Post-seeding ripping demonstration - Ripper Gauge Project

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This project explores the viability of post seeding ripping as an effective amelioration strategy to reduce compaction, whilst simultaneously reducing the risk of wind erosion by ripping into established plants and moist soil.

Deep ripping is a proven compaction and water logging management strategy. By deep ripping, plant roots can access a greater depth of the soil profile, increasing the plant available water and water holding capacity. This allows plants to access nutrients that would not otherwise be available.

Deep ripping traditionally takes place during the summer fallow period; however, the optimal time for ripping often falls at the end of this period, after the first autumn break, where the opportunity and farm labour demand is at its highest. Whilst ripping earlier in the fallow period is an option, this strategy involves a high level of risk, due to prolonged exposure to wind erosion and a higher operational cost. Economics and labour availability are the primary driver of on-farm decisions, and they will determine the amelioration strategy on-farm. As a result, there is increasing interest in ripping after seeding to reduce the economic and opportunity cost of deep ripping.

BACKGROUND

Previous studies undertaken by the GRDC and DPIRD found that on sandy, sandy loam and duplex soils, ripping after the first autumn rain resulted in the greatest advantage in terms of reduction of soil compaction and yield advantage. This is largely due to the moisture in the soil profile allowing the ripping tines to penetrate deep enough to reach the compaction layer, whilst not being too wet that smearing rather than shattering of the compaction layer will occur.

However, this preferred ripping window coincides with the greatest period of labour demand within most farming operations, clashing with optimal sowing windows. This creates an opportunity cost, where soil amelioration competes with other aspects of the farming enterprise. Ripping earlier is an option, however, there are significant risks and costs associated with this strategy. Ripping into harder baked soils before the autumn rains both reduces the effectiveness of the ripping and increases the cost associated with the amelioration. Ripping into harder subsoils requires more horsepower, which in turn raises the cost of ripping. Early ripping also eliminates stubble cover, reducing the fallow efficiency by increasing evaporation rates, which in turn reduces plant available water.

DEEP RIPPING TIMING TRIAL

The trial aims to evaluate the effectiveness of post-seeding deep ripping. Four treatments were applied: a pre-seeding rip, 1 week after seeding, 3 weeks after seeding and 6 weeks after seeding, as well as an untreated control and tramline buffer control. The trial will be monitored throughout the season, to assess the viability of ripping post seeding, and the effect of the timing of the ripping on crop performance, yield, and soil compaction. This trial will extend into 2022, where we will monitor the effectiveness of the ripping and yield performance next season.

The data collected from the trial thus far is producing some interesting results with regards to the effectiveness of the ripping on compaction and crop performance. Penetrometer soil strength tests were conducted after the ripping treatments were applied, to determine the effect the ripping has had on compaction within the paddock. Each of the ripping treatments resulted in a statistically significant reduction in soil strength when compared to the control treatments. Interestingly whilst the addition of inclusion plates may have amplified the burial effect, it did not seemingly impact the effectiveness of the deep ripping in terms of alleviating compaction.

The soil penetrometer graph highlights the immediate impact that the deep ripping can have on soil compaction. The penetrometer graph shows that deep ripping effectively reduced soil strength across all treatments. As a result of the ripping treatments plant roots will be able to access a further 200mm of the soil profile compared to the untreated control, improving nutrient availability/acquisition and water availability. A soil strength of 2500kPa is widely accepted as being limiting to root growth, whilst a soil strength of >3000kPa, is likely to halt root growth all together. As the soil becomes increasingly compacted, water infiltration slows, increasing the likelihood of water logging, which will be particularly evident this season.

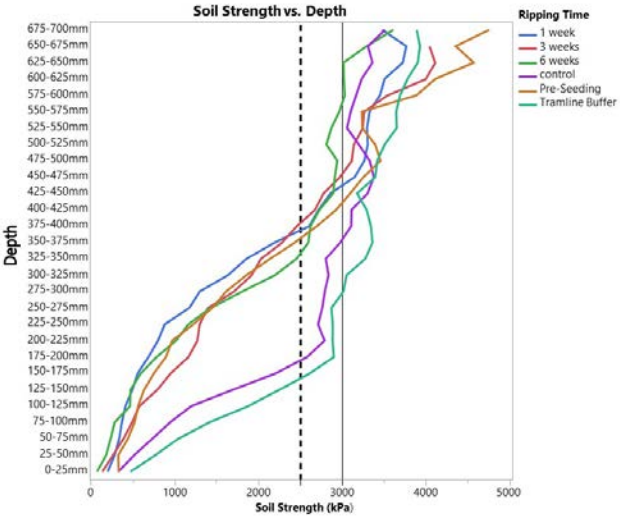

Figure 1: Soil strength (kPa), after the ripping treatments were applied. All three ripping treatments resulted in a statistically significantly lower soil strength then the control treatments.

