Sugar Research Australia

Burdekin

# Legume fallow

B17001

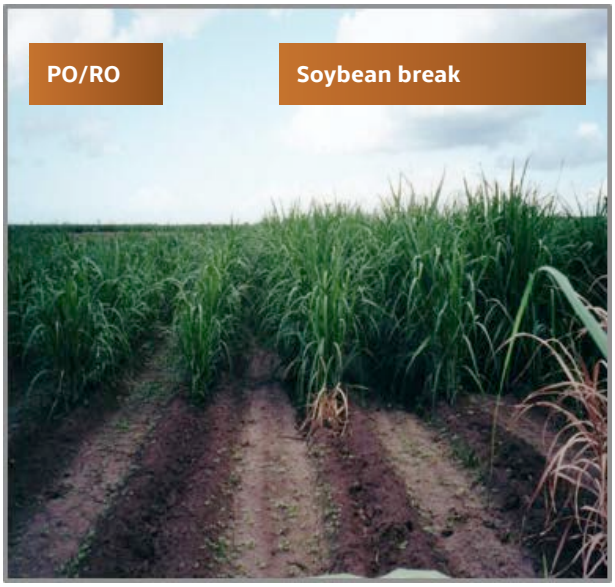
Growing legumes during the fallow will not only improve the long-term health of your soils, but is also one part of an effective farming system that has many other short and long-term benefits. Results from the Sugar Yield Decline Joint Venture project (SYDJV 1999–2007) illustrated that **legume breaks produce**:

- **Improvements in soil health through better balanced biology**
- **Fewer sugarcane root pathogens**
- **Biologically-fixed nitrogen, which reduces the need for inorganic nitrogen fertiliser**
- **Better cane growth resulting in improved yield and profitability**
- **Soil structure improvement through taproot of legumes compared with the adventitious root system of sugarcane**

**Below:** Cane yields from crops planted with plough-out replant and fallow planting system (SYDJV 2007).

| Site and crop class | Cane yield (t/ha) in plough-out-replant system | Cane yield (t/ha) following legume fallow crop |
|---|---|---|
| Tully (P) | 88 | 102 |
| Ingham (P) | 48 | 61 |
| Mackay (P) | 63 | 90 |
| Mackay (R1) | 92 | 116 |
| Bundaberg (P) | 107 | 124 |
| Bundaberg (R1) | 110 | 138 |
| Bundaberg (R2) | 107 | 125 |

**Below:** Cane yields from crops planted with plough-out replant and fallow planting system (SYDJV 2007).




**Above:** Cane plants comparison between crops planted following plough-out replant (PO/RO) and soy fallow (SYDJV 2017).

| Treatment | Cane yield (t/ha) |
|---|---|
| Early cane plant, soybean crop incorporated | 160.5 |
| Late cane plant, soybean crop incorporated | 120.3 |
| Late cane plant, soybean crop harvested | 125.5 |

Trials comparing soybeans, mungbeans, cowpea and peanuts demonstrated that soybeans were the most preferred legume as they produced more dry matter and accumulated the most nitrogen. (Garside *et al.* 2001). Nevertheless, other legumes and/or alternative fallow crops present other opportunities that should be considered (e.g. mungbeans short growing season and potential economic return). Since above mentioned work was conducted fallow options like sun hemp have become available, and mixed species fallow have been trialled on farms in the Herbert and Central regions.

**Below:** Calculation of N contribution from a legume crop (SYDJV Data).

| Legume crop | Fallow crop dry mass (t/ha) | N% | Total N contribution (kg/ha) | N contribution if grain harvested (kg/ha) |
|---|---|---|---|---|
| Soybean | 8 | 3.5 | 360 | 120 |
| | 6 | | 270 | 90 |
| | 4 | | 180 | 60 |
| | 2 | | 90 | 30 |
| Peanut | 8 | 3 | N/A | 125 |
| | 6 | | | 100 |
| | 4 | | | 65 |
| | 2 | | | 25 |
| Cowpea | 8 | 2.8 | 290 | 100 |
| | 6 | | 220 | 75 |
| | 4 | | 145 | 50 |
| | 2 | | 70 | 25 |
| Lablab | 8 | 2.3 | 240 | 80 |
| | 6 | | 180 | 60 |
| | 4 | | 120 | 40 |
| | 2 | | 60 | 30 |

