Dry Sowing in The Mid North – Season 2024 and learnings from the lack of rainfall

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The last season of 2024 has certainly tested and challenged cropping farmers in many ways, largely as a result of limited rainfall and the subsequent flow on effect of events that follows low (or no) rainfall cropping years. Soil management is a large part of understanding how to maximise capacity in relation to crop performance and it is through an understanding of the soil to plant continuum that an understanding of dry sowing techniques (risks, reversals and rewards) has evolved. Every farmer approaches dry sowing in their own way and knowledge in this space has built rapidly in a collaborative, transparent way. In an ideal world we would all plant in to soil with adequate moisture but that will never be the case in every season. Dry sowing is here to stay.

Dry sowing, or sowing crops without necessarily relying on prior rainfall, is increasingly being practiced in the mid north of South Australia. Water scarcity and our often unpredictable rainfall patterns present additional challenges for traditional conservation tillage management methods. This dry sowing technique obviously involves planting crops before significant rainfall occurs (we had no choice in 2024), often relying on stored soil moisture (critical) or early seasonal rains (even more critical) to support crop establishment.

To move forward and take learnings from this year, we need to look back and reflect on the actions and what was successful and what had unintended consequences in the year that was.

Key strengths of Dry Sowing:

1. **Risk Management**: Dry sowing allows farmers to plant crops early in the season and at scale, potentially avoiding late-season droughts, frost/chilling peak stress effect – cultivar dependent, heat stress, drought stress or other abiotic (and potentially biotic) stressors. By planting when conditions are suitable and potentially more favourable, farmers reduce the risk of crop failure from sudden changes in weather, don't have to wait for rain and can get more of their crop in the ground earlier in a season

2. **Water Efficiency**: Dry sowing takes advantage of residual moisture in the soil from previous summer rains or seasonal rainfall, reducing the dependency on waiting for a break. This is particularly beneficial in regions with limited and erratic rainfall distribution (everyone in 2024).

3. **Faster Field Operations**: Dry sowing can enable farmers to complete planting operations earlier, which may help to avoid congestion during peak sowing times, improving overall farm management and general efficiencies.

4. **Drought Tolerance**: Certain drought-resistant crops, such as wheat and barley, are particularly suited for dry sowing, as they can germinate and establish roots in the residual moisture, making them more resilient in dry conditions.

5. **Fracture Patterns** – in heavier soils with varying percentages of clay in the mid north the tillage point fracture effect to depth is more pronounced in drier soils and this allows better distribution to depth in furrow of smaller rainfall events, an effective dismantling and redistribution of dispersive upper (finer clay) layers. A broader furrow water harvesting potential (preferential flow pattern) is usually observed. Depending on soil type a disc can also create a fracture effect to suit but the disc benefit is usually related to a more precise germination. This is a trade off depending on available moisture.

Omnipresent issues with Dry Sowing:

1. **Uncertainty of Rainfall**: The main risk of dry sowing is the reliance on uncertain rainfall. If rains fail to materialize or are delayed, crops obviously fail to germinate properly, emerge under stress or subsequently grow poorly, and we may get some fertiliser toxicity, enzyme depletion of seed potential over time, moulting of seed etc …leading to potential losses.
2. **Soil Erosion**: Dry sowing can leave the soil exposed to wind erosion, particularly in areas with light soils or low ground cover, as there is less vegetative growth to protect the soil from autumn winds and potential heat stress on germinating crops
3. **Weed Pressure**: Early sowing may give some weed species a head start, as they can also germinate with the first rain, potentially competing with crops for nutrients and moisture. Most farmers however have the herbicide rotations and post emergent options to suit…largely?

Key learnings of Dry Sowing in 2024:

Overall, dry sowing offers a viable option for Mid North farmers but requires careful management and risk assessment to maximize its benefits.

