

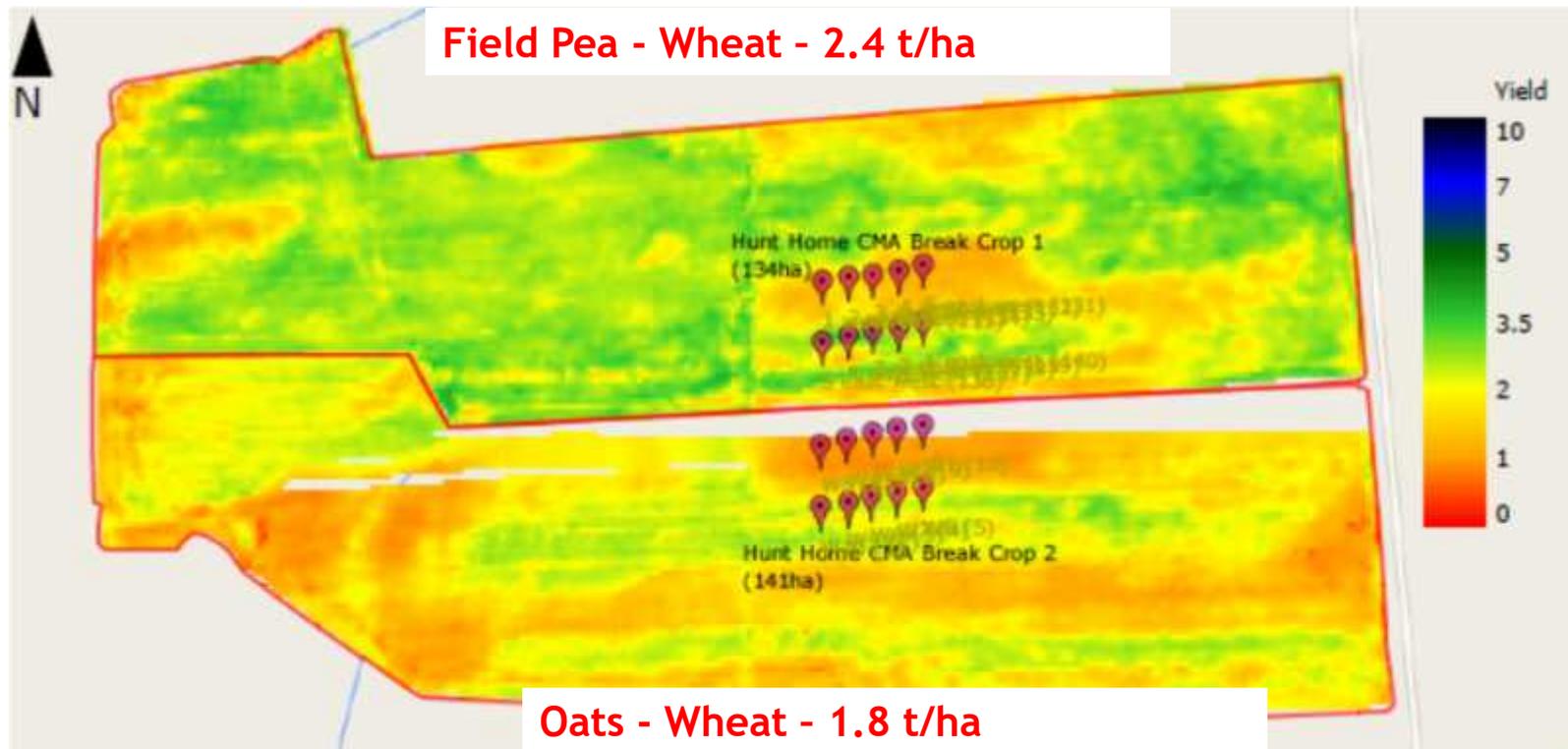
The net contributions of fixed N by crop legumes in low rainfall farming systems

Michael Moodie, Mark Peoples, Laura Goward, Nigel Wilhelm



Background

Legume crops deliver significant break crop benefits in the Southern Australian low rainfall zone (275 -350 mm)



Aim

To provide low rainfall farmers with local information on productivity and N₂ fixation capacity of grain legume crops



