# Overcoming Challenges of Inconsistent Agronomic Treatments Across Experiments in a Weed Suppression Project

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Queensland's Department of Agriculture and Fisheries

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## Acknowledgement of
# First Nations peoples

I would like to respectfully acknowledge the Traditional Owners and Custodians of the land on which we meet today, and I pay my respects to their Elders past, present and emerging.

I extend that respect to all Aboriginal and Torres Strait Islander peoples here today.

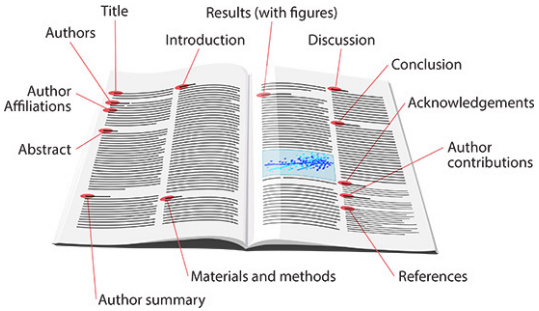
# Challenge

**Dealing with a data set of multiple field crop trials where treatments are not consistent**

- Multitude of ways the data can be analysed

# Two audiences

**1. Scientific research paper** for weed scientists




**2. Industry publication** for growers and advisors

# Introduction: Crop competition to suppress weeds

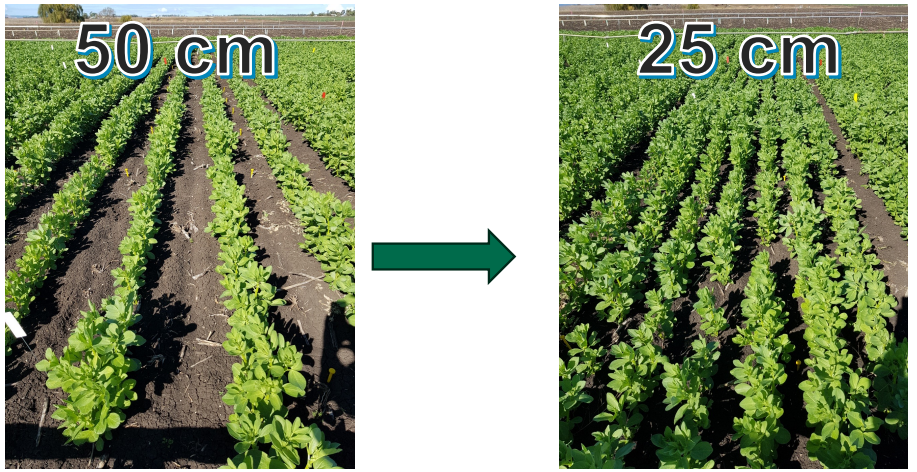
Crop competition is one of the weed control tactics to reduce:

- crop yield losses and
- contamination of grain

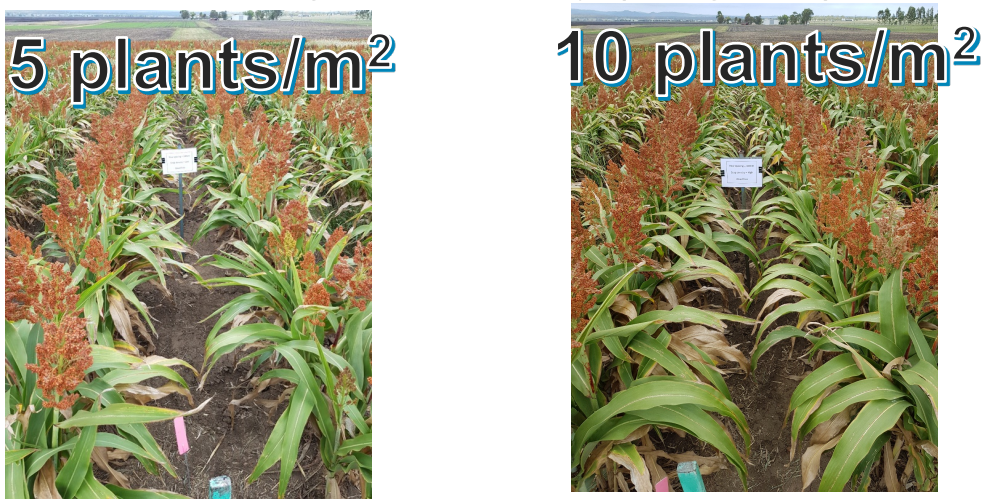
Competitive crops can suppress in-crop weeds through:

