

# Impact of stubble height on cropping systems in the Western region

Host: Slade Family (Mount Barker).

By: Dan Fay, Research and Development Co-ordinator, SCF

## KEY MESSAGES:

- The performance of strip & disc systems in the High Rainfall Zone (HRZ), compared to the more standard draper front & tyned seeder practice, will be assessed between 2021 and 2024.
- In 2022, the strip & disc treatments did result in a slight yield advantage. However, the high stubble loads led to a series of in season management issues i.e., spray efficacy.
- By 2024, this project will provide growers with key knowledge on stubble architecture and how this interacts with management variables, such as weed & disease control.

## Background

Stirlings to Coast Farmers (SCF) is taking part in a GRDC state-wide investment managed by the Liebe Group which commenced with the 2021 harvest and will run through until December 2024 (3 growing seasons).

Stubble plays a key role in providing ground cover during the fallow period to protect soils from wind and water erosion, increasing infiltration and managing weed burdens. Strip and disc systems have become increasingly popular, particularly in the low and medium rainfall regions where preserving soil moisture is of the utmost importance to ensuring the success of a continuous cropping system. However, the performance of the strip and disc system in high rainfall zones is still up for debate, with high stubble loads, increased weed pressure and slow stubble residue turnover rates needing to be considered.

This trial will take an extensive look at different stubble management and stubble architectures and how they interact with a wide range of variables, to provide growers with a comprehensive insight into how to best optimise stubble management systems.

## Methodology/Treatments

The trial, located west of Mount Barker, is centred around four different stubble architecture treatments:

- Stripper front + disc seeder (strip & disc)
- Stripper front + speed tiller + disc seeder (strip & disc with tillage)
- Draper front high cut + disc seeder (draper-high & disc)
- Draper front standard cut + tyne seeder (draper & tyne – standard practice)

In 2022, the plots were seeded with canola, with the previous crop being barley in 2021. In 2021, all the harvest treatments were conducted with a draper front, with a standard cut height.

In 2021, baseline soil, biomass, yield, grain quality, weed, and stubble residue measurements were collected, so that changes throughout the time span of the project could be observed. In 2022, a broad range of variables that interact with stubble management were measured and will continue to be measured throughout 2023 and again in 2024. These include:

- Soil moisture - increases water infiltration and decreases evaporation.
- Weed germination due to levels disturbance.
- Soil structure
- Disease burden and carryover
- Hair pinning of stubble at seeding
- Herbicide tie up in stubble.
- Harvest weed seed control options.
- Pre-emergent herbicide efficacy

## Notable Results - 2022

### Seeding and plant establishment

Seeding canola into high barley stubble loads on a paddock with a history of non-wetting posed a significant issue. The 2021 barley crop produced an average yield of 7.4t/ha across the plotted area, which resulted in an extremely high stubble load at the time of seeding the 2022 canola crop (Figure 1).

The main effect of the high stubble load was inconsistent plant establishment and poor plant development. In particular, the heavy stubble cover resulted in an extremely staggered plant establishment in the stripper front plots where tillage was not applied. This was likely due to a combination

of lack of sunlight and poor seed/soil contact due to the heavy residue cover on the ground. By contrast where the tillage was applied to the stripper straw, the emergence was more uniform (Figure 2).

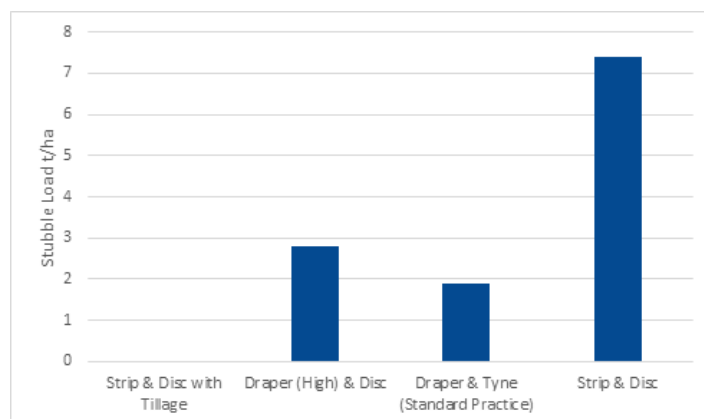


Figure 1. Stubble load (t/ha) at the time of seeding the 2022 crop.

### Crop Nutrition

During the rosette stage, it was noted that the speed tilled plots looked to be slightly nitrogen deficient, with a touch of purple and yellowing in the leaves. This was likely a result of nitrogen tie-up early in the growing season resulting from the high residue load that was incorporated into the top 15cm of the soil profile by the tillage. By placing >6t/ha of stubble residue into the topsoil, the subsequent change in the C:N ratio likely resulted in nitrogen immobilisation, which occurs when the C:N ratio of the decomposing matter goes past net 30.