**Below:** Nitrogen returned for different legume species or management from experiments in North QLD (SYDJV Data).

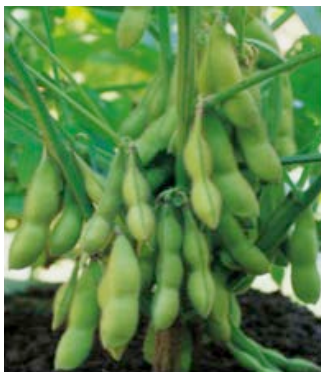
| Fallow management situation | Nitrogen input (kg/ha) |
|---|---|
| Unmanaged cowpea | 31 |
| Unmanaged lablab | 76 |
| Well managed cowpea | 140 |
| Well managed soybean | 150–310 |

Key findings from SRA/DAFF project *Cropping solutions for the sugarcane farming systems of the Burdekin (2015077)* highlighted that:

- **The best yield results can be gained when sugarcane planting is maintained in autumn. Later planting times (July/August) are associated with cane yield declines in the Burdekin region.**
- **Short duration fallow crops such as mung bean and some soybean varieties can be harvested whilst maintaining sugarcane planting in the optimum autumn period.**
- **Legume residue management is important, as incorporation of green residue immediately prior to planting sugarcane had a negative effect on sugarcane yield.**
- **Extended fallow periods (17 months) had a positive effect on plant cane yields (~25%), however no difference was found in the ratoons.**
- **Grower gross margins were improved with the inclusion of a fallow cash crop into the sugarcane farming system.**

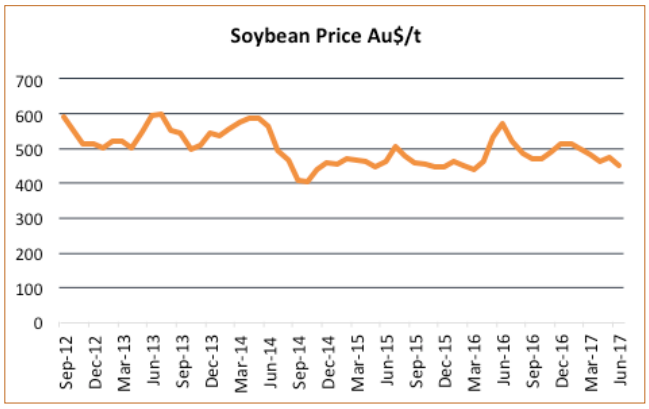
Soybeans and mungbeans have been a popular choice of legume to plant during the fallow. In the Burdekin, sugarcane growers with long-standing legume fallow experience advocate that both soy and mungbeans have a place in the farming system. Generally, soy for the wetter and mung dryer time of the year. However, weather permitting, growers are also having success with mungs planted in January.

## Soybeans



Soybeans offer attractive opportunities for income diversification and improved cash flow. Using an equivalent five-year average price around **$500/tonne for soybeans** (See graph opposite) and a yield potential in the Burdekin that can reach up to 4T/ha, **gross income of around $2000/ha could be expected**. Conservative yield estimates of 2–2.5t/ha are recommended for budgeting purposes.

***Note:*** *Prices are indicative only – fluctuating on basis of annual market, crop grading and associated charges.*




*(Data sourced from http://www.indexmundi.com/commodities/?commodity=soybeans&months=60&currency=aud)*

Whilst soybeans present agronomic and financial advantages as both green manure and harvested crop, a **choice of variety and good planning** (growing season to harvest maturity: 4–5 months) are critical to avoid planting cane too late.

**Leichhardt and Stuart** are generally recommended as the two commercially proven soybean varieties for the Central and Northern regions (QDAF). However, in a recent trial, Farmacist concluded that **A6785** also proves to be a good choice for the Burdekin with **comparable yield to Leichardt and crop maturity three weeks earlier**. In the same trial, Bunya was also identified as an early crop but with significantly lower yield (Bunya can attract a premium price due to a clear hilum sought by the tofu market).

**Below:** Fallow crop gross margins (SRA 2015 77 Data).
*Note: Cowpea crop = green manure*

| | Mung beans | Soy beans | Cow peas | Bare |
|---|---|---|---|---|
| Yield (t/ha) | 1.8 | 4 | 0 | 0 |
| On-farm price (mean, $/t) | 870 | 475 | 0 | 0 |
| **On-farm revenue ($/ha)** | **1566** | **1900** | **0** | **0** |
| Planting ($/ha) | 123 | 195 | 161 | 0 |
| Crop nutrition ($/ha) | 0 | 0 | 0 | 0 |
| Weed & pest control ($/ha) | 168 | 142 | 37 | 86 |
| Irrigation ($/ha) | 99 | 148 | 63 | 0 |
| Pre-harvest spray & harvesting ($/ha) | 128 | 148 | 0 | 0 |
| Other ($/ha) | 50 | 50 | 118 | 0 |
| Total variable cost ($/ha) | 568 | 683 | 379 | 86 |
| **Gross margin ($/ha)** | **998** | **1217** | **-379** | **-86** |

## Mungbeans

As for soy, mungbeans offer interesting N and cash returns, with the added benefit of a shorter growing season (2–3 months). Current prices indicate **$700-1000/tonne for mungbeans (2017)**. Using an average/conservative yield in the Burdekin around **two tonnes per hectare, gross income ranging between $1400–2000/ha could be expected**.

