**Paddock Yield and Seeding Depth Optimisation**

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### The Issue
Most farmers recognise the importance of seeding depth accuracy in maximising crop potential. However, being able to quantify the effect of a poorly set and operated seeding machine on crop response is a useful step to justify efforts and investments to secure an optimum seeding depth.

### Key Points to Consider
- **Seeding depth uniformity** is influenced by the seed placement quality within the furrow and the consistency of the added soil cover, both of which are influenced by a wide range of machinery factors. (figure 1.)
- **Deep sowing** (e.g., beyond 50-60mm) can significantly affect crop emergence and final grain yield.
- Many paddock situations can soon suffer a 5-10% yield loss as a result of inadequate seeding depth, with more extreme situations suggesting yield penalties of 15-20% or more.

### What We Know
Seeding depth variation is influenced by:
- the consistency of furrow depth and size;
- the seed placement within the furrow; and
- the soil cover subsequently added during the furrow closing operation.

In undulating ground, the lack of contour following ability of the machine can create large local variations in both tillage and seeding depth. Floating hitches, flexible frames and a range of contour following designs for openers and seed boot systems, can provide partial or full remedial solutions. In soft soil conditions that create implement wheel sinkage, or with leaking hydraulics, the variation in implement frame height can be monitored and corrected using remote sensor technology.

The seed boot design, setting and matching to point type, dictate the quality of seed placement obtained in a given furrow size and shape. However, its performance is only the first half of the equation, as seed covering is another significant source of variation. A more uniform seeding depth is typically achieved with press wheels, which minimises variation in soil cover, compared with the rougher surface finish achieved by rotary harrows. Significant variation in seeding depth (eg. 20-50mm) can also be created due to lateral soil throw effects (furrow ridging), whereby seed rows corresponding to front mounted openers get additional soil cover from adjacent rows of rear mounted openers.

### Crop Emergence: Too Shallow or Too Deep?
Seeding depth trials using Clearfield JNZ and Krichauff wheat (intermediate coleoptile length) have highlighted the following findings.

- The optimum seeding depth was 30-35mm under press wheel systems.
- A reduced crop establishment was measured at 60mm, 85mm and 110mm seeding depths with 85-89%, 73-76% and 53-59% emergence rates, respectively.
- A potential emergence loss (10-15%) was also measured at very shallow seeding depth (e.g., 10-15mm) explained by the limited soil moisture buffer and higher possible predations.

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- Minimise soil throw by using low disturbance openers, coulter-tine combinations, shallow operating depths and wider row spacings. This option may involve specific machinery investment, with possible crop yield reduction occurring at wider row spacings.

- Compensate seed placement on a row by row basis to minimise the effects of furrow ridging. This option is not applicable to all seeding technologies and may place the crop at greater risks of toxicity from soil-incorporated herbicides (e.g., trifluralin).

- Equalise ridges in a levelling operation using full width harrow devices or single ridge dividers. The increased soil manipulation may further stimulate weed seeds and seedling protection, and water harvesting benefits of furrows may be compromised.

- Contain soil throw using rolling shields to redirect part of the outward soil throw back onto the furrow. Besides the additional cost, the residue handling ability of the machine may also be affected.

**Moisture delving/conserving techniques**

- As an alternative to deep sowing, deep tillage below the seed zone, combined with press wheels, is a technique able to improve the reliability of crop establishment in top-soil moisture-limiting conditions, while not compromising seeding depth.

- Research has also shown that some amount of loose soil cover added over press wheel furrows (e.g., using snake chains, finger tines or full width gentle harrows) can help minimise water evaporation rates out of consolidated soil and optimise seedling emergence in dry conditions.

**Where to from here?**

The above considerations should form part of a precision farming approach to maximising paddock crop yields by securing optimum seed environment in every furrow, over the entire paddock. Further information is available at www.msfp.org.au.

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**A significant risk of staggered crop emergence was noted under very shallow seeding depth when combined with marginal soil moisture conditions (e.g. late follow up rains), which was equivalent to later sowing.**

**Grain yield: maximised at optimum seeding depth**

- An optimum 30-35mm seeding depth achieved the highest yield (eg. 2.55t/ha in Fig. 2).
- In a below average season, deeper seeding at 60mm, 85mm and 110mm created yield penalties of 5%, 13% and 21% respectively.
- 3-4% yield loss was also experienced at the very shallow depth (10-15mm).

**What this means**

**Paddock yield optimisation**

- Research data in Figure 2 suggest that, even in the best case scenario (e.g. implement set to achieve an optimum seeding depth at low speed), a 2-8% yield penalty can be expected from uncorrected furrow ridging developing at actual sowing speed. These losses would rise to 7-13% and 15-19% if the implement was instead set deeper by 20mm and 40mm, respectively (e.g. deep sowing into moisture).
- It is critical to achieve an optimum seeding depth on each seed row over the whole paddock to maximise paddock yield.
- Suitable technologies and practices, which improve the control over tillage depth and seed placement at the individual row level, include:
  - contour following tillage unit and/or seed delivery systems;
  - automated regulation of implement frame height (e.g. ultrasonic depth sensors) and levelling (floating hitch); and
  - Soil throw (furrow ridging) issues should effectively be managed.

**Managing furrow ridging issues**

- **Control** soil throw by adopting low travelling speeds. This option, however, reduces work rates with potential timeliness penalties.