Annual Results Report Template

# 2019/20
# Annual Results Report
## Summer Cropping Demonstrations in the Western Region


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|---|---|
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## REPORT SENSITIVITY

Does the report have any of the following sensitivities?

| | |
|---|---|
| Intended for journal publication | NO |
| Results are incomplete | NO |
| Commercial/IP concerns | NO |
| Embargo date | NO |

# KEY MESSAGES

- The growing season rainfall in 2019 was below average at Perillup, and the summer cropping demonstration did not suffer from water-logging.
- Grain growers in this region believe that the soil drying effects from growing summer crops has the greatest potential benefit to winter cropping yields.
- In 2019, there was a 770kg/ha barley yield increase above the control from the plots where cowpea was grown in the summer.
- There was a 470kg/ha decline in winter barley yield in the plot that was planted to canola between January 30 and May 9, 2019.
- Nutritional requirements of summer crops need to be considered when selecting species. Cowpeas fixed useful nitrogen in the 90 growing days.

# SUMMARY


- The winter barley grown over the summer cowpea crop yielded 770kg/ha more than the control (wheat stubble). The increased yield was possibly due to the extra nitrate-nitrogen produced by the legume.
- The winter barley grown over the canola summer crop yielded 471kg/ha less than the control (wheat stubble). Soil tests indicate the canola used more macronutrients than the other treatments.
- The 2019 rainfall was below average, and the demonstration site did not suffer from waterlogging. We were unable to measure the benefits obtained from the summer crops drying out the soil profile in 2019.
- We were unable to detect any significant differences in NDVI assessments taken during the 2019 growing season.


# BACKGROUND

Waterlogging is widespread in winter in the agricultural areas of Western Australia and is a major factor reducing crop yields, especially in wet years. Areas with higher rainfall (mostly greater than 450mm), low relief and low in the landscape are more susceptible. Shallow duplex soils, particularly with clay subsoil and on slopes less than 10%, are highly susceptible. (McDonald 2017). Land resource mapping shows that on average 7% of the land available to agriculture is at high to very high risk of waterlogging and inundation in the southern shires of the Albany and Esperance port zones, with a further 10% at moderate risk. State-wide, one million hectares is a high to very high risk with a further two million hectares at moderate risk of waterlogging (Van Gool et al., 2008).

This GRDC investment aims to look at the impact of summer cropping on waterlogged winter soils and the resultant impact on crop growth and yield in the next winter growing season. Stirlings to Coast Farmers member Steve Lynch has been growing summer crops for the sole purpose of drying his soil profile in the summer to reduce the risk of waterlogging in the winter. Without livestock to benefit from the summer feed, Steve still believes the reduced

risk of water-logging is a tangible benefit to his winter crop yields as well as providing diversity into the cropping system.

Understanding which summer crops offer the most significant benefit to winter cropping systems is an important outcome we hope to derive from this project.

# OBJECTIVES

100% of Albany and Esperance port zone growers who frequently experience waterlogging will know if ripping or summer/cover crops are viable tools to improve crop establishment, plant rooting depth, and yield in a waterlogging year on their property.

# METHODS

The trial was set up with four summer crops with a ripping strip implemented next to the trial site.
The trial was knocked down on January 27, 2019, with 3L/ha of Paraquat. The demonstration was dry sown on January 30. It was planted with 60kg/ha MAPSZC: MOP mix (Ratio) 5:1.

**Table 1**. Displays the Summer crop types and varieties, seeding rate and seeding depth sown at the Lynch's 2019 summer cropping demonstration.

| Crop Types | Seeding Rate | Seeding Depth |
|---|---|---|
| Ebony Cowpea | 20kg/ha | 30mm |
| Pearler Millet | 6kg/ha | 30mm |
| Hyola 970 CL | 5kg/ha | 20mm |
| Sprint Sorghum | 6kg/ha | 30mm |

