GOVERNMENT OF WESTERN AUSTRALIA

Department of **Water and Environmental Regulation**

Department of **Primary Industries and Regional Development**

Soil amendments

Fact sheet

Keeping phosphorus on farms and out of waterways

The Department of Water and Environmental Regulation is working with farmers in the south-west of Western Australia to find ways of modifying soils to reduce phosphorus lost from farms into waterways. Materials with a high phosphorus-retention capacity are being trialled on paddocks with sandy soils to ensure phosphorus stays in the topsoils for longer, reducing the amount washed off the farm and into waterways.

What are soil amendments?

Soil amendments are bulk, granular materials with a high phosphorus-retention capacity. They typically contain minerals, such as iron oxide, which help to hold phosphorus in soil. These materials are either applied to the surface of the soil or mixed into the soil to increase its ability to hold phosphorus. This prevents phosphorus being washed into nearby waterways where it can fuel algal growth and unbalance the ecosystem.

Recent trials have used Iron Man Gypsum (IMG) produced by Iluka Resources Ltd in Capel.

Farms with areas of clay can use it as a soil amendment by digging it up and mixing it into nearby sandy paddocks to increase the soil's phosphorus-retention capacity.

Iron Man Gypsum (IMG) is a granular soil amendment with a high iron oxide content, which holds phosphorus in the soil.

What is the problem with sandy soils?

Many grey, sandy soils of south-west WA are poor at retaining phosphorus during winter. Fertiliser (mostly consisting of phosphorus) can be washed into streams, wetlands and estuaries during rainy periods if the soil can't retain it.

Even small amounts of phosphorus washed from paddocks (less than 5 kg/ha/year) can fuel large algal growth in estuaries and waterways.

Sudden excess algal growth (called an algal bloom) can create seasonal dead zones, killing fish and other aquatic life because of low oxygen or algal toxins in the water.

The challenge for farmers with sandy soils is to provide sufficient nutrients for optimal plant growth and minimise the amount of phosphorus lost to the environment.

Areas of farms where phosphorus can easily become overloaded and wash from paddocks into waterways include:

- ⇨ soils with a low phosphorus buffering index (PBI) and high phosphorus levels from years of regular fertiliser applications
- ⇨ stock congregation points (yards, laneways, milking sheds)
- ⇨ animal feeding areas (feedlots) on grey sands.

Algal blooms in the Serpentine River

How do we apply IMG?

Trials in the Peel-Harvey and Vasse-Geographe catchments have tested different methods of applying IMG to dairy paddocks and a recreational oval. Methods included:

Dairy paddocks:

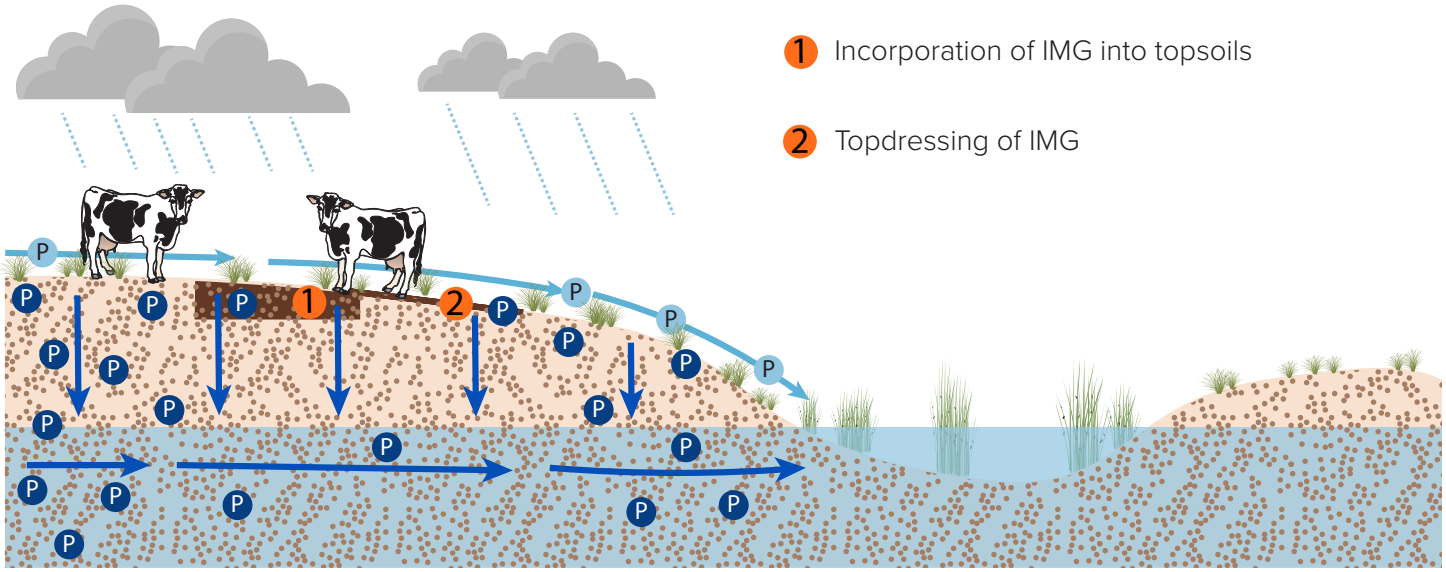
1. Surface topdressing of IMG (at less than 20 t/ha), onto soils with overloaded phosphorus and with exhausted phosphorus-retention capacity
2. Incorporation of IMG into topsoils (at less than 20 t/ha), via power harrowing or speed tilling to aid emergence of new growth.

