

*A COMMERCIAL APPLICATION OF
VIROSOIL™ TECHNOLOGY*

**CASE STUDY
ACIDIC SOIL (ASS) REMEDIATION
ON A FARM IN THE LOWER TWEED
VALLEY REGION**

“The application of ViroSoil™ Technology is an effective short and long-term solution to the problems of Acid Sulphate Soils.”



Application of ViroBind™ reagent to the soil.

PROBLEM

Acid Sulphate Soils (ASS) can cause severe environmental degradation of both the soil (acid scalds) and nearby waterways (low pH, elevated metal concentrations, and occasional large drops in dissolved oxygen concentration). The environmental impact of acid sulphate soils is often made worse by drainage associated with development of coastal low lands. ASS inhibits plant growth and generate sulphuric acid with elevated metal loads that can kill aquatic life in nearby waterways and corrode steel and concrete infrastructure.

Acid sulphate soils form when pyrite and iron monosulphides (monosulphidic black ooze or MBO) in the soil are exposed to oxygen and moisture and react to produce sulphuric acid. One tonne of pyrite alone can produce over 1.5 tonnes of sulphuric acid and there is an estimated 100,000,000 ha of ASS worldwide; a high proportion of these soils are in valuable coastal lowland areas.

The common practice for treating ASS has been to neutralise