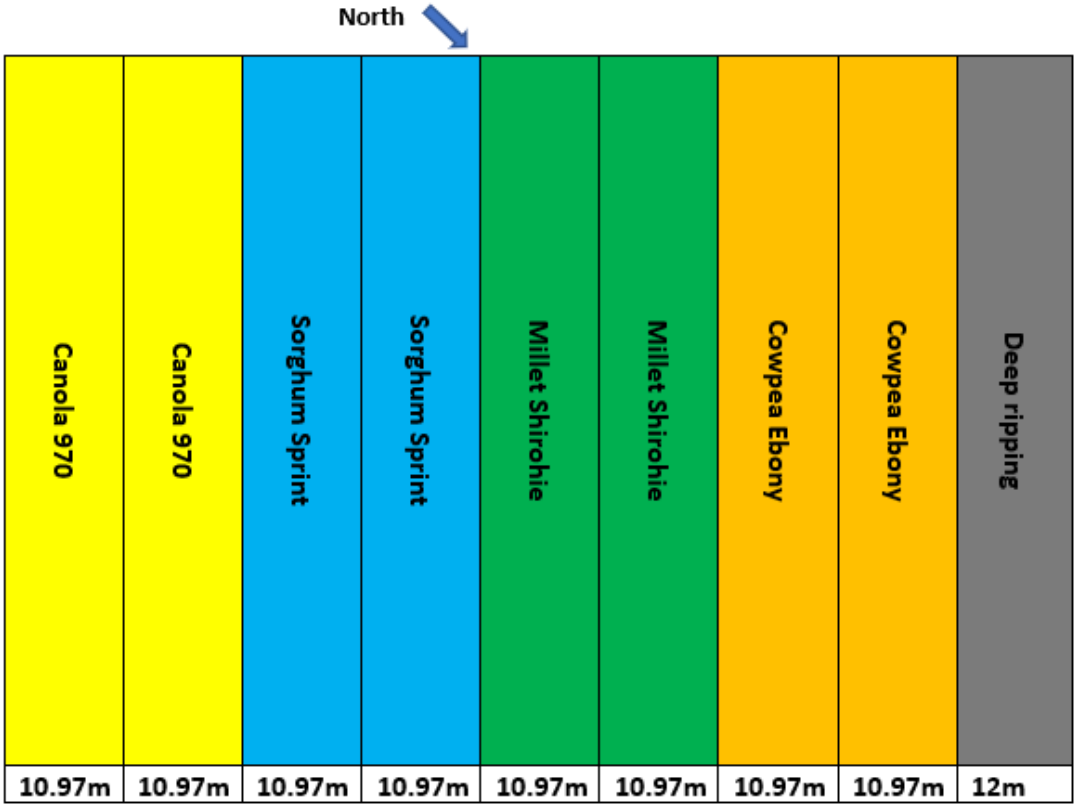


**Figure 1:** Diagram of the layout for Lynch's Summer Cropping demonstration sown on January 30, 2019. Each air-seeder strip was approximately 250m long. Trial was planted in very dry soil.

Soil samples were collected before the summer cropping treatment being sown, and they were again collected pre-seeding of the winter crop in 2019. Final soil samples were collected post-harvest of the winter crop in April 2020.

Penetrometer and NDVI measurements were carried out on the 17/04/2019. Plant counts were not completed as the site was very patchy and we were not able to get an accurate representation of the trial. Extra NDVI readings were collected throughout the trial.

The summer crops were sprayed out before seeding of the barley on the April 30 2019, using Glyphosate 2.4L/ha, Li700 at 0.5% and Goal 80ml/ha. The trial was over sown to barley on May 8, 2019. NDVI imagery and yield data were collected over the growing season in 2019. Header yield monitors collected the yield data which were analysed by SCF's precision agriculture expert, Phillip Honey.

# LOCATION

NOTE: Where field trials have been conducted, please include location details: Latitude and Longitude, or nearest town, using the table below (please add additional rows as required):

| | Latitude (decimal degrees) | Longitude (decimal degrees) |
|---|---|---|
| Trial Site #1 | 34°40'24.31"S | 117°29'19.57"E |

| | |
|---|---|
| Nearest Town | Mt Barker |

| | | | |
|---|---|---|---|
| Research | Benefiting GRDC Region (can select up to three regions) | Benefiting GRDC Agro-Ecological Zone (see link: http://www.grdc.com.au/About-Us/GRDC-Agroecological-Zones ) for guidance about AE-Zone locations | |
| Experiment Title | Western Region<br>Choose an item.<br>Choose an item. | ☐ Qld Central<br>☐ NSW NE/Qld SE<br>☐ NSW Vic Slopes<br>☐ Tas Grain<br>☐ SA Midnorth-Lower Yorke Eyre<br>☐ WA Northern<br>☐ WA Eastern<br>☒ WA Mallee | ☐ NSW Central<br>☐ NSW NW/Qld SW<br>☐ Vic High Rainfall<br>☐ SA Vic Mallee<br>☐ SA Vic Bordertown-Wimmera<br>☒ WA Central<br>☒ WA Sandplain |