- narrowing row spacing
- increasing crop density

Narrowing row spacing (Fababean)




Increasing crop density (Sorghum)

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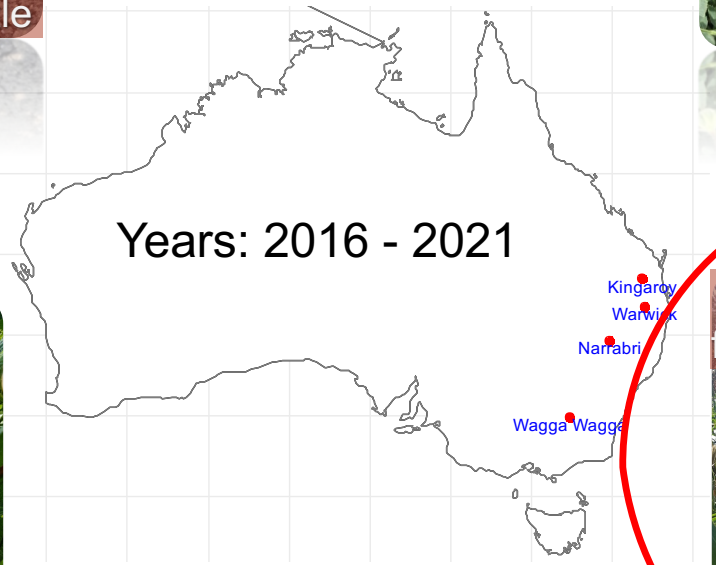
US00084 Innovative Crop Weed Control for Northern Region Cropping Systems

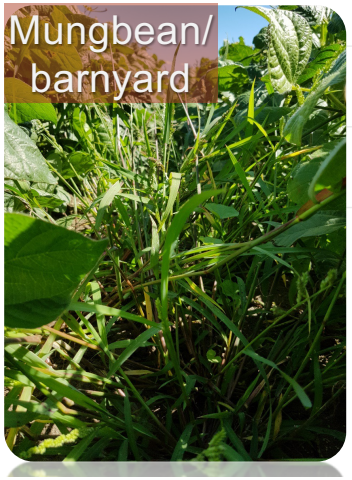
# Project consists of 6 data sets with multiple experiments

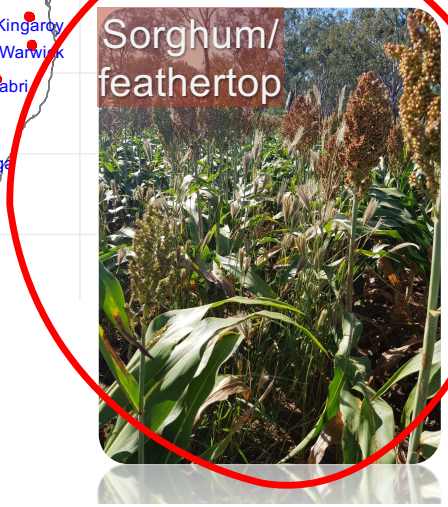


Mungbean /feathertop




Sorghum/ barnyard



# Look at one data set - *Suppression of feathertop Rhodes grass in Sorghum*

Research Questions:

A. What is the effect of **narrowing row spacing** (100 cm versus 50 cm)?
B. What is the effect of **increasing crop density** (5 plants versus 10 plants)?
C. What is the effect of **low versus high crop competitiveness** (100cm/5plants versus 50cm/10plants)?

