GRDC Irrigation Project **All Protocols**– 2019/20 season
GRDC Project No. (FAR1906-003RTX)

Project

Development and validation of soil amelioration and agronomic practices to realise the genetic potential of grain crops grown under a high yield potential, irrigated environment in the northern and southern regions.

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Section 2.0 Faba Bean Protocols

Project Outputs

Output 1

By March 2023, locally validated, replicated field trial data set to addressing key constraints of yield and profit in irrigated cropping systems, with a focus on gaps in durum wheat, faba bean, canola, chickpea and maize crops grown under irrigation. This will include evaluation of crop response to agronomic practice across a range of irrigated systems and environments and quantify yield potential in different environments (targeting >4 t/ha canola, >6 t/ha in faba bean, >10 t/ha in durum and >19 t/ha in maize). Minimum 66 replicated field trials per year for 3 years over a four-year period, covering the major irrigation types in the region being geographically distributed across the Murrumbidgee and Murray Valleys of southern NSW, the Murray Valley of northern Victoria, south-east SA, SA/Vic Mallee and Tasmania (TBC). Action Learning Groups (ALG) engaged with trials where and when appropriate.

Output 1 - Research Programme

The research programme will be conducted at a minimum of six locations per annum and cover research into agronomic practices for six crops (faba beans, chickpeas, durum, canola, maize and winter/spring barley). 66 trials per annum will be dedicated to the five core crops specified and barley, although the exact numbers for each crop will vary between the different years of the project and the constraints identified. Little research has been conducted on winter or spring sown barley under irrigation in Australia and new germplasm has increased interest in this crop. In order to allow for more in depth research and to give greater control for management of the research programme it is proposed that the trials programme will be conducted at a series of Irrigated Research Centres (IRCs), which will address a range of agronomic issues at one field applied research site. The centres will vary in size (number of trials) depending on the region, crop types and agronomic issues being investigated. The principal Irrigated Research Centres (IRCs) at Kerang and Finlay will cover all four autumn sown crops (faba beans, chickpeas, durum, and canola) with the addition of maize sown in commercial paddocks in the Murrumbidgee and Murray region. Satellite centres will be established in Frances, Griffiths and Tasmania with a smaller number of trials per annum. Each year six trials will be reserved for other regions (e.g. Yarrawonga, Coleambally, Corop) that have smaller acreages of irrigated broad acre with individual trials covering different crop and agronomic issues.

Protocol Summary

Protocols cover two research components:

i) Agronomy
ii) Soil amelioration

66 trials based on four replicates will form the basis of the research program for Output 1 of the agronomy component. There will be a further two trials covering soil amelioration which will be conducted in large replicated blocks as opposed to small trial plots.

i) Agronomy

Nine protocols have been ascribed to cover the major agronomy components of growing the six irrigated crops with so far two additional protocols being generated for Maize. More maybe added as the project develops.

1. Influence of irrigation type on sowing date and subsequent crop establishment.
2. Investigating the influence of irrigated break crops on the yield and nutritional needs of following cereals.
3. Optimum timings and rates for the nitrogen (N) forms applied in irrigated crops of durum, canola, barley and maize.
4. Interaction between germplasm, nitrogen rate and PGR application in irrigated crops of durum, canola and maize.
5. The influence of rhizobium inoculation in irrigated crops of faba beans.
6. Interaction between stubble incorporation of faba bean stubbles on following durum crops.
7. Germplasm disease management interaction.
8. Disease management for irrigated crops – products, rates and timings.
9. Lodging control in irrigated crops.
10. Establishment – row spacing and plant population
11. Potassium nutrition

Each of these general protocols will be modified for the specific crops

Section 1.0 - Maize

Section 2.0 - Faba beans

Section 3.0 - Chickpeas

Section 4.0 - Durum

Section 5.0 - Canola

Section 6.0 - Barley

Section 7.0 Soil Amelioration

Not all protocols will be conducted on each specific crop.

Section 2.0 Faba beans

Protocol 1 & 10: Optimum plant populations of faba beans grown under overhead and flood irrigation

Output 1. – Agronomy research on faba beans

Protocol Objective:
These protocols evaluate the plant population of faba beans grown at different plant populations under flood and overhead irrigation.

The individual objectives are as follows:

- Evaluating the influence of faba bean three different plant populations on dry matter production and grain yield under flood and overhead irrigation.

- To compare the economics of faba beans grown under flood versus overhead irrigation sown at the same time.

- To examine the influence of plant population on disease levels and pod set under two different systems of irrigation.

- To examine whether cultivar susceptibility to disease interacts with the plant population under these two irrigation systems.

