

# Biofumigation



Tas Farming Futures  
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Biofumigation is the use of specialised *Brassica* cultivars and some sorghum varieties, which are grown, pulverised and incorporated into the soil prior to cropping. High biomass and especially masses of roots can provide the traditional benefits of green manure crops, *PLUS* these plants have naturally occurring compounds that, if done right, can suppress various soilbourne pests, diseases and weeds.

## Quick facts

- When biofumigation crops are macerated, glucosinolates (GSLs) are broken down and active compounds, including isothiocyanates (ITCs) are released. These are highly toxic to many soil-borne pests, diseases and weed seedlings.
- To contain the active compound in the soil for as long as possible, the biofumigation crop must be finely macerated, incorporated directly (within 20-30 minutes), and the soil surface sealed through irrigation, rain or rolling.
- Brassicas can be grown in cool conditions, sorghum needs warmth to survive.
- An interval of about 4 weeks is recommended before planting the commercial crop to ensure the biofumigant doesn't affect the commercial crop.

## Benefits

*Biofumigation crops in your farm's rotation can improve overall efficiency and productivity. The benefits of correctly incorporating biofumigant crops include improvements in soil health and a reduction in farm inputs. In order to reap the full rewards of biofumigation, specific crop management and incorporation techniques must be used. Benefits are dependent on local climate and soil conditions, the type of biofumigant crop used and its management.*

## Common biofumigant crops

In Australia, some commonly used biofumigant crops include:

- Caliente 199™ (mustard)
- Fumig8tor™ (sorghum)
- Nemat™ (arugula)
- Nemclear™ (mustard)

## Soil biology

Biofumigation crops act as a break crop, breaking the lifecycle of pests and diseases. Suppression may result from direct biocidal toxicity as well as indirectly through changes in the soil fauna and microbial community. Populations of beneficial microorganisms, including mycorrhizal fungi, have been found to increase after biofumigant crops.

## Weed suppression

Early vigorous growth and improved plant vigour helps to outcompete weeds. When incorporated correctly, the release of isothiocyanates (ITCs) from the biofumigant crop leads to the biocidal burning of weed seedlings.

## Soil organic matter

Organic matter is replenished in the soil after crop incorporation. As microorganisms break down organic matter they produce sticky substances that bond soil particles together into soil aggregates. This, in turn improves:

- Water infiltration and, water and air holding capacity,
- Structural stability, reducing the risk of compaction,
- Soil friability, making the soil easier to work,
- The soil's resilience to wind and water erosion,
- Nutrient holding capacity,
- Overall microbial activity and
- Root growth.

Organic matter also buffers against changes in pH, salinity or sodicity and it inactivates or filters toxic elements.

## Nutrient cycling

Deep-rooted break crops can access nutrients stored deeper within the soil profile that are unavailable to shallow-rooted crops. The nutrients become available to the next cash crop. Increased rates of nitrogen mineralization following brassica and other break crops have been recorded.

## Managing a biofumigant crop

Growing a biofumigation crop requires good management and attention to detail similar to a cash crop. Unlike many of the low input, low management green manure crops, they may need some looking after, including fertiliser and irrigation.

To get the most out of biofumigant crops you need to:

- Choose the right variety. There are several varieties available, each with specific requirements and benefits.
- Have the necessary equipment to ensure the correct management takes place.
- Plant at the best time within your rotation.
- Know your soil nutrient status. Test your soils to ensure appropriate nutrient management for the biofumigant crop as well as other crops in your rotation. Make sure soil sulphur levels are adequate.
- Time biofumigant crop growth to maximise production of the active compound. For example, GSL levels are highest at 20-25% flowering.
- Seed at the rate recommended by the seed supplier to get the most benefit.
- Macerate and incorporate only if soil moisture levels are not too high, otherwise soil structure will be damaged.
- Incorporate the well-macerated biofumigant straight away to release the active compound. Soil temperature >12 degrees for example improves ITC formation.

Benefits of biofumigants will not always happen after the first crop.

Biofumigants cannot be grazed.

**All agronomy management practices should be discussed with your agronomist or production advisor.**



### Case study farmer: Darren Long

**Location:** Sheffield, TAS

**Crop area:** 20ha plus 35ha of contracted land

**Enterprise:** Fresh market potatoes

**Average annual rainfall:** 1,050mm

After noting the decline in soil resilience and increase in disease pressure on his property, Darren started looking at different ways to run his potato operation. For the last 15 years he has trialled different biofumigation crops and in the last 4 years he has used 'Caliente' as one approach in an integrated system. Now he is reaping the rewards. He relies less on applied fertilisers and chemicals (fungicides, pesticides and herbicides), needs fewer irrigations, has healthier soil and no longer has high disease pressure, including Powdery Scab and *Rhizoctonia*.

One method for estimating nitrogen use efficiency (NUE%) is the *partial nitrogen balance* (also known as *removal to use ratio*). It calculates NUE% as the ratio between the amount of fertiliser nitrogen applied and the amount of nitrogen removed with the harvested crop.

Through the Tas Farming Futures project Darren calculated his nitrogen use efficiency (NUE%) for two of his paddocks with a 3-year rotation of potatoes, pasture hay and Caliente. The NUE% for the pasture hay and potato crops as well as the overall NUE% is greater than 100% demonstrating that the crops are very efficient and/or gain nitrogen from sources other than synthetic fertiliser. Whilst high NUE% can indicate soil mining of nitrogen, Darren's soil tests show that the extra nitrogen added by the cover crops are ensuring nitrogen in the soil is not depleted.

## Working with industry and NRMs statewide

Resources available online  
[www.tasfarmingfutures.com.au](http://www.tasfarmingfutures.com.au)

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### Like to know more?

Contact our extension team:

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*We can visit you on-farm and support  
you with improving farm efficiency &  
reducing GHG emissions*



Biofumigant crops can potentially reduce nitrogen fertiliser use, therefore also reducing nitrous oxide emissions!