### Spray efficacy

The results of the spray efficiency testing showed that there was a statistically significant difference ( $P=0.0064$ ) between the stubble height treatments. The draper front/standard cut, and speed-tiller treatment resulted in the greatest spray coverage at ground level. The improved spray coverage is ideal for eradicating summer grasses. However, the stubble mass acted as a barrier for spray contact where the



Figure 2. Heavy stubble residue leading to uneven plant emergence compared to a more even emergence in tilled plots with low residue.

stubble height was higher. Interestingly, the stripper front treatment had a lower percentage of spray coverage at the canopy level. The spray paper (used for coverage assessment) was “streaked” rather than the consistent “course” blot that is targeted for knockdown sprays. This was probably due to an increased influence of the wind due to the boom being set higher (canopy + 50cm) on the stripper front plots. This increased boom height, coupled with greater average stubble height from the stripper front plots, led to a greater variability in the spray coverage at ground level (Figure 3).

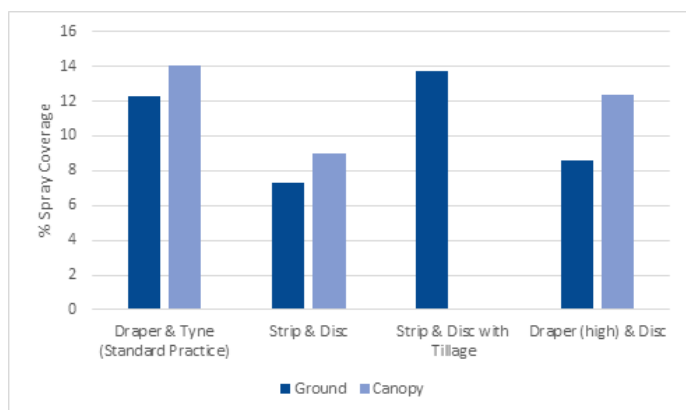


Figure 3. Pre-seeding spray efficacy (% coverage) for each treatment.

### Harvest Yield & Grain Nitrogen %

The yield results show that the plots that were seeded after stripper front use at harvest the year before, performed better than those that had been previously harvested with a draper front, despite the poor plant establishment in the plots where the heavy residue impacted plant establishment (Figure 4).

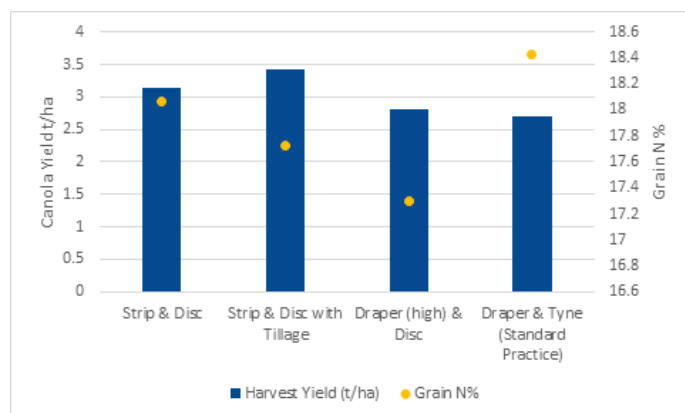


Figure 4. Canola yield (t/ha) and grain nitrogen (N) % for four different stubble architecture treatments for the 2022 season.

The strip and disc treatment yielded on average 3.14t/ha despite the poor plant establishment, while the strip/disc with tillage resulted in an average yield of 3.42t/ha. The higher yield where tillage was undertaken is representative

of the good initial plant establishment and even plant growth development within these plots. Both plots seeded into the draper cut stubble yielded less than those seeded into the stripper front stubble. The standard practice control, which utilised draper front cut at approximately 12cm and tyne seeder was the worst performing plot treatment. However, the tyne seeder was loaned, and due to time constraints was not set up properly to interrow sow between the existing narrow row spacings (6.6 inch). As a result there was a lot of hairpinning and bulldozing of stubble residue.

Grain quality was largely uniform across all plots, with each making the CAN1 classification. Interestingly, there was a variance in grain nitrogen %, calculated from the grain protein using the nitrogen to protein ratio of 5.49, as outlined by the Canadian Grains Commission. The strip & disc with tillage plots had a lower grain nitrogen % compared to plots where tillage was not applied (Figure 4). This could be a symptom of the immobilisation of nitrogen resulting from the tillage.

### Conclusion

The 2022 season was the first full season in the project where the crop was carried from seeding to harvest and allowed us to assess the carryover impact of the various stubble treatments. While the strip & disc treatments did result in a slight yield advantage, the high stubble loads led to a series of in season management issues. These management issues are likely to be exacerbated in the 2023 wheat crop with the high stubble loads of both the canola and previous year’s barley yet to break down. The next two seasons will allow us to examine the long-term viability of a strip and disc system within the HRZ over a full rotation, where nutrition, disease and weed management pressures are likely to increase over time.

### Acknowledgments

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