INNOVATIVE CARBON STORAGE AND NITROGEN MANAGEMENT STRATEGIES IN THE WA WHEATBELT

Year: 2012 - 2016

Funding Provider:
Australian Government

Lead Organisation:
Liebe Group

Collaborators
UWA

Location:
Multiple in Liebe Group region

PROJECT FUNDERS

Australian Government

REPORTS & LINKS

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Aim:
This project has two main aims:

1. *Reduce nitrous oxide emissions:* To trial and demonstrate innovative on-farm practices that can reduce nitrous oxide emissions, through the rotational use of leguminous crops to reduce the use of nitrogenous based fertilisers whilst maximising net primary production (biomass).

2. *Increase carbon stored in soil:* To trial and demonstrate innovative on-farm practices that can increase the sequestration of carbon in soil, through the use of biochar, soil amendments, biological amendments, and use of additional composting materials to develop economically viable farming practices that sustainably build and store soil carbon.

Project Background:
The project investigated on-farm practices to reduce nitrous oxide emissions and increase sequestration of soil carbon through the rotational use of legumes and the addition of soil amendments (including biochar, compost, manure, and biological amendments) on paired sites on nine cropping and grazing farms throughout the Western Australian wheatbelt.

Carbon (C) is an important part of maintaining soil health and the productivity of the soil. It provides an energy source for many functions considered important for soil biological health, including the transformation of nutrients to more plant available forms, increasing soil pH buffering capacity, increasing cation exchange capacity, stabilisation of soil structure, and the degradation of soil pollutants.

Building soil carbon is a product of soil type, climate, and management factors. The soil organic content that can be achieved depends not only on the potential of the soil to protect C but also on the productivity of the crop or pasture. Theoretically, there is a soil carbon upper and lower limit in all soils.

Previous research conducted by the Liebe Group show that in the low rainfall environment in the Northern Wheatbelt of Western Australia, the upper and lower limits of soil carbon will reach an equilibrium over time, that is where the microbial decomposition of organic carbon is lower (upper limit) or higher (lower limit) than the input of new carbon inputs.

The challenge for our farming system is to find methods to push our current carbon storage equilibrium more towards the upper limit and thus the soils potential and keep it at that current equilibrium.

The Liebe Group has a strong history in research, development, extension, and validation of agricultural practices that improve the economic, environmental, and social aspects to a farm business.

Project Activities:

- *Impact of rotation on fertiliser efficiency and nitrous oxide emissions: Dalwallinu*

Locally referred to by growers as the 'Practice for Profit' trial the heavy clay site has been home to the trial from 2010 to 2017. Four different crop types are compared (canola, wheat, field peas and volunteer pasture) in different rotations. Over top of the crop types, high and low fertiliser regimes are compared to see which combination has the least nitrous oxide emissions.

- *Testing the forage shrub Tedera: Watheroo*

Tedera, a drought tolerant legume, has shown an excellent ability to produce sheep feed over summer on good yellow sand at the Liebe Groups' Buntine site. This project tested the plants ability to grow on the poorer quality land which is unsuitable for cropping. Results were anticipated to provide great benefit to farmers by producing sheep feed over autumn when there is no other feed around. The group investigated if the root system of Tedera would increase carbon storage in areas of soil where other plants will not grow. Seedlings were planted in August 2013.

- *Bentonite clay incorporation for increasing production on sandy soil: North Miling*

Trial investigating if increasing the clay content of a soil by adding a soil amendment (bentonite clay) will increase biomass production, which in turn will increase soil C.

- *Using cereal rye to increase soil carbon: Wubin*

This patch of soil became so windblown and low in C that it would not grow conventional crops like wheat, so the Liebe Group and local farmers tried cereal rye. This deep rooted, drought-tolerant plant is on its way to increasing soil carbon.

- *Can mouldboard ploughing increase soil carbon storage by ameliorating soil constraints?: Buntine*

Investigation into creating a soil free of constraints, such as acidity and compaction, to see if crop roots will be able to grow more extensively and thus store more carbon in the soil. This trial compares the effectiveness of a mouldboard plough and deep ripper in ameliorating these constraints.

- *Biochar: Buntine*

Biochar, the by-product of using organic matter such as old mallee's for electricity generation, has potential as a carbon storage method. In this trial 4t/ha of biochar was added to a deep yellow sand.

- *Brown maturing: Buntine*

In this trial Liebe returned the 2012 canola crop to the soil using offset disks to see if the economic benefits of increased nutrition, weed control, and carbon storage in future years outweigh the loss of grain income in 2012.