Legume Soil Health Project

The project, funded by the Australian Government's National Landcare Programme, is field testing a range of legumes to determine applicability in enhancing soil fertility and complementing current cropping cycles. **As a result of improvements in soil health, can legumes reduce the reliance on nitrogen fertilisers in the northern cropping region?**

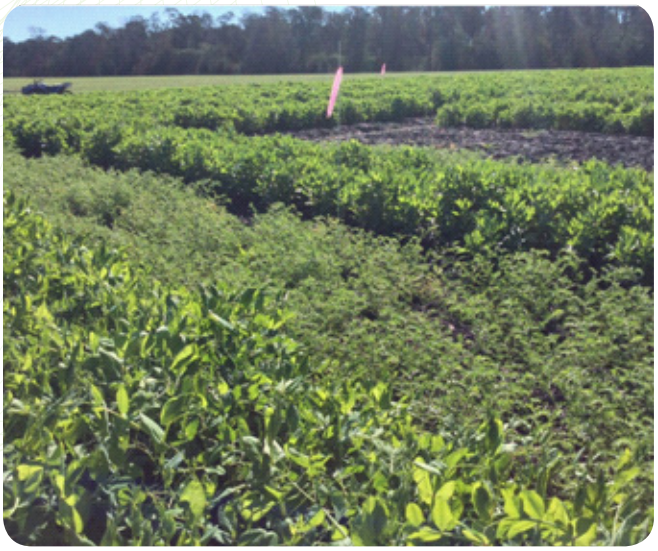
The trials:

Tulloona summer 2013-2014:

- Lab lab, soya bean and guar planted.
- Lab lab produced significant biomass.
- Visual crop differences were seen in 2014 wheat planted over trial compared to fallow.

Winter 2014:

- Killarney, Jimbour and Tulloona planted.
- Fababean, chickpeas and field peas included.
- Low N paddocks going into cereals selected for trial.
- Killarney trials performed well.
- Commercial plantings of Fababeans at the other sites also provided data.

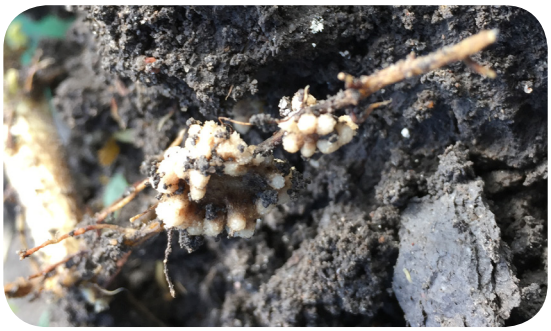


Summer 2014:

- Tulloona planted October 2014 and Jimbour planted December 2014.
- Guar, lab lab, mungbean or soya bean and a multi-species planting included.
- Jimbour trials performed well. Tulloona trials failed due to seasonal conditions.

Winter 2015:

- Fababean, chickpeas and field peas are planted at Jimbour and Tulloona.
- Very good establishment and growth at Tulloona.



Winter green manuring:

Killarney winter 2014

- The Fababean and field pea produced more biomass (1.6t/ha) than chickpea (1.0t/ha) by termination at 90 days.
- Based on biomass, both the field peas and fababeans fixed between 24 and 38kg N/ha compared to 15 to 25Kg N/Ha for Chickpeas.
- No yield differences were found between legumes in the following sorghum crop.
- N contribution to the following sorghum crop is estimated to be equivalent to 50% of grower N rates.
- Chickpeas produced less biomass but there was more soil moisture; a nearly full soil profile 96 days after sowing.
- Field peas had the lowest residual soil moisture.
- Mechanical incorporation of cover crops reduced yields in double cropping situation despite potentially increasing N availability.
- The yield decrease is likely due to water limitation resulting from tillage.

Jimbour winter 2014

- Timing of Fababean termination and its effect on soil moisture, biomass and N contribution was examined.
- Fababeans terminated more than 60 days after planting depleted soil moisture to 1m.
- A comparison between barley and fababeans showed more soil moisture left in the soil after barley.
- The difference may be explained by the extra tonne of biomass in the Fababeans which also produced an estimated 25Kg N/Ha.

Winter Findings:

- Fababean provided a profitable commercial winter rotation when taken to harvest and offers potential for weed and disease management.
- Mechanical incorporation of cover crops is a financial cost and reduces soil moisture.
- Generally more legume biomass provides more N inputs, but this was not found to date in the Killarney trial results.

Summer green manuring:

- Summer legume cover crops can rapidly accumulate biomass and potentially supply significant N to the following cereal crop.
- All cover-crop species used almost two-thirds of stored soil water.
- Accumulating cover crop biomass early and spraying out prior to the most reliable January to February rainfall period increases the potential to refill the soil profile for winter.
- Challenges associated with including summer green manure crop in rotations include soil moisture depletion and crop establishment.
- Legume cover crops require good soil moisture and establishment for rapid canopy closure, biomass production and N fixation.
- Stressed cover crops are unable to adequately suppress weed infestations.
- The decision to sow a legume cover crop verses a grain crop must take into account longer-term rotation benefits.
- Decisions will also be influenced by legume species and varietal selections for disease or nematode management.

Emerging learnings to date:

- There are potential benefits and trade-offs from the adoption of green manuring legumes.
- The amount of Nitrogen fixed by a legume increases with biomass production, but is reduced by high levels of soil nitrate.
- Biomass alone is not necessarily the indicator of N availability for the following crop rotation.
- The actual amount of Nitrogen fixed will depend on; the species, the site, the season, crop management, the effectiveness of inoculation and how well the legume grows.
- Winter legumes trialled made an estimated N contribution to the following crop equivalent to 50% of grower N fertilisation.
- Longer-term effects of the winter cover crops will be assessed on a current barley crop at Killarney (cover crop – sorghum – barley rotation).
- The trade-offs associated with growing legumes as green manure crops relates to soil water and the potential to refill the soil profile before the planting of the next crop.
- Mechanical incorporation of green manures is not the best option due to the negative effect on yield of the following crop – which is attributed to moisture loss.
- Given that green manure crops are usually planted cheaply on residual moisture, there is a high chance stands will be poor and the practice might fail without sufficient rainfall.
- Good legume cover crop establishment is required to suppress weeds.

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