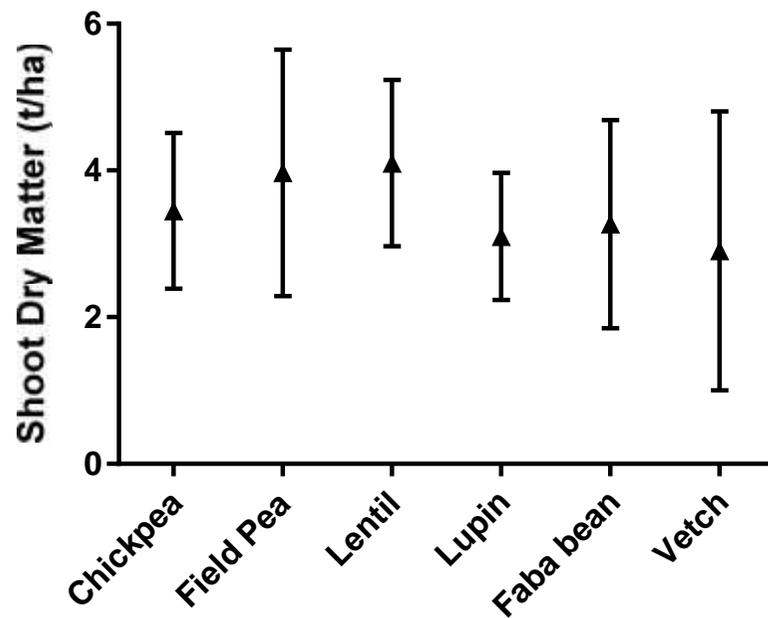
Methodology

- ▶ Replicated trials comparing a range of break crops undertaken at Mildura (2013 and 2014) and Loxton (2015)
- ▶ Each trial located on sandy loam - loam soil type
- ▶ Each trial was sown into a moist seedbed in the first week of May
- ▶ Growing season rainfall 130 - 145 mm which is less than average (175 mm)
- ▶ Peak biomass and N₂ fixation was measured for selective treatments within each trial
- ▶ Pulse crops represented included: Chickpea, Field Pea, Lentil, Lupin, Faba Bean and Vetch