# RESULTS

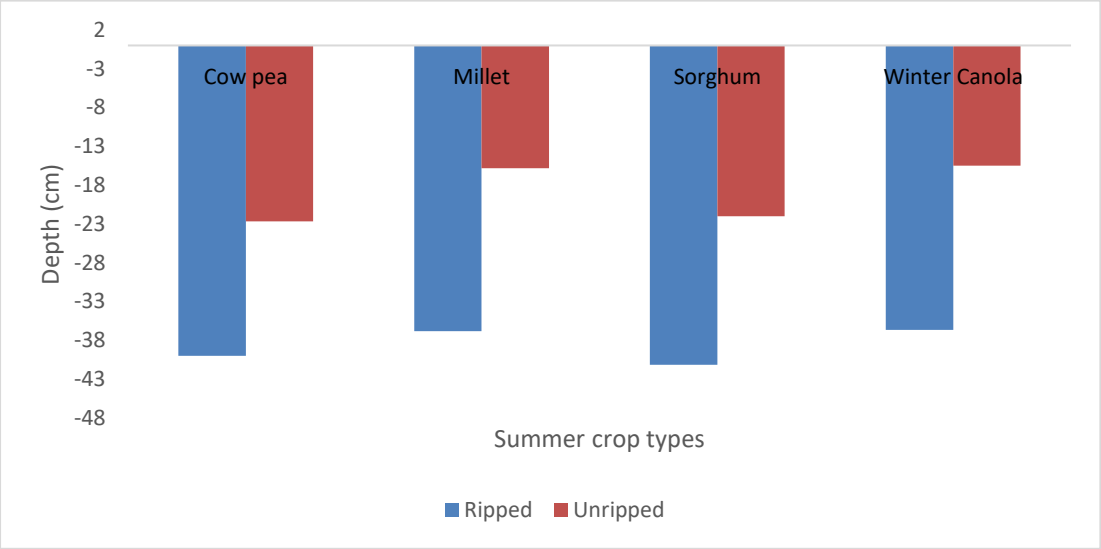


**Figure 2** Push-rod readings collected on April 17, 2019; the readings are the soil depth (cm) that resistance exceeds 2500kpa.

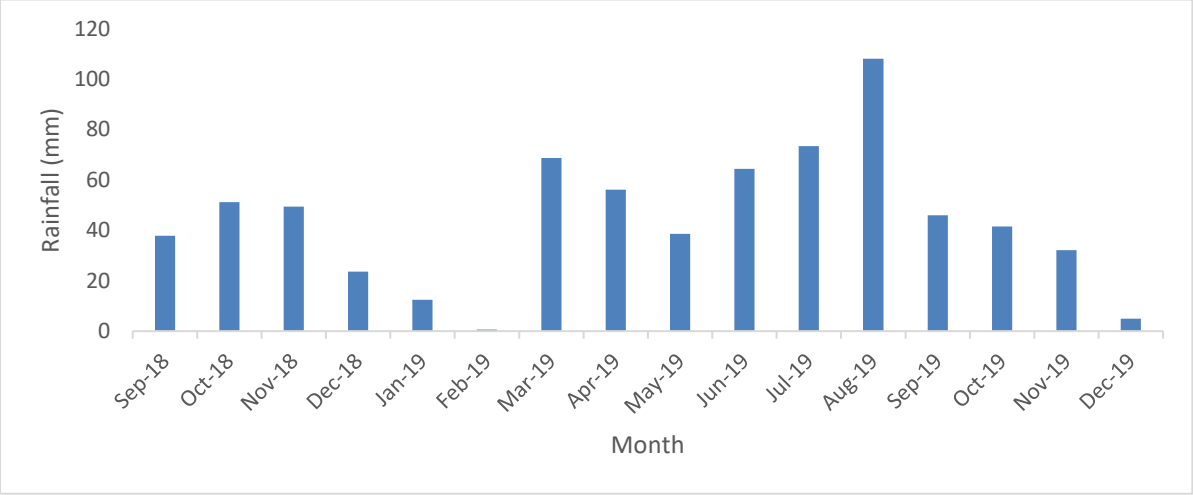


**Figure 3** Displays the rainfall data from September 2018 through to December 2019 (mm)

**Table 2**. The average NDVI readings from April 17, (summer crops), July 3, August 12 & 22, and October 21, at the Lynch summer cropping demonstration site in 2019. The last four NDVI readings were taken from the winter barley sown over the summer crops.