***Note:*** *Prices are indicative only – fluctuating on basis of annual market, crop grading and associated charges.*

**Below:** Cane yield following mung or soybean (SRA 2015 077): No significant difference in sugar yield after the plant crop following mung, soy or extended multispecies fallow.

| Fallow length (months) | Planting month | Fallow species | Cane yield (t/ha) | | | | Sugar yield (t/ha) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | P | 1R | 2R | Total (P-2R) | P | 1R | 2R | Total (P-2R) |
| 6 | April | Mungbean | 157.6 | 167.1 | 132.7 | 457.4 | 22.4 | 25.8 | 20.2 | 68.4 |
| 7 | May | Soybean | 162.8 | 168.4 | 122.0 | 453.2 | 24.1 | 26.2 | 18.8 | 69.0 |
| 17 | April | Soy-maize-mung | 195.6 | 168.4 | 118.9 | 482.9 | 30.3 | 26.4 | 17.7 | 74.4 |
| 17 | April | Cotton-maize-mung | 182.2 | 171.0 | 115.8 | 469.0 | 26.8 | 27.7 | 17.8 | 72.3 |
| LSD$^{(0.05)}$ | | | *24.9* | *ns* | *ns* | *38.5* | *4.6* | *ns* | *ns* | *7.7* |

**Below:** Average mung yield (t/ha) of nine trials from September 2012 to September 2015 (CSIRO 2016).

| | Years | Sowing time | Crystal t/ha | Jade t/ha |
|---|---|---|---|---|
| 6 Trials | 2012–15 | Mid Aug – Late Sept | 2.21 | 2.13 |
| 3 Trials | 2013* & 15 | Mid Jan – Early Feb | 2.15 | 2.13 |

**Range:**
Crystal = 1.60 to 2.82 t/ha
Jade = 1.62 to 2.62 t/ha
No statistical difference in yield
*2014 crop/trial lost to birds and rain

Whilst shorter growing season gives an advantage over soybean in terms of earlier cane planting, **timely crop management is critical** (i.e. prediction three key growth stages – 1st flower, 1st mature pod and desiccation – plan key management activities e.g. early flowing irrigation vs last irrigation to set crop for harvest).

***Note:*** *If/when planting legumes for grain, engaging an agronomist is advised to undertake regular pests and diseases inspections (factor consultancy fees when budgeting).*

## Green manures

**Cowpea**

**Lablab**

**Sun hemp**

It is recommended to allow large biomass green manure crop/residue to break down before incorporating (more so on heavier soils) to prevent N draw down on following cane crop and possible allelopathic effect. Alternatively, incorporate green residue well before planting cane (6–8 weeks).

## References and additional information


Dowie. J (2013). *Developing a robust soybean industry in central and northern Queensland – Results from the Burdekin district for the 2013 season.* Farmacist report for the United Soybean Growers Group.

Drew. E (2012). *Inoculating legumes: A practical guide.* GRDC https://grdc.com.au/resources-and-publications/all-publications/bookshop/2015/07/inoculating-legumes

Garside. A, Bell. M (2006). *Final Report – SRDC Project YDV002 Sugar Yield Decline Joint Venture Phase 2 (July 1999 – June 2006).* http://elibrary.sugarresearch.com.au/handle/11079/1108

Garside. A, Bell. M, Halpin. N, Berthelsen. J (2001). *Species and management of fallow legumes in sugarcane farming systems.* Australian Society of Agronomy 2001.

Garside. A, Bell. M, Halpin. N, Berthelsen. J (2007). *Soybeans in the sugarcane cropping system.* SYDJV http://www.australianoilseeds.com/__data/assets/pdf_file/0016/2608/Garside.pdf

Gendry. J, (2011). *Mungbean management guide.* DEEDI. https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/mungbeans/mungbean-management-guide-2011

QLD DAF. *Soybeans for grain in coastal districts.* https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/soybeans/growing-guide/coastal-soybean-cropping-guidelines/grain-in-coastal-districts#Grain_yields

QLD DAF. *Mungbean production in Queensland.* https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/mungbeans

Salter. B (2017). *Final Report – SRA Project 2015077 Cropping solutions for the sugarcane farming systems of the Burdekin.*

Yeates. S (2016). *Mung bean agronomy update.* CSIRO.

Young. R, Poggio. M (2007). *A case study on the use of legume crop rotations in sugarcane.* Future Cane.