Recreational oval:

3. Incorporation of IMG into subsoils (at 160 t/ha) to retain phosphorus in the root zone.

Phosphorus often washes into waterways from soils in seasonally wet areas that have been overloaded with phosphorus fertiliser.

How do we apply IMG?



Phosphorus is lost to waterways through surface water runoff and leaching into groundwater. IMG applied to the surface and incorporated into topsoil holds phosphorus and reduces phosphorus entering waterways.

Measuring the impact of soil amendments

The benefits of reduced phosphorus loss as runoff or leachates were measured using custom-made runoff simulators, buried collection devices (lysimeters) and shallow groundwater bores. This was coupled with intensive sampling and soil analysis.

Risk assessments for pasture nutrition, aquatic organisms, cattle health and exposure to humans via cattle products have also been undertaken and confirm the safety of these amendments.

A catchpan and drum (lysimeter) installed to collect water that has leached through the top soil.

A department scientist uses a rainfall simulator to measure phosphorus loss from saturated soil.

Encouraging results for farmers and waterways

Either incorporating or topdressing of IMG substantially reduced phosphorus loss compared with untreated soils, while ensuring phosphorus was still available for plant growth.

Both methods of applying IMG increased the soil PBI without reducing phosphorus available for plant growth (Colwell P).

Mixing IMG into soils stopped 10-20 kg/ha of phosphorus loss per year.

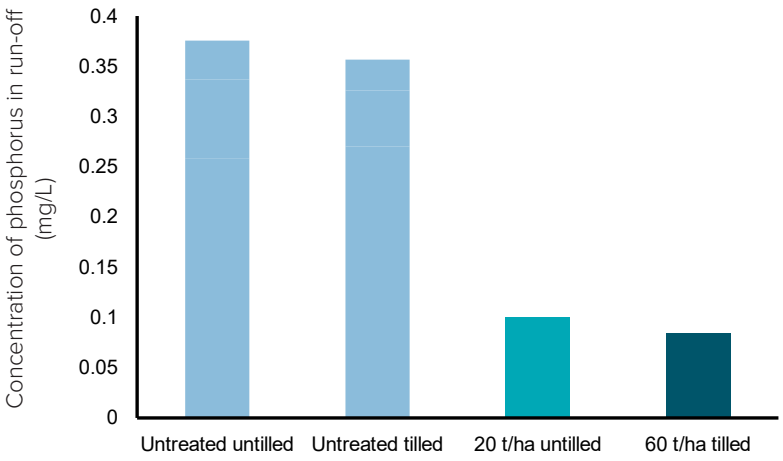
Topdressing IMG at 20 t/ha was just as effective in limiting runoff phosphorus losses as incorporating at 60 t/ha in the first year, but starts to become less effective in the second winter. Topdressing can also reduce phosphorus leaching by up to 80 per cent despite only influencing the surface few centimeters of the soils. Incorporating IMG has benefits of reducing phosphorus loses throughout the whole topsoil.

Soil and leaf tissue testing confirmed that amending soils with IMG did not reduce the availability of potassium, magnesium or any other nutrients.

Future directions

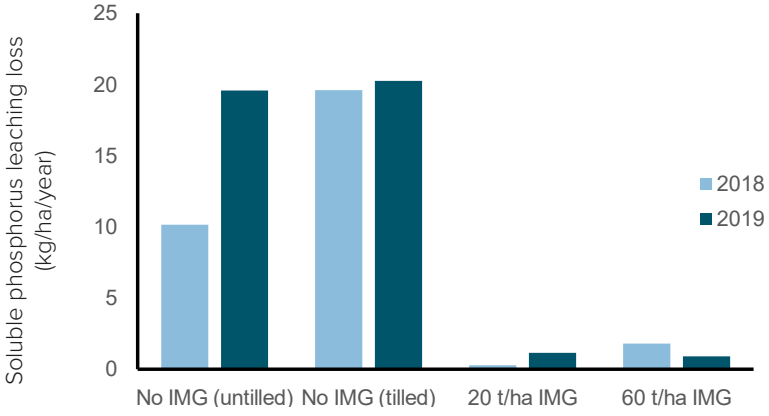
Further trials are being planned to confirm the specific rates of amendment that are needed to target high-risk areas of phosphorus loss on farms, and for how long treatments can be effective. The prospects of using other amendments, such as subsoil and deeper clays, will also be explored, along with further clarification of any aquatic risks, particularly for materials such as IMG.

Keysbrook trial



Phosphorus concentrations in runoff from amended soils were substantially lower than untreated soils. Tilling had very little effect on phosphorus loss.

Yoongarillup trial



Very little phosphorus leached from soils amended by incorporating IMG, compared with untreated soils.

For more information: estuaries.dwer.wa.gov.au/innovative-remediation/

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