Research update. Farming systems – how do they compare?

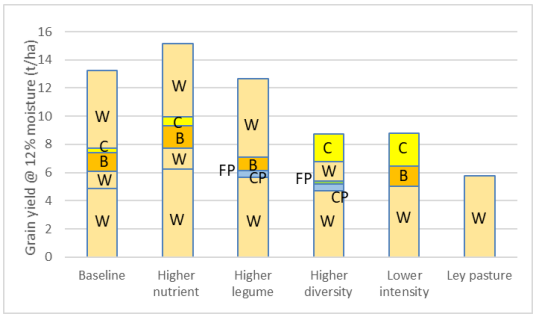
In a partnership funded by GRDC, NSW DPI, CSIRO and QDAF, research began at Trangie Agricultural Research Centre (ARC) in 2015 to identify key limitations, consequences and economic drivers of farming systems. The research aims to develop systems with the most potential. How does modifying the system impact on performance of the system as a whole? Key aspects that have been measured have included water use efficiency, nutrient balance, nutrient use efficiency, crop pathogens, weeds, soil health and profitability.

Two long term experiments were established on locally representative red and grey soil types at the Trangie ARC consisting of six farming systems which included key modifications.

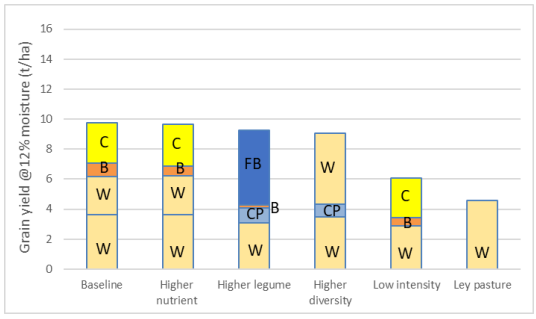
1. **Baseline.** A system based on local standard practice that includes wheat, barley and canola. Fertiliser inputs are based on an average rainfall year (50th percentile).
2. **Higher nutrient.** This system is run parallel to the *Baseline* system, but it investigates the effects of higher nitrogen (N) inputs on crop performance and economics. It is fertilised for a 90th percentile season from the sowing date.
3. **Higher legume.** The system includes a legume crop every second year, with the aim of reducing fertiliser N inputs.
4. **Higher diversity.** This system investigates alternative crop options to manage and reduce nematode populations, disease and herbicide resistance.
5. **Lower intensity.** This system only sows crops when the soil profile has more than 80% plant available water (PAW). Fewer crops are generally sown, but the target is for high value crops.
6. **Ley pasture.** This system is a traditional four-year lucerne phase followed by four crop years. It does not include pulse crops.

The 2020 winter crop season marked five years of crop information in each of the systems. In that time, seasonal conditions were highly variable. Annual rainfall varied between 160 mm in 2019 and 631 mm in 2020.

Cumulative grain production is shown below on the two soil types. In 2016, all crop systems were sown to wheat and the *Ley pasture* system was sown to lucerne.



Red soil



Grey soil

Key: W – wheat B – barley C – canola CP – chickpea FB – faba bean FP – field pea

Key findings

Red soil

- Over 5 years, there was a significant response to N fertiliser. The *Higher nutrient* system outperformed all other systems, producing 13.22 t/ha. This was the equivalent of 13% more grain than the *Baseline system*. Overall production levels were similar between the *Baseline* and *Higher legume* systems and the *Higher diversity* and *Lower intensity* systems.
- In dry seasons, cereals significantly out yielded pulse and canola.
- In 2020, the top yielding wheat crop (5.76 t/ha) was in the *Ley pasture* system, after a 4-year lucerne phase.

Grey soil

- No crop was sown in 2019 in any farming system due to a lack of sowing moisture.
- Over 5 years, there was little difference in total grain production between the *Baseline*, *Higher nutrient*, *Higher legume* and *Higher diversity* systems – averaging 9.42 t/ha.
- Even with highly varied individual pulse crop performance, pulse crops performance maintained longer term grain production levels. Under favourable conditions in 2020, faba bean achieved the top yield of all crop types – 4.98 t/ha.
- In 2020, the canola yield was 5% higher in the *Higher nutrient* system compared with the *Baseline* system.

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