



SHELL THIOGRO

Agronomy research

Crop and pasture field trials have demonstrated the effectiveness of sulphur-enhanced fertilizer produced with Shell Thiogro technology. Recognising the agricultural issue of sulphur-deficiency in soils, these trials have been conducted in diverse countries, climates and soil types.

The outcome is an aggregate of data that demonstrates the effectiveness of Shell Thiogro technology:

- To safely “micronise” elemental sulphur into fine particles which are then effectively oxidised in soils to sulphate, the plant nutrient form of soil sulphur
- To customise the amount of elemental and sulphate sulphur as needed for particular crops and regions
- To effectively incorporate these particles into ammonium phosphate and triple superphosphate fertilizer granules in a way that resists breaking up during transport and application.

Fertilizer made with Shell Thiogro technology, produced a weighted mean yield increase of 18%, averaged over 118 sulphur responsive sites in four countries*

The benefits of sulphur-enhanced fertilizer on yield and other crop attributes is timely, given pressures to produce more food¹ in a way that does not encroach on forests and other natural areas:

Crop yields

- Tomato yield increased 9% in China field trials conducted by a grower for the world’s largest producer of tomato-based pastes and sauces
- In China, a fertilizer producer has noted a yield increase of 11% in rice
- Clovers are important in animal nutrition; a 98% increase in annual clover production with Shell Thiogro-produced fertilizer has been recorded in temperate Australia
- Soybean yields increased an average of 18% with Shell Thiogro-produced fertilizer in eight field trials in Brazil.

1. The UN Food and Agriculture Organisation estimates that 70% more food must be produced by 2050 to feed the world’s growing population.

More findings

Field trials, like other scientific experiments, are replicated within sites, over seasons and planting areas, before drawing firm conclusions. With nearly six years of trials – mostly in China – along with the growing body of knowledge on sulphur as an essential plant nutrient, Shell has learned:

- Sulphur deficiency limits crop yields in many important food-producing areas of the world
- Incorporation of fast and slow release sulphur into ammonium phosphate and triple superphosphate fertilizers provides better-balanced nutrition to crops
- The sulphur in Shell Thiogro-produced fertilizer may result in increased efficiency of utilisation of the other fertilizer plant nutrients; especially, nitrogen and phosphorus
- In some cash crops, both yield and quality have increased following Shell Thiogro-produced fertilizer application
- In Australia, Shell Thiogro-produced fertilizer application improved the quantity and quality of animal forage thanks to the resultant increase in clover content
- Laboratory and glasshouse tests have shown that the micro-fine particle size of the elemental sulphur readily oxidises to plant-available sulphate
- Collaboration with the best research and production groups in the various countries has resulted in reliable, verifiable and important findings about sulphur.

*Shell Thiogro field trial research, July 2010.

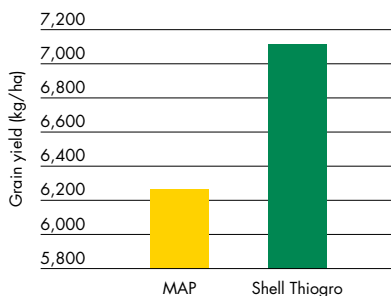


Field Trials have been conducted or are underway in various parts of the world known for sulphur-deficient soils; Australia, Brazil, China, India and Argentina. We work with universities, government agencies, larger farming operations and fertilizer producers (the latter being potential Shell Thiogro technology licensees) to carry out the trials. Shell has also co-sponsored trials with The Sulphur Institute.

Shell Thiogro field testing in China

An average rice yield increase of **13%** was obtained with Shell Thiogro-produced fertilizer at 21 sulphur responsive sites in China.

Rice, China

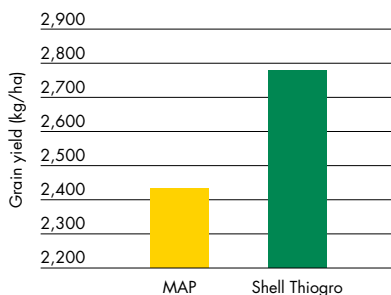


Shell Thiogro field trials include a variety of crops in these locations.

Shell Thiogro field testing in Brazil

Soybean yields increased by an average of **18%** with Shell Thiogro-produced fertilizer at eight sulphur responsive trial sites in Brazil.

Soybean, Brazil

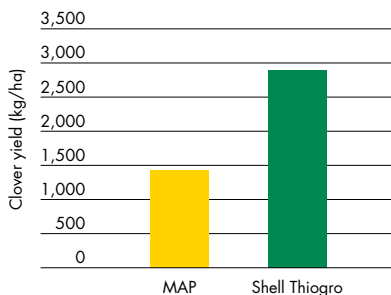


Shell Thiogro field trials include a variety of crops in these locations.

Shell Thiogro field testing in Australia

A **98% increase** in clover production with Shell Thiogro-produced fertilizer has been recorded in temperate Australia.

Clover Pasture, Australia



Shell Thiogro field trials include a variety of crops in these locations.

For further information

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