Treatment List:

Influence of irrigation system on faba bean performance

Trials 1,2,3 and 4
FAR trial codes: FAR IRR F20-01-1 (Trial 1) – overhead irrigation, FAR IRR F20-01-2 (Trial 2) – flood irrigation, ICC F20-01-3 (Trial 3) – sprinkler irrigation, ICC F20-01-4 (Trial 4) – flood irrigation

Protocol version: **Version 1 (11.02.2020)**

Trial 1: FAR IRR F20-01-1 – Under overhead Irrigation
Trial 2: FAR IRR F20-01-2 – Under flood Irrigation
Location: Newell Highway Finley, NSW, GPS: -35.614731, 145.59182
Trial treatments: Four seed rates applied to a disease susceptible and resistant cultivar.
Trial Design: Randomised complete block with four replicates (Main plot cultivar and sub plot plant population)
Time of Sowing: April 20-30 target window 2020
Cultivar: Amberley (resistant) & Fiesta (disease susceptible)

Trt.	Variety	Seed rate (Seeds/m2)
1	Amberley	12 seeds/m2
2	Amberley	24 seeds/m2
3	Amberley	36 seeds/m2
4	Amberley	48 seeds/m2
5	Fiesta	12 seeds/m2
6	Fiesta	24 seeds/m2
7	Fiesta	36 seeds/m2
8	Fiesta	48 seeds/m2

Trial 3: ICC F20-01-3 – Sprinkler Irrigation
Trial 4: ICC F20-01-4 – Under flood Irrigation
Location: Kerang, VIC
Trial treatments: Four seed rates applied to a disease susceptible and resistant cultivar.
Trial Design: Randomised complete block with four replicates (Main plot cultivar and sub plot plant population)
Time of Sowing: April 20-30 target window 2020
Cultivar: Amberley (resistant) & Fiesta (disease susceptible)

Trial Treatments:

Trt.	Variety	Seed rate (Seeds/m2)
1	Amberley	10 seeds/m2
2	Amberley	18 seeds/m2
3	Amberley	24 seeds/m2
4	Amberley	36 seeds/m2
5	Fiesta	10 seeds/m2
6	Fiesta	18 seeds/m2
7	Fiesta	24 seeds/m2
8	Fiesta	36 seeds/m2

Management:
Standard farm management of inputs (fertilisers and agrichemical input) for both trials with same sowing date
Irrigation input (mm) specific for each irrigation system in order to establish a crop in April 20 – 30 sowing window

Total Plot Number: 2 Cultivars x 4 seed rates x 4 reps = **32 plots**

Protocol 2. Investigating the influence of irrigated break crops on the yield and nutritional needs of following cereals.

Research question: Can irrigation water applied to break crops provide ongoing value into the subsequent cereal crop?

Protocol Objective:
The research will look to quantify whether higher yielding break crops, such as chickpeas and faba beans, as a result of irrigation and improved agronomic practice provide greater productivity and profitability for the following irrigated canola or cereal crops. In essence, do higher yielding break crops give quantifiable benefits to other crops in the irrigated farming system?

The individual objectives are as follows:

- To compare the nodulation of direct drilled faba beans sown into cereal stubble with different inoculant treatments

- To assess whether rhizobium treatments improve dry matter, yield and grain yield under irrigation.

- To quantify the break crop effect of faba beans grown under irrigation and how inoculation or fertilisation effects the break effect.

- To assess the economics of inoculating faba beans under irrigation.

- To evaluate an acid tolerant rhizobium strain if available

Treatment List:

Influence of rhizobium inoculation on the break crop effect of faba bean yield and profitability

FAR trial codes: **FAR IRR F20-02-1 (Trial 1) – overhead irrigation**

Trial 1: FAR IRR F20-02-1 – Under overhead Irrigation
Location: Newell Highway Finley, NSW, GPS: -35.614731, 145.59182
Trial treatments: Five inoculant treatments versus an untreated control
Trial Design: Randomised complete block with four replicates
Time of Sowing: April 20-30 target window 2020
Cultivar: PBA Bendoc (herbicide tolerant- imidazolinone (Group B))

Trial Treatments:

Trt	Trt Name	Inoculant	Fertiliser
1.	Untreated	-	-
2.	Alosca Inoculant granules (rate 1) *	10kg/ha	-
3.	Alosca Inoculant granules (rate 2) *	20kg/ha	-
4.	Alosca Inoculant granules (rate 3) *	30kg/ha	-
5.	40 kg N/ha pod set	-	Urea 87kg/ha
6.	40 kg N/ha (incorporated by seeding)	-	Urea 87kg/ha

*Acid tolerant rhizobium would be tested if sufficient product was available or a single treatment could replace the nitrogen treatment

Management:
Standard farm management of inputs (fertilisers and agrichemical input) for both trials with same sowing date
Irrigation input (mm) specific for overhead irrigation system, monitored to prevent soil moisture deficit.