So from a soil and crop perspective in 2024, What did we see, what did we not make sense of, what did we make sense of and what needs to be better understood from a dry sowing perspective

1. There is a seed depletion effect from seed being in dry soil, in furrow for an extended period. We need to not always write it off as fertiliser toxicity effect (false break volatile ammonia activity) and start to understand it all from an enzyme depletion effect, consider the same falling numbers considerations used for rain affected grain and potentially look to counter this effect where possible. We noticed better germination and subsequent emergence of seed in paddocks that were dry sown closer to the first effective rainfall.

2. There was a severe lack if mineralisation (dissolving of nutrients to add to available soil pool) from adequate soil moisture. Summer rainfall gives us moisture and importantly mineralisation. Mineralisation is the decomposition of the chemical compounds in organic matter with moisture. Mineralised compounds are released in soluble organic forms available to plants. Without enough soil moisture prior to planting, crops start with a depleted access pathway for nutrients despite what fertiliser is added at sowing. A better understanding of mineralisation in soils is needed in order to plan more effective dry sowing programmes. A mineralisation checklist is critical for phosphorus availability, nitrogen availability and all other nutrients. Also in relation to low rainfall years and the resulting lower soil organic turnover we are noticing larger areas of soils with water repellent surface layers from accumulated organic residues that are not wetting effectively with smaller rainfall events. Anecdotal evidence for use of root hydration agents in calcareous red clay soils in furrow at sowing is positive enough to warrant far more investigation in this space. Improved water residence time and more constant soil hydration may also be a mechanism behind this response.

3. The season certainly showed up challenges with seeder bar set ups. What was perfect for 2023 was not ideal for 2024 in many instances. This has created significant interest in greater understanding and evaluation the physical structure of their ground engaging sowing tools and how to best refine them to suit dry sowing. It was a battle of soil cloddiness, managing seed to soil contact and speed of operation. Shallower seeding generally performed better this year with smaller rainfall events occurring. Some farmers sowed a lot of country at speed and with minimal fracture, skating across the surface of heavier soils and the season unfortunately did not necessarily provide for this behaviour, especially when it came to later season access of subsoil moisture.. In some soil types we need to slow down and get the depth of fracture, the seed bed preparation and the interrow throw right. High speed lift can be a production grift. With the same rainfall across a paddock sometimes there are good reasons in 2024 as to why wheat was yielding 2 tonnes to the hectare on the softer loam soils and 250kg per Hectare on the heavier clay soils. Yes its soil type and how different soils manage the access to moisture, but there is more thinking that needs to be done in relation to how different soils types are sown with the same machine.

4. The edge effect (better crop growth on outer rows) in crops has been pronounced this last season. Yes, the outside edge rows on crops are better perhaps from more moisture availability and subsequent mineralisation benefits but we really need to better understand why the edge effect has been so pronounced when there has been virtually no rainfall. In plot trials this year the outer two rows have been outyielding the inner 4 rows in 6 row plots. It's not all about more moisture. Thoughts in this space are now underway to consider many variables to enable a better understanding of this effect to better design seeding techniques to suit adequate fracture, seed placement, potential water residence time in furrow after rainfall and other variables to consider how this effect happens and how then some rows do so much better than others in certain years. We have always written off this observed effect as "access to more water" but a much deeper assessment is necessary.

5. The valuable use of lime and gypsum in 2024 as an amelioration strategy has certainly not provided the expected seasonal benefit one would expect and that is simply from the fact that there has not been enough rainfall to solubilise the ameliorants on the soil surface. Gypsum is more soluble than lime in soil solution, but both are necessary in many mid-north soil types depending on the soil issue and a pivotal part of regulating soil performance in broadacre cropping. This money is not wasted, never will be, and the benefits of this strategy are still all in place as more rainfall falls in 2025.