Missing 5 plants/m$^2$

Inconsistent Cultivars

8 Trials

| | | Row spacing (cm) | | Crop density (plant/m$^2$) | | Cultivar | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2 Sites | 6 Years | 50 | 100 | 5 | 10 | MR43 | G33 | Rippa | Taurus |
| Warwick | 2016 | | | | | | | | |
| Warwick | 2017 | | | | | | | | |
| Warwick | 2018 | | | | | | | | |
| Narrabri | 2018 | | | | | | | | |
| Warwick | 2019 | | | | | | | | |
| Narrabri | 2019 | | | | | | | | |
| Warwick | 2020 | High | Low | Low | High | | | | |
| Narrabri | 2021 | High | Low | Low | High | | | | |

}Only 2 treatments

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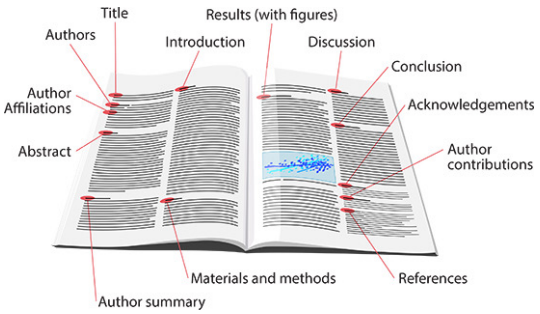
# Two audiences – different expectations

1. **Scientific research paper** for weed scientists
   - Transparent in describing the effects of row spacing & plant density by accounting for different background conditions, e.g. cultivar




2. **Industry publication** for growers and advisors
   - Did row spacing & plant density make a difference over a diverse range of cropping options?

# 1. For scientific paper

*[Combined experiment analyses using REML with separate design and residual variances.]*

To analyse within same treatments, need several combined trial analyses:

A) 2 Trials, Cultivar MR43: 2 Row spacing x 2 crop density

B) 2 Trials, Cultivars G33, Rippa, Taurus: 2 row spacing x 2 crop density x 3 cultivar

C) 4 Trials, Cultivars G33, Rippa, Taurus: 2 row spacing (@ 10 plants/m$^2$) x 3 cultivar

D) 4 Trials, Cultivar G33: 2 crop competition levels (Low, High)

| | | Row spacing (cm) | | Crop density (plants/m$^2$) | | Cultivar | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Year | 50 | 100 | 5 | 10 | MR43 | G33 | Rippa | Taurus |
| Warwick | 2016 | | | | | | | | |
| Warwick | 2017 | | | | | | | | |
| Warwick | 2018 | | | | | | | | |
| Narrabri | 2018 | | | | | | | | |
| Warwick | 2019 | | | | | | | | |
| Narrabri | 2019 | | | | | | | | |
| Warwick | 2020 | High | Low | Low | High | | | | |
| Narrabri | 2021 | High | Low | Low | High | | | | |

A)

B)

C)

D)

Overlap with B)

# Weed seed count / plant

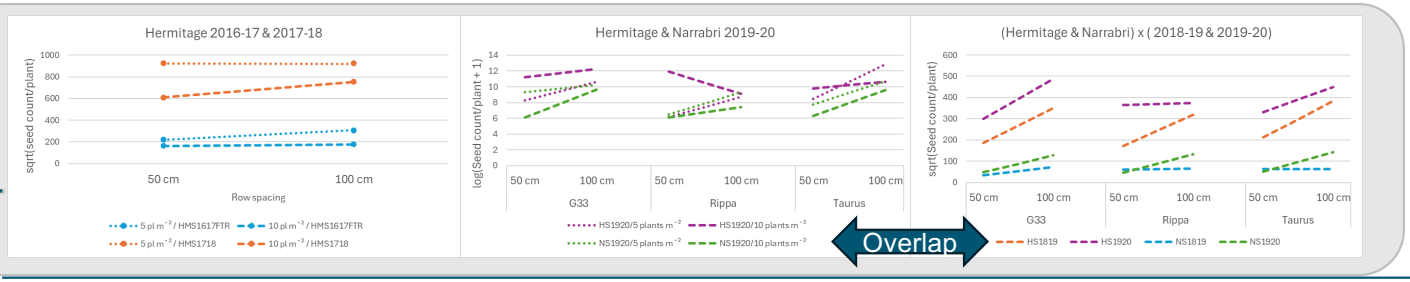
**A)** 2 Row spacing x 2 Crop densities (MR43) (50,100 cm) (5,10 plants m$^{-2}$)