Total Plot Number: 6 Trts x 4 reps = **24 plots**

Protocol 6: Influence of faba bean stubble incorporation on yield and profitability of following durum wheat

Output 1. – Agronomy research on faba beans

Protocol Objective:
To evaluate the influence of top work cultivation (speed till) on durum wheat yield and profitability.

The individual objectives are as follows:

- Evaluating the influence of incorporating faba bean stubble into the seedbed prior to establishing faba bean, examining crop establishment and early vigor.

- To examine whether cultivation of faba bean stubbles is cost effective prior to establishment using a tyne seeding boot.

- Does the cultivation of faba bean stubbles influence the nitrogen requirements of the following durum wheat crop when both are grown under irrigation.

Treatment List:

Influence of faba cultivation on durum wheat yield and profitability

Trial 1
FAR trial codes: FAR IRR F20-06 (Trial 1) – overhead irrigation
Protocol version: **Version 1 (11.02.2020)**

Trial 1: FAR IRR F20-06-1**– Under overhead Irrigation**
Location: Newell Highway Finley, NSW, GPS: -35.614731, 145.59182
Trial treatments: Plus and minus surface work cultivation.
Trial Design: Randomised complete block with six replicates (Main plot cultivar and sub plot plant population)
Time of Sowing: April 20-30 target window
Cultivar: Samira

Trial Treatments:

Trt.	Cultivation	Seed rate (Seeds/m2)
1	Direct drill	12 seeds/m2
2	Direct drill	24 seeds/m2
3	Direct drill	36 seeds/m2
4	Direct drill	48 seeds/m2
5	Speed Till	12 seeds/m2
6	Speed Till	24 seeds/m2
7	Speed Till	36 seeds/m2
8	Speed Till	48 seeds/m2

Management:
Standard farm management of inputs (fertilisers and agrichemical input) for both trials with same sowing date
Irrigation input (mm) specific for irrigation system in order to establish a crop in April 20 – 30 sowing window

Total Plot Number: 2 Cultivation x 4 seed rates x 6 reps = **48 plots**

Protocol 7: Disease management strategies for faba beans grown under irrigation

Output 1. – Agronomy research on faba beans

Protocol Objective:
To evaluate the economics of disease management strategies of different costs in irrigated faba production.

The individual objectives are as follows:

- Evaluating the influence of cultivar resistance on the cost effectiveness of disease management strategies for irrigated faba bean production.

- To evaluate the disease control, yield response and quality effects of cheap (based on older fungicide chemistry) and expensive disease management strategies (based on new chemistries).

Treatment List:

Trials 1 & 2
FAR trial codes: FAR IRR F20-07-1 (Trial 1) – overhead irrigation, ICC F20-07-2 (Trial 2) – flood irrigation & FAR IRR F20-07-03 overhead (Trial 3)
Protocol version: **Version 1 (11.02.2020)**

Trial 1. FAR IRR F20-07-1 – Under overhead Irrigation - NSW
Location: Newell Highway Finley, NSW, GPS: -35.614731, 145.59182, Kerang, VIC and
Trial treatments: Three strategies applied to a disease resistant and susceptible cultivar
Trial Design: Randomised complete block with four replicates (Main plot cultivar and sub plot plant population)
Time of Sowing: April 20-30 target window 2020
Cultivar: Amberley (resistant) & Fiesta (disease susceptible)

TRT	Variety	Management Strategy	4-6 Node	Pre-Flower	Mid-flower
1	Amberly	Untreated	-	-	-
2	Amberly	Cheap	Tebuconazole 430 @ 145ml/ha	Chlorothalonil 720 @ 1.4l/ha	Chlorothalonil 720 @ 1.4l/ha
3	Amberly	Expensive	Veritas @ 1l/ha	Aviator Xpro 600ml/ha	Veritas @ 1l/ha
4	Fiesta	Untreated	-	-	-
5	Fiesta	Cheap	Tebuconazole 430 @ 145ml/ha	Chlorothalonil 720 @ 1.4l/ha	Chlorothalonil 720 @ 1.4l/ha
6	Fiesta	Expensive	Veritas @ 1l/ha	Aviator Xpro 600ml/ha	Veritas @ 1l/ha

Trial 2: ICC F20-07-2 – Under flood Irrigation – VIC
Location: Kerang, VIC
Trial treatments: Three strategies applied to a disease resistant and susceptible cultivar
Trial Design: Randomised complete block with four replicates (Main plot cultivar and sub plot plant population)
Time of Sowing: April 20-30 target window 2020
Cultivar: Samira (resistant/region standard) & Farah (disease susceptible)