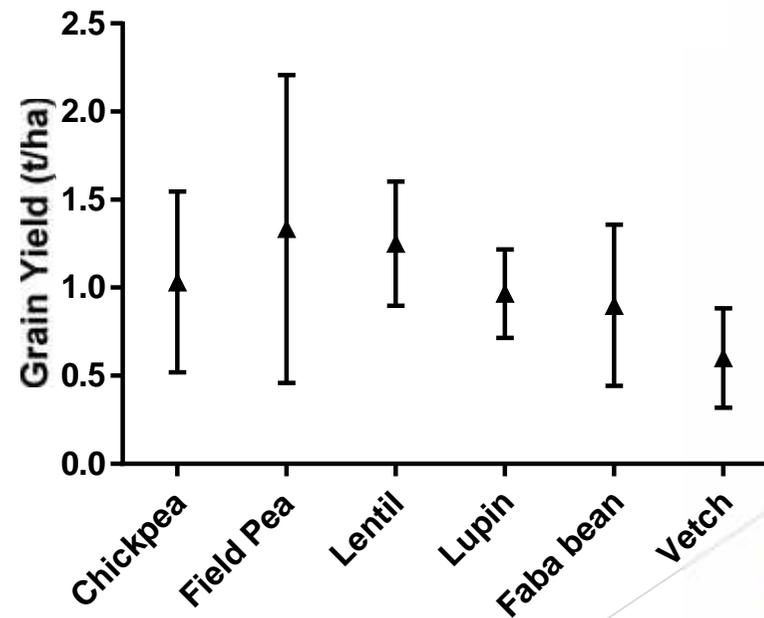


Grain Legume Productivity

Shoot Dry Matter

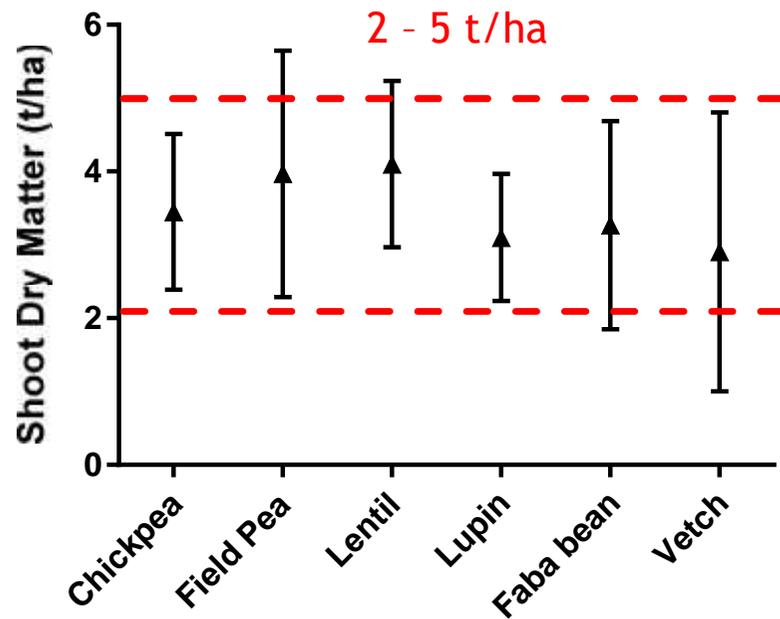


Grain Yield

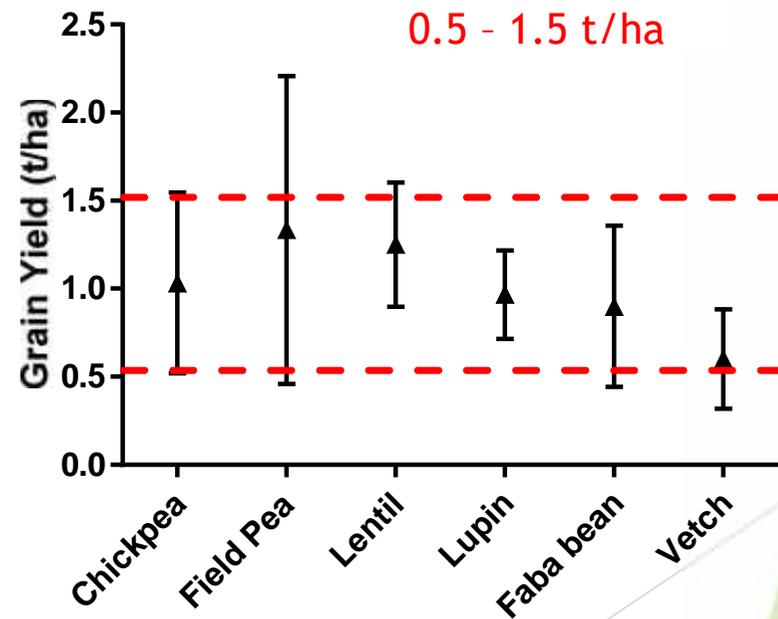


Grain Legume Productivity

Shoot Dry Matter

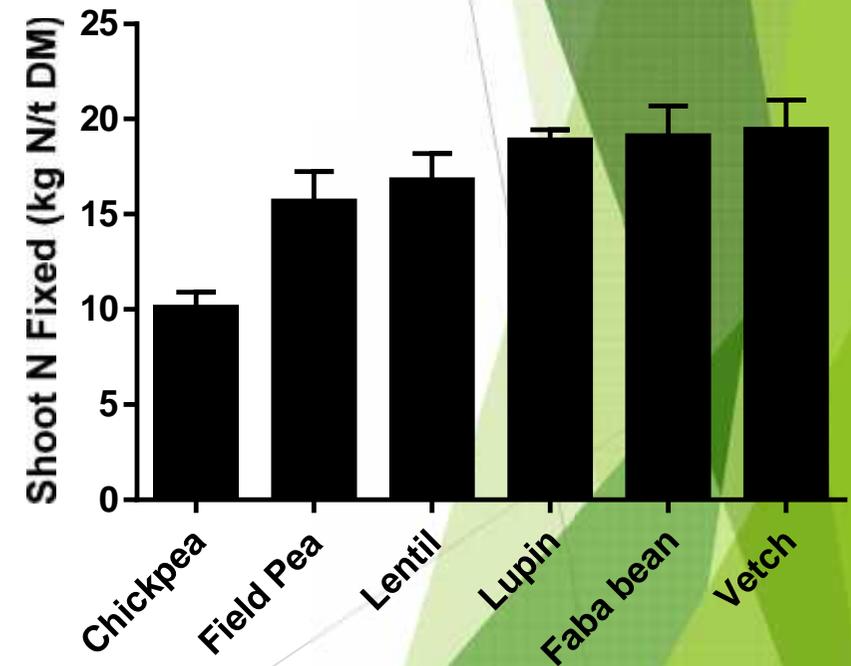


Grain Yield



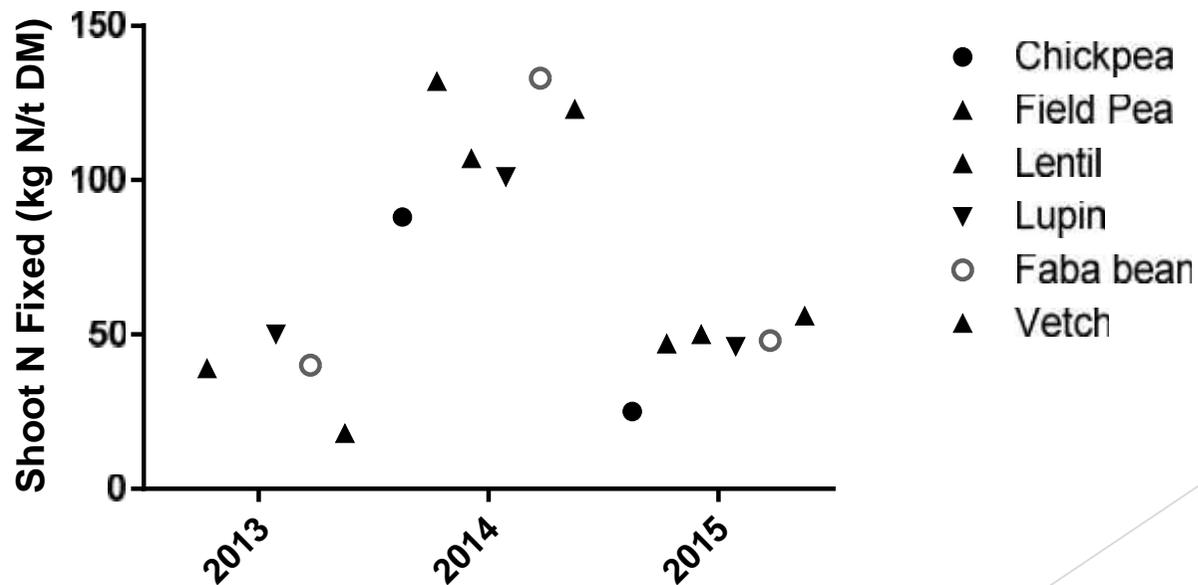
Shoot N Fixed

- ▶ Average of 16.3 kg N/t shoot DM fixed
- ▶ Shoot N₂ fixed by chickpea lower than all other crops
- ▶ Percent of shoot N fixed (%Ndfa) by chickpea was 50% compared to 61-83% for other crops
- ▶ Shoot N₂ fixed by field pea also less than the other crops except chickpea
- ▶ Lentil, lupin, faba bean and vetch generally fixed 15 - 20 kg N/t shoot DM



