GISERA
Gas Industry Social and Environmental Research Alliance

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AGRICULTURAL LAND MANAGEMENT FACTSHEET

Soil compaction

Heavy machinery from CSG operations can compact clay soils but rehabilitation should restore productivity.

An example of a CSG work-over rig in action on a cultivated field.

KEY POINTS

- Soil compaction has been found to be higher in areas around CSG wells than in neighbouring fields.
- The levels of compaction were similar to those tested in agronomic trials in Queensland which found yield impacts of up to 43% and 5 years for rehabilitation by natural processes.
- Simulation modelling suggests that rehabilitation of damage to the surface 30 cm may remove most of the impact on crop production. Rehabilitation would need to be undertaken under suitable soil moisture conditions.

What is "soil compaction"?

Soils can be compacted by movements of farm or CSG machinery across them. Compression of soils can cause reduction in soil volume and therefore soil pore space. This can decrease the rates at which rainfall can infiltrate into the soil. It can also make it more difficult for roots to penetrate. As a result, plant growth rates can be severely reduced under high levels of compactions.

The Darling Downs is well known for the high quality of its clay soils. As a result, state government legislation has been developed to protect areas of strategic value to agricultural production. Protection of such lands requires consideration of possible soil damage from CSG development, such as soil compaction.

Soil compaction has long been considered an important issue for soils of the region and modern farming methods have been developed to minimise damage to these soils from farm machinery. However, it has not been clear what damage may result from the large numbers of vehicles used along CSG pipelines and access tracks and within lease areas.

Research findings

GISERA research has investigated the level of compaction related to CSG activities. Studies for wells on clay soils on the Darling Downs found that soil compaction was higher within areas of CSG activity and as a result water infiltration rates were lower. The level of compaction found at the study sites was comparable to previous compaction studies conducted on similar soil types in Queensland, and so these existing studies can provide information on the likely impacts on cropping.

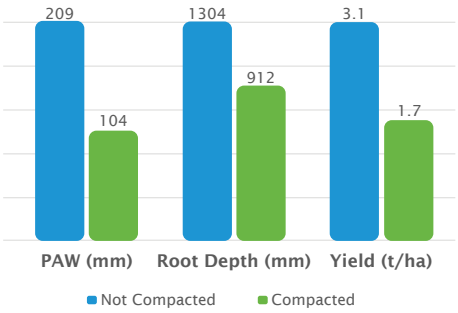
These agronomic trials found that yields were reduced by up to 43% for similar levels of compaction and that rehabilitation of the soil through natural processes during subsequent minimum tillage took approximately five years.

Long term simulation modelling of these soils for the Chinchilla region found similar average reductions in yield (50%) due to reductions in wheat rooting depth (30%) and plant available moisture at sowing (50%). Modelling also suggested that, though existing damage appears to depths of up to 70 cm, careful rehabilitation of the surface 30 cm may be sufficient to overcome impacts on crop production.

Such rehabilitation would need to be carefully undertaken during periods of suitable soil moisture conditions so as to not cause further damage to these soils.

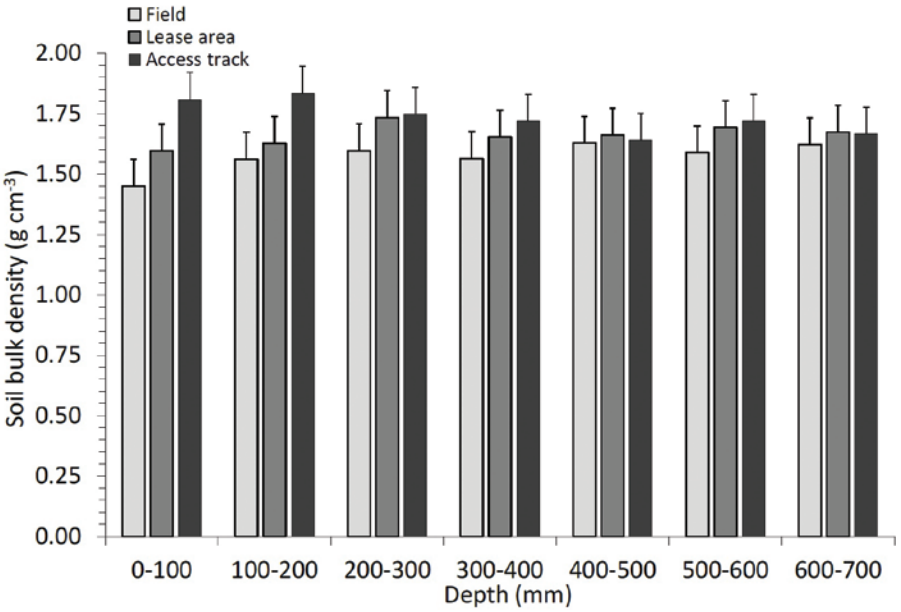
What does this mean for me?

Heavy CSG machinery will be required to access lease areas several times during the lifetime of a CSG well. The level of compaction may need to be considered if farmers are looking to continually crop these areas. Though compaction can occur to depth, it may be that rehabilitation of the surface soils will be adequate for subsequent cropping. Deeper damage may be rehabilitated by natural processes, including shrink-swell cycles observed during wetting and drying. Further consideration of rehabilitation may be required when CSG infrastructure is decommissioned.



Estimated impacts of compaction on plant available water at sowing, wheat rooting depth and yield for 100 years of simulated wheat production for a grey clay soil at Chinchilla.

Visible signs of vehicle movements over most of the lease area after well work-over.



Example results from the study showing that soil bulk density is higher within lease areas and under access tracks. (Note: Compaction increases density).

FREQUENTLY ASKED QUESTIONS

How did you conduct the research?

In conjunction with USQ, we conducted a wide range of soil tests on well pads in the Miles and Cecil Plains districts. These tests were compared to other compaction studies in Queensland and the long term impacts evaluated using simulation modelling.

How did you determine the impact of CSG operations?

We compared soil properties within each lease area or access track with those in neighbouring unaffected soil.

What did you measure?

The surveys measured a range of soil properties including:

- Soil compaction (Bulk Density and Soil Strength)
- Soil structure (Soil and aggregate stability)
- Soil chemistry (pH, EC, ESP, Cations)
- Soil hydrology (Infiltration)

Where do I find more information?

A complete report of this project can be found at the GISERA website:

"*The effects of coal seam gas infrastructure development on arable land*, 2015" at gisera.org.au

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