleoptile length or seedling vigour—particularly under marginal moisture conditions. Check product labels and choose seed treatments that have been tested under deep sowing conditions.

References

Grains Research and Development Corporation (2025) ‘GRDC in Conversation: Callum Wesley’, *GRDC in Conversation* [Podcast]. Available at: https://grdc.com.au/news-and-media/audio/podcast/2025/grdc-in-conversation-callum-wesley

Seeder considerations

Successful deep sowing with long coleoptile wheat depends on the seeder's ability to place seed accurately at 8–10 cm, with good seed–soil contact and minimal soil throw. This can be difficult in dry or heavy soils, where penetration and breakout force are often limiting.

Tyne seeders are generally more capable of reaching depth but disturb more soil. This increases the risk of soil drying, furrow ridging, and soil throw, especially when operating at speed.

Disc seeders create less disturbance, but often require additional downforce or ballast to reach target depth in firm soils. Sharp coulters and increasing frame weight can help.

Herbicide

Some pre-emergent herbicides—especially trifluralin—can reduce coleoptile length and affect emergence if they reach the seed. While long coleoptile wheat is usually sown beneath the treated zone, soil throw can move treated soil into the seed row, undoing the benefit of deeper placement.

Minimising soil throw is the best option (see case study on seeding systems).

Fertiliser placement and rate

Separating seed and fertiliser remains essential. High fertiliser rates placed too close to the seed can reduce emergence and seedling vigour, particularly on sandy soils where the risk of salt injury is greater.

The likelihood of damage depends on fertiliser type and rate, seed size, soil texture, and available moisture. Narrow row spacing and wider lateral seed spread (higher seedbed utilisation) can help dilute fertiliser concentration near the seed, but physical separation is still the safest approach.

In some deep-banding double shoot systems, seed is delivered via the fertiliser tube and fertiliser can only be placed above the seed. While this reduces toxicity risk, it may delay early nutrient uptake and reduce seedling vigour in dry conditions.

Stubble

Stubble helps preserve soil moisture and reduce surface temperatures, but also adds to the distance seedlings must travel to emerge—especially when sowing deep. Long coleoptile wheat can help by pushing through both the soil and stubble layer, but only if seed placement is accurate and seed–soil contact is good.

Heavy stubble can still interfere with seed placement and reduce emergence. Hair-pinning, where residue is pushed into the furrow, can block emergence entirely. Long coleoptile varieties offer more flexibility in high-stubble paddocks, but don't remove the need for good residue management.

Where stubble loads are high, consider reducing residue ahead of sowing through grazing or residue managers.

FarmLink open day at Temora, discussing the long coleoptile wheat trial. Photo: FarmLink

Birchip Cropping Group

Key messages

- **Long coleoptile wheats provide flexibility in dry seasons by allowing crops to access stored soil moisture at depth.**
- **Deep sowing in marginal conditions carries a risk of seed drying out before emergence; split-depth sowing can help manage this.**
- **Sowing deeper needs careful setup, with higher press wheel pressure and slower travel speeds to ensure good seed–soil contact.**

For BCG growers, interest in long coleoptile wheat is growing but adoption is still limited. The big questions are: Will it suit my soil? Will it yield as well? And can my gear do the job?

‘There’s definitely awareness,’ said Kelly Angel, Operations Manager from Birchip Cropping Group (BCG). ‘But it’s not just about the trait. It’s about how well it fits your soil and seeding system. We’ve got heavier clays across the region, and if you’re sowing into a drying profile, trying to sow deep can mean you get a very cloddy seed bed. That’s a potential challenge for emergence.’

At the 2024 BCG Main Field Day, Dr Greg Rebetzke (CSIRO), Callum Wesley (WA Farmer) and Brooke

Dr Greg Rebetske talking about long coleoptile wheat at the BCG field day, 2024.

Bennett (BCG) discussed some important messages for growers when using long coleoptile wheats.

Western Australian grower Callum Wesley spoke about his experience with long coleoptile wheat. Callum farms near Southern Cross on the eastern edge of WA's wheatbelt, where dry starts and unreliable autumn breaks are common. For several seasons, he found himself sowing dry while moisture sat frustratingly out of reach—just 50 to 80 mm below the seed.

'I remember just about banging my head against the tractor window because I could see the moisture 50–80 mm below the seed—and we just couldn't harness it,' he said in GRDC podcast (GRDC 2025). Callum knew CSIRO were working on long coleoptile varieties, and requested seed from Dr Rebetzke to run a trial.

In 2020, after receiving around 150 mm of summer rainfall, Callum sowed long coleoptile lines at 120 mm depth into that moisture. Conventional wheat was sown dry at 40 mm and there was only around 80 mm of in-crop rainfall. The deep-sown long coleoptile wheat emerged more than three weeks earlier and went on to yield around 1.2–1.3 t/ha. The shallow-sown crops struggled to establish and performed poorly. Water use efficiency was also better, around 24 kg of grain per mm of water used, compared to 15 kg/mm in the conventional strips.

According to CSIRO's Dr Greg Rebetzke, Callum's early sowing approach allowed the crop to use stored moisture and mature ahead of the heat in late spring, contributing to the yield advantage, even in a decile one year.

Callum has continued using long coleoptile varieties since then. He has found that being able to access stored soil moisture and get the crop out of the ground on time delivers a significant advantage, compared to sowing dry and waiting for follow-up rain that might not arrive for another six or seven weeks.

The value was shown once again in 2024, when the season break wasn't until the start of June.

While Callum acknowledges long coleoptile varieties won't be the right tool every season, he sees them as a flexible option. If moisture is shallow, he seeds shallow. If it's deep, he has the confidence to chase it.

Other key messages from the BCG field day

Achieving reliable emergence with long coleoptile wheat requires matching sowing depth to soil moisture conditions.
In lighter, sandy soils, sowing to depths of 100 mm or more is often needed to reach stored moisture, but growers should also factor in furrow infill, which can increase the effective depth by an additional 30 mm.

Several long coleoptile varieties are currently available, including Calibre(Φ) and Magenta(Φ), though these may not be suitable for all environments. A newer line, Mace 18, has shown promise in trials, delivering more reliable emergence from depth compared to shorter coleoptile varieties like Scepter(Φ).

One of the key risks with deep sowing is that the seed may germinate and then dry out before emergence if surface conditions are hot and dry. To manage this, a split-depth sowing strategy is recommended—placing some seed deep to chase moisture, and leaving some shallower as a safeguard in case conditions improve.

Mechanical setup also plays a role. Sowing deeper often requires higher press wheel pressure to close the furrow effectively, and slower travel speeds to maintain accuracy and good seed–soil contact.

While long coleoptile wheats present a valuable option for dry sowing, success depends on understanding soil type, monitoring moisture profiles, and adjusting seeding practices accordingly.

The project, "*De-risking the seeding program – Adoption of key management practices for the success of dry and early sown crops*" was led by Ag Excellence Alliance. It combined research and on-farm experience to support earlier and more strategic sowing decisions to build drought resilience. The project draws on the expertise and local knowledge of fourteen grower groups across the grain producing regions of South Australia, Victoria, New South Wales and Western Australia. Scan the QR code to find out more.

Cover photo: *By Rachel May.*