| | | NDVI Average | | | | |
|---|---|---|---|---|---|---|
| **Treatment** | **2019 Summer Crop** | **17-Apr-19 Summer crops** | **3-Jul-19 Barley** | **12-Aug-19 Barley** | **22-Aug-19 Barley** | **21-Oct-19 Barley** |
| **1** | **Cowpea** *Ebony* | 0.64 | 0.66 | 0.7 | 0.7 | 0.62 |
| **2** | **Millett** *Shirohie* | 0.58 | 0.65 | 0.69 | 0.7 | 0.61 |
| **3** | **Sorghum** *Sprint* | 0.63 | 0.64 | 0.69 | 0.7 | 0.62 |
| **4** | **Canola** *Hyola 970* | 0.57 | 0.62 | 0.68 | 0.7 | 0.62 |
| **5** | **Control** *wheat stubble* | 0.60 | 0.61 | 0.69 | 0.7 | 0.65 |

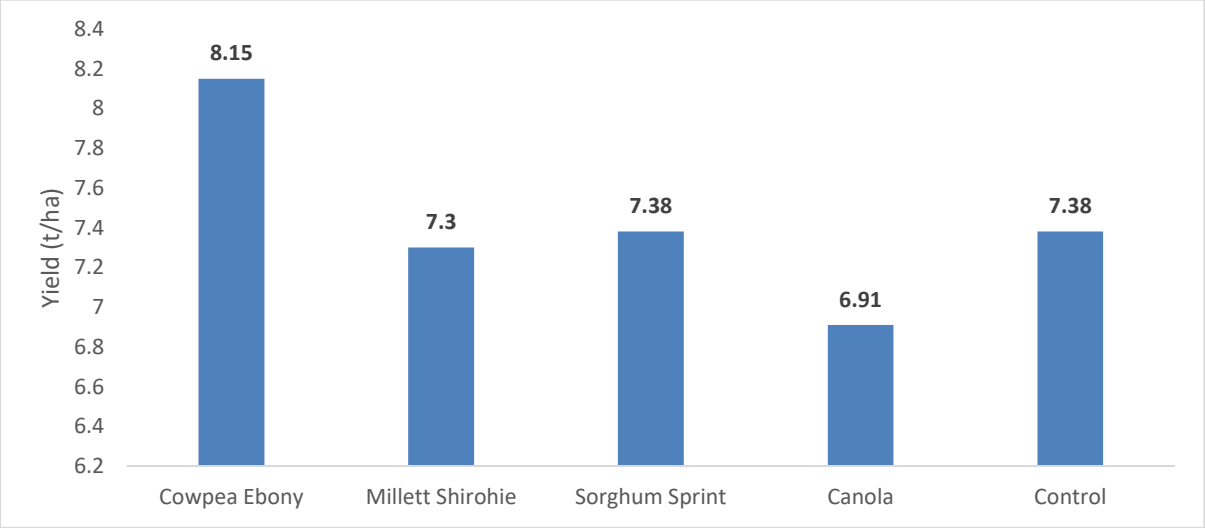


**Figure 3** The 2019 winter barley yields in (t/ha) from the single plots at the Lynch's 2019 summer cropping demonstration site.

**Table 3**. The soil test results (0-10cm) summarised from the start and end of the summer cropping phase in 2019. Site averages from January 30, were taken from a representative transect across the whole trial site. Average soil figures calculated on May 9, were derived from eight separate topsoil (0-10cm) transects taken within the individual summer cropping plots.