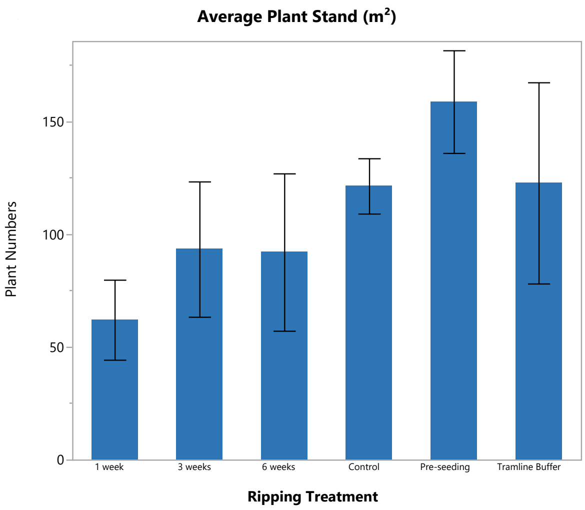

Figure 2: Average plants (m2), taken from the treatment plots after all the ripping treatments had been applied. All post-seeding ripped treatments resulted in a statistically significantly lower number of plants per m2 (P=0.5) when compared to the pre-seeding rip and the untreated controls.

Whilst the post seeding ripping treatments were effective in reducing soil compaction equal to a conventional pre-seeding rip, the plant stand count was significantly impacted. Plant stand counts and tillers were recorded after the 6-week rip was completed. There was a significant burial effect as well as mechanical damage, on all the post seeding ripped treatments. As a result, the plant stand in the post-seeding ripped plots was patchy. Some areas within the treatment plots showed minimal damage, whilst other areas had up to an 80% reduction in plant numbers compared to the unripped control. As shown in Figure 2, the one week after seeding rip has resulted in the lowest number of plants per m2. This likely due to the mechanical damage and burial effect at emergence, being harder to recover from, than later in the plant development stage when plants were up and out of the ground and the roots have a stronger structure. It should be noted that tillering was largely unaffected by the timing of the ripping treatments, with the tiller count mirroring the plant stand count. (Figure 3)

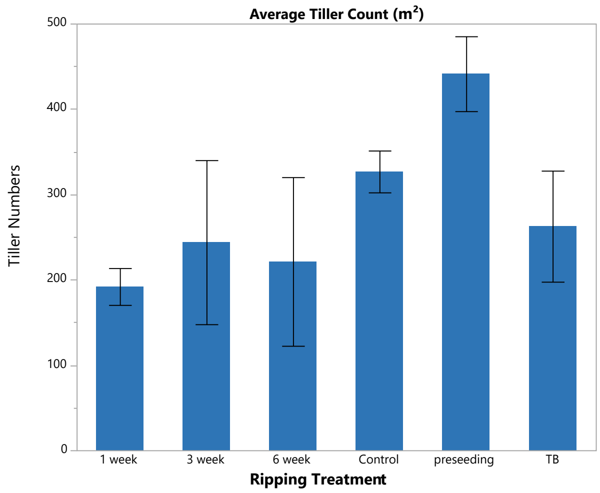

Figure 3: Average tillers (m2), taken from the treatment plots after all the ripping treatments had been applied. All post-seeding ripped treatments resulted in a statistically significantly lower number of tillers per m2 (P=0.5) when compared to the pre-seeding rip and the untreated controls.

Plant dry matter per m2 was measured after the final ripping treatment was applied. There was a significant difference in dry matter between the pre-seeding ripping treatment and all post-seeding treatments. However, the dry matter per m2 was largely influenced by the number of plants at the randomly sampled locations. Given the post-seeding ripped plots had a patchy establishment, it is harder to discern how reflective the average dry matter per m2 is of the whole plot.

Figure 4: Deep ripping three weeks after seeding has caused extensive damage and loss of plant numbers (left), compared to deep ripping in the optimal pre-seeding window (right).

This trial so far suggests that ripping post-seeding is effective in reducing soil strength. However, it is detrimental to both plant establishment and dry matter production. Going forward the trial will measure and compare the final yields of the plots. Hopefully this will provide a greater insight into the economic viability of ripping post-seeding.

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