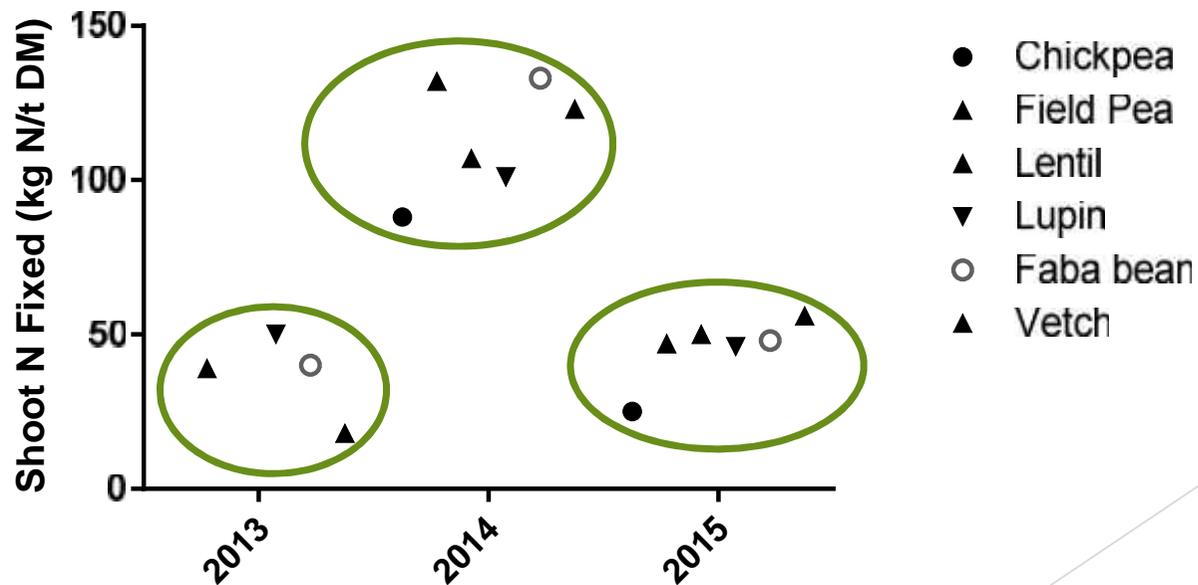
Shoot N Fixed

- ▶ Total shoot N fixed by chickpea relatively less than other crops
- ▶ Higher production by field pea compensated for low shoot N₂ fixed/t DM
- ▶ Variation in total shoot N₂ fixed greater between seasons than between species within a season



Shoot N Fixed

- ▶ Total shoot N fixed by chickpea was relatively less than other crops
- ▶ Higher production by field pea compensated for low shoot N₂ fixed/t DM
- ▶ Variation in total shoot N₂ fixed greater between seasons than between species within a season



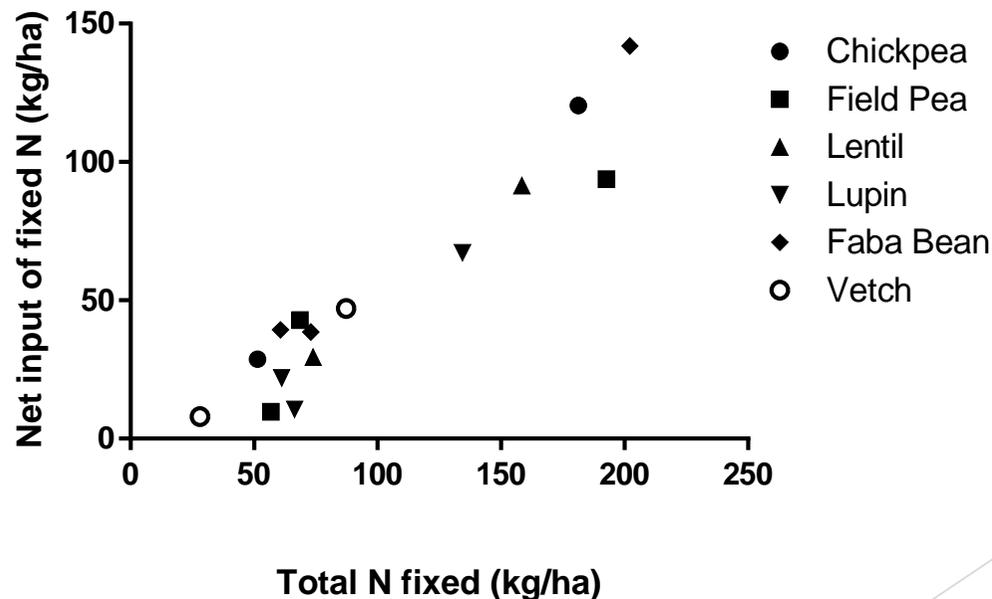
Net inputs of fixed N

- ▶ Total fixed N inputs (shoots + roots) estimated using published root factors
- ▶ Grain N removal estimated using grain N percentage from previous trials

Soil	Root Factor	Grain N %
Chickpea	2.06	3.8
Field Pea	1.46	4.3
Lentil	1.48	4.5
Lupin	1.33	5.6
Faba Bean	1.52	4.3
Vetch	1.56	5.0

Net input of fixed N

- ▶ The average net input of fixed N was approximately 50 kg/ha
- ▶ 12 out of 15 crop x season combinations contributed agronomically significant (>10 kg/ha) fixed N inputs
- ▶ There is a high probability (95%) of a positive net fixed N input when total fixed N input (shoots and roots) is 39 kg/ha



Conclusions

- ▶ Grain legume crops are a viable mechanism to maintain or improve N fertility of cropping soils in low rainfall Mallee farming systems
- ▶ However, based on an average cereal yield of 1.6 t/ha and N removal of 32 kg/ha, a grain legume crop would need to be grown for every 1-2 cereal crops
- ▶ Therefore, further work is required to investigate a wider range of options to be used in conjunction with grain legume crops to maintain a positive N balance including:
 - ▶ Legume pastures
 - ▶ Forage or manure crops
 - ▶ N fertiliser strategies

Thankyou

Grains Research and Development Corporation (GRDC)

South Australian Grains Industry Trust (SAGIT)