| **Date collected** | **30/01/2019** | 9/05/2019 | 9/05/2019 | 9/05/2019 | 9/05/2019 | **9/05/2019** |
|---|---|---|---|---|---|---|
| ***Treatment*** | ***Site Ave.*** | *Canola* | *Cowpea* | *Sorghum* | *Millet* | ***Average*** |
| **pH (CaCl2)** | **5.3** | 5.8 | 5.7 | 5.8 | 5.6 | **5.7** |
| **pH water** | **6.3** | 6.4 | 6.3 | 6.4 | 6.2 | **6.3** |
| **EC** | **0.201** | 0.138 | 0.230 | 0.278 | 0.153 | **0.200** |
| **OC** | **3.8** | 3.0 | 3.4 | 3.2 | 3.0 | **3.1** |
| **NO3-N** | **42** | 35 | 63 | 46 | 39 | **46** |
| **NH4-N** | **1** | 8 | 2.5 | 2 | 2 | **4** |
| **P (colwell)** | **40** | 35 | 45 | 56 | 39 | **43** |
| **PBI + ColP** | **NA** | 32 | 52 | 68 | 32 | **46** |
| **K** | **36** | 24 | 56 | 50 | 33 | **40** |
| **S** | **20** | 14 | 26 | 36 | 18 | **23** |

## Summary

- The barley sown over the cowpea treatment yielded 800kg/ha more than the barley sown over the sorghum, millet and surrounding paddock (control), which was a wheat stubble.
- The barley that was planted over the canola treatment was the lowest yielding plot in the demonstration site.
- The millet and sorghum treatments yielded similar to the 2018 wheat stubble (control) treatment.
- The highest soil nitrate levels were measured in the cowpea crop, indicating that the only legume in the trial fixed some nitrogen in the 90 days it was growing.
- Soil nitrate, phosphorus, potassium and sulphur levels were all lowest in the canola summer cropping treatment.
- There was no difference between NDVI readings at any of the crop stages in 2019.
- The growing season rainfall was 372.2mm which was recorded from May – October at the Mt Barker research station which is 4km north east of the trial site. The average for this period at this site is 513.8mm.
- The ripping strips were implemented in the trial but unfortunately was unable to get individual yields from each piece, using the header yield monitor.

# Conclusions

Despite the late sowing date of the summer crop in 2019 and minimal rainfall in February, the summer crops grew a surprising amount of biomass in 90 days, which indicates how resilient the crops types selected are. The barley grown over the sorghum and millet crops yielded similarly to the control.

The two most exciting yield results were from the canola and cowpea summer crops. The barley grown over cowpea yielded much higher than any other treatment, and conversely, the barley grown over canola yielded much lower than all other treatments, including the control. The cowpea was the only legume in the trial, which showed well in the soil test results collected 90 days after sowing the summer crops. Nitrate nitrogen was 37% higher in the cowpea treatments compared to the average nitrate levels from the eights soil samples collected on May 9 2019.

Canola soil samples measured the lowest levels for nitrate N, P, K and S in the trial. However, the levels for nitrate N and P were similar to the site average. Soil testing for K and S revealed they were approximately 40% lower in the canola treatment compared to the site average. The soil test data is suggesting canola has consumed more of the macro-nutrients in the soil than the other crops. This is possibly why the barley sown over the canola plots yielded less than all other treatments.

Predicta-B samples were collected in April 2020, but there did not appear to be any significant disease differences between treatments that were relevant to the barley crop in 2019.

The farmer's main interest in growing summer crops is to ‘consume’ soil water to reduce the chances of water-logging during the following winter cropping season. The 2019 winter rainfall was below average, which meant we could not assess waterlogging as a factor. Steve Lynch did comment however,that the barley sown over the summer cropping area germinated excellently and looked to have better early biomass compared to the rest of the paddock. Steve also thought the rainfall penetration was better in the summer cropped area compared to the rest of the paddock. Steve was impressed with the germination of the Cowpeas and surprised at the resulting barley yield results across these plots.

Cowpeas look likely to be the best summer cropping option for the Lynch’s since it is a legume, offering crop diversity, and could be worth harvesting for grain in wetter summers. Seeding on January 30, was relatively late because there was not enough soil moisture before then to plant. With earlier moist soil conditions, it could be possible to plant a summer crop from mid-November onwards once the previous winter crop has been harvested. Seeding in November could provide the summer crop up to 150 days of growing which would likely increase the N fixation (in the case of legumes) and give time for seed production. In the case of Steve Lynch, he is interested in further exploring how cowpeas could fit into his cropping system based on the results of the trial.

It is also worth mentioning that in a wetter year with both more summer and winter rainfall, the benefits to the winter crop of reduced waterlogging where millet and sorghum are planted in summer may also be more evident. It wasn’t so in 2019.