**B)** 2 Row spacing x 2 Crop densities x 3 Cultivars (50,100 cm) (5,10 plants m$^{-2}$) (G33,Rippa,Taurus)

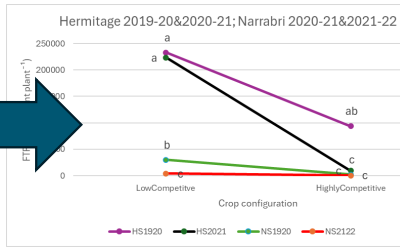
**C)** 2 Row spacing x 3 Cultivar @ 10 plants/m$^2$ (50,100 cm) (G33,Rippa,Taurus)

**D)** 2 Crop configurations (G33)

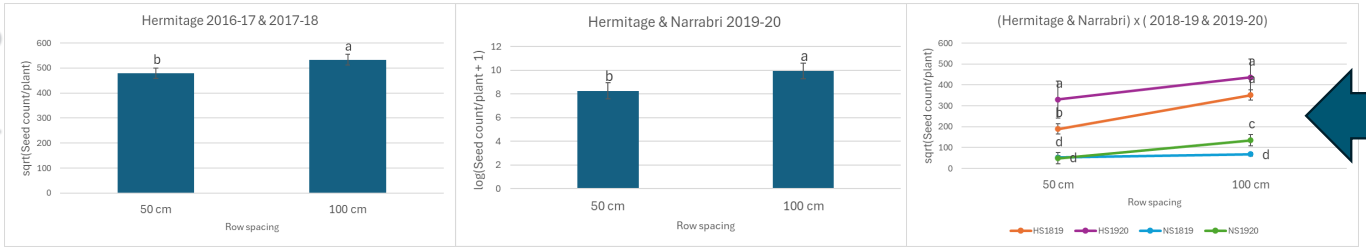
## All predictions




Crop configuration: Limited cases high < low competitiveness

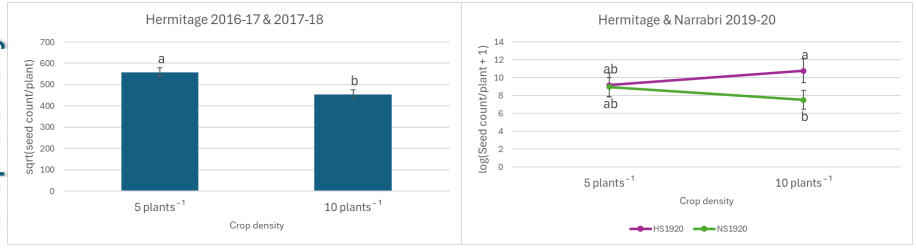



## Row spacing




Row spacing: Most cases 50 cm < 100 cm

## Crop density




NS

Crop density: Limited cases 10 < 5 plants/m$^2$

## Cultivar

NS

NS

Cultivar: No evidence of an effect

Need to consider analyses A, B, C & D together to describe results.

(Bars indicate LSD value)

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# 2. Industry publication – crop competition (low vs high)


- ❖ How consistently did increasing crop competition suppress weeds over a diverse range of cropping options?
- ➢ Create "Environments" aka 'Cropping options', from combinations of non-target treatments x cultivar within each trial.
- ➢ Combined experiment analysis (using REML separate design and residual variances), the fixed effects of interest are:

## 2 Crop competition x 17 Environments

| | | Row spacing (cm) | | Crop density (plants/m²) | | Cultivar | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Year | 50 | 100 | 5 | 10 | MR43 | G33 | Rippa | Taurus |
| Warwick | 2016 | High | Low | Low | High | | | | |
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| ~~Warwick~~ | ~~2018~~ | | | | | | | | |
| ~~Narrabri~~ | ~~2018~~ | | | | | | | | |
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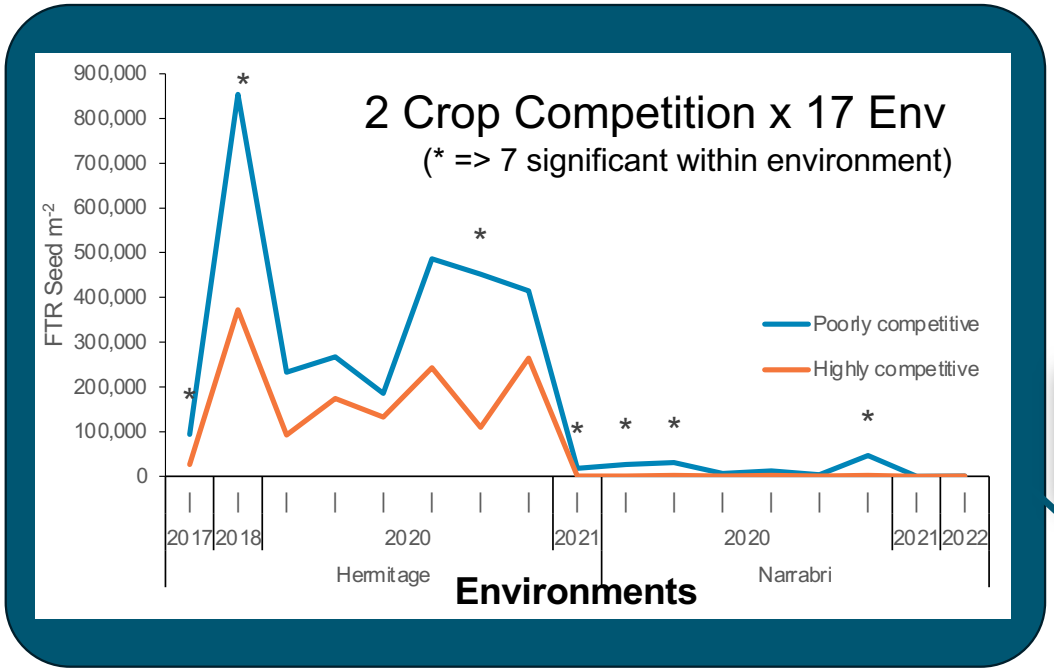
# Presenting results for industry




- For significant interactions show % environments with outcomes:
  significantly worse : not significantly different : significantly better
- Main effects and no significant differences described within the bar.

## Sorghum/feathertop

**By narrowing row spacing**

| | | |
|---|---|---|
| Weed biomass (n=34) | 68% | 32% |
| Weed seed (n=34) | 68% | 32% |
| Crop yield (n=34) | No difference in crop yield | |

**By increasing crop density**

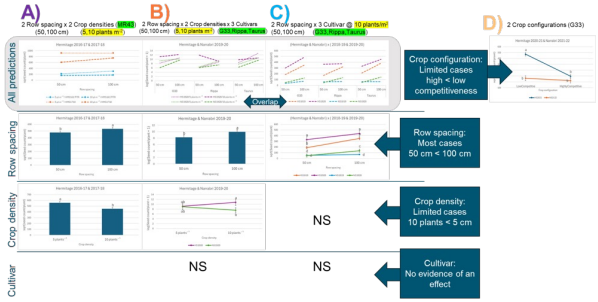
| | |
|---|---|
| Weed biomass (n=30) | On average weed biomass decreased by 8... |
| Weed seed (n=30) | On average weed seed decreased by 30132... |
| Crop yield (n=30) | On average crop yield increased by 0.79 t/ha |

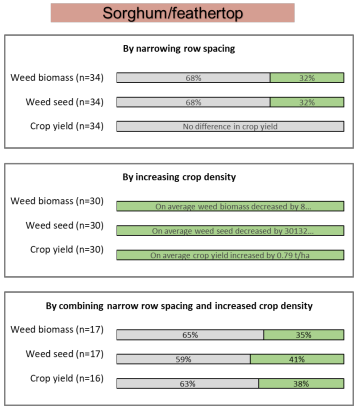
**By combining narrow row spacing and increased crop density**

| | | |
|---|---|---|
| Weed biomass (n=17) | 65% | 35% |
| Weed seed (n=17) | 59% | 41% |
| Crop yield (n=16) | 63% | 38% |

# Summary – analyses across trials for different audiences

| Audience | Weed scientists (research paper) | Growers and advisors (Industry publication) |
|---|---|---|
| Analyses | Series of analyses with strict adherence to using common background conditions (transparency) | One analyses per RQ, using ‘environments’ / ‘cropping options’, lose some back story about where the information came from |
| Findings | Pull out trends across analyses, making it trickier when there are conflicting results | Draw on one analysis with many comparisons – to assess an effect of increasing crop competition |
| Displaying results | Series graphs and/or tables displaying significant results | Succinct display of results with visual impact |



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# Acknowledgements

Weeds team who collected the data and provided feedback
GRDC for funding the project

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