TRT	Variety	Management Strategy	4-6 Node	Pre-Flower	Mid-flower
1	Samira	Untreated	-	-	-
2	Samira	Cheap	Tebuconazole 430 @ 145ml/ha	Chlorothalonil 720 @ 1.4l/ha	Chlorothalonil 720 @ 1.4l/ha
3	Samira	Expensive	Veritas @ 1l/ha	Aviator Xpro 600ml/ha	Veritas @ 1l/ha
4	Farah	Untreated	-	-	-
5	Farah	Cheap	Tebuconazole 430 @ 145ml/ha	Chlorothalonil 720 @ 1.4l/ha	Chlorothalonil 720 @ 1.4l/ha
6	Farah	Expensive	Veritas @ 1l/ha	Aviator Xpro 600ml/ha	Veritas @ 1l/ha

Trial 3: FAR IRR F20-07-03 – Under overhead irrigation - SA
Location: Frances IRC, SA
Trial treatments: Three strategies applied to a disease resistant and susceptible cultivar
Trial Design: Randomised complete block with four replicates (Main plot cultivar and sub plot Disease management)
Time of Sowing: April 20-30 target window 2020
Cultivar: Amberley (resistant) & Fiesta (disease susceptible)

Trial Treatments:

TRT	Variety	Management Strategy	4-6 Node	Pre-Flower	Mid-flower
1	Amberly	Untreated	-	-	-
2	Amberly	Cheap	Tebuconazole 430 @ 145ml/ha	Chlorothalonil 720 @ 1.4l/ha	Chlorothalonil 720 @ 1.4l/ha
3	Amberly	Expensive	Veritas @ 1l/ha	Aviator Xpro 600ml/ha	Veritas @ 1l/ha
4	Fiesta	Untreated	-	-	-
5	Fiesta	Cheap	Tebuconazole 430 @ 145ml/ha	Chlorothalonil 720 @ 1.4l/ha	Chlorothalonil 720 @ 1.4l/ha
6	Fiesta	Expensive	Veritas @ 1l/ha	Aviator Xpro 600ml/ha	Veritas @ 1l/ha

Management:
Standard farm management of inputs except fungicides (fertilisers and agrichemical input)

Irrigation input (mm) specific for irrigation system in order to establish a crop in April 20 – 30 sowing window

Total Plot Number: 2 Cultivars x 3 disease management strategies x 4 reps = **24 plots**

Protocol 9: Influence of plant growth regulation on faba bean yield and profitability

Output 1. PROC 9175813 – Agronomy research on faba beans

Protocol Objective:
To evaluate the effect of PGR application on crop height, lodging and brackling reduction, yield and profitability of irrigated faba beans.

The individual objectives are as follows:

- To evaluate the ability of PGRs to reduce crop height and brackling in the long stemed cultivar PBA Bendoc.

- To examine whether PGRs need to be sequenced in order to have a significant effect in faba beans.

- To understand if plant population has a greater impact on reducing height and lodging than PGRs in irrigated PBA Bendoc

Treatment List:

Influence of plant growth regulation on faba bean yield and profitability

Trials 1 & 2
FAR trial codes: FAR IRR F20-09-1 (Trial 1) – overhead irrigation, ICC F20-09-2 (Trial 2) – flood irrigation
Protocol version: **Version 1 (11.02.2020)**

Trial 1: FAR IRR F20-09-1 – Under overhead Irrigation
Location: Newell Highway Finley, NSW, GPS: -35.614731, 145.59182, Kerang, VIC
Trial treatments: 3 plant populations x 3 PGR treatments x 4 reps
Trial Design: Factorial
Time of Sowing: April 20-30 target window
Cultivar: PBA Bendoc (long straw imidazolinone (Group B) tolerant cultivar)

Trial 2: ICC F20-09-2 – Under flood Irrigation
Location: Kerang, VIC
Trial treatments: 3 plant populations x 3 PGR treatments x 4 reps
Trial Design: Factorial
Time of Sowing: April 20-30 target window
Cultivar: PBA Bendoc (long straw imidazolinone (Group B) tolerant cultivar)

TRT	Seed rate	PGR - Start of flowering	PGR - End of flowering
1	12 seeds/m2	-	-
2	12 seeds/m2	Moddus Evo 400ml ha	-
3	12 seeds/m2	Moddus Evo 400ml ha	Cerone 355ml ha
4	24 seeds/m2	-	-
5	24 seeds/m2	Moddus Evo 400ml ha	-
6	24 seeds/m2	Moddus Evo 400ml ha	Cerone 355ml ha
7	36 seeds/m2	-	-
8	36 seeds/m2	Moddus Evo 400ml ha	-
9	36 seeds/m2	Moddus Evo 400ml ha	Cerone 355ml ha

Management:
Standard farm management of inputs (fertilisers and agrichemical input) for the trial with same sowing date window as small plots
Irrigation input (mm) specific for overhead irrigation system in order to establish a crop in April 20 – 30 sowing window

Total Plot Number: 3 Plant populations x 3 PGR strategies x 4 reps = **36 plots**