6. Do we need to panic or not need to panic in relation to dry sowing and phosphorous availability? 'Grey ground' (calcareous soils) in the mid-north have been of much concern for growers especially early-mid season. Phosphorous availability in dry soil with low prior mineralisation activity and alkaline pH soil environment to contend with has been a depleting exercise in terms of 2024 production. Phosphorous has been applied over many years and adequate P has been provided at sowing yet we have a phosphorous availability issue. The dry soil conditions were not favourable for phosphorus availability from granular fertilisers. Farmers who have adopted a hybrid approach to phosphorus management in dry sowing conditions by applying liquid P to complement granular applications aided in bridging the phosphorus inefficiency gap. A granular fertiliser when dry sown can sit in furrow, absorb moisture over time, imbibe calcium to lock up P and fail to diffuse the phosphorous necessary for adequate crop germination, emergence and early vigour. In moist sowing conditions it's all generally fine. Not in dry soil. Treating the symptoms needs to be a strategy of adding additional phosphorus to compensate for inefficiency in dry sowing or look to a hybrid approach of liquid P in the right form in furrow if sowing dry, using additional Zinc and P on seed if possible, adding early foliar P in susceptible soils with Zinc and other critical required trace elements and acting according to the season. There are 3 ways of looking at phosphorous availability, P deficiency, P inefficiency and P sufficiency. They are 3 different ball games when dry sowing and all three need to be considered when acting on delivery of the right form and timing of phosphorous in dry sowing conditions.

7. Alkaline 'grey soils' have also been responsive to iron in 2024 in the field. There is research actively occurring in this space led by SARDI (Wilhelm & Pearce) and with in crop responses in 2024 we need to further understand the use of iron in relation to Nitrogen efficiency in dry seasons. Iron is critical for many reasons but we need to certainly understand its use for nitrogen efficiency. Dry seasons ensure limited nitrogen use, limited N uptake, efficiency and subsequent materialisation in to yield and iron is a critical part of getting more value and conversion to yield form the nitrogen available in any given season. Grower use of iron in this particular area of nitrogen management has been promising.

8. Use of seed priming compounds, foliar antioxidants and performance evaluated bio stimulants in dryland cropping systems has come a long way. There has been some really interesting developments at Flinders University in relation to laboratory and greenhouse trials done in 2024 that Upper North Farming Systems and Field Systems have been involved in. The most interesting concepts in this soil, leaf and seed microbiome space have been that a seed treatment can potentially confer abiotic stress tolerance (heat, chilling, drought stresses) on a wheat plant sown in dry conditions for the entire growing season until crop senescence (Ramesh and Booth), and that leaf applied antioxidant compounds can have a similar effect (Anderson, Sweetman, Rainbird, Soole, Lowe).UNFS provided soils from Boolaroo and Jamestown for Flinders University laboratory and greenhouse trials looking at different seed treatments, the subsequent root exudation relationship to microbial function and the resilience of field crops in controlled greenhouse conditions to adverse conditions (drought and heat stress). Seed applied GABA and ethylene pretreatments showed positive effects on early vigour, establishment and biomass in wheat, chickpea and lentil cultivars (Ramesh and Booth). Additionally in GABA pretreated wheat cultivars, a shift in microbial alpha and beta diversity was observed. This was most pronounced under drought stress in red clay soil from Boolaroo, where root exuded amino acids were accompanied by increases in bacterial species associated with carbohydrate breakdown and phosphorus mobilisation (Ramesh and Booth). Some very interesting data has been created on novel leaf assay enzyme recognition work in field crops for use of foliar applied antioxidant compounds to counter abiotic plant stresses (Anderson, Sweetman, Rainbird, Soole, Lowe). Farmed soil types from inside and outside Goyders line were also assessed through the soil microbiology lab at Flinders to determine the bacteriophage (viruses that live in soil bacteria) populations that can potentially add increased stress resistance function to dryland crops (Mitchell, Jayarwardene). Field assessment in 2025 will further determine effectiveness of several seed treatments and foliar applied options especially in relation to dry sowing crop performance.

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Field Systems is a soil and land management consultancy, primarily involved with soil management in broadacre cropping systems with individual broadacre farmers. We are actively involved in the Upper North Farming Systems Group and have been working in the Mid North with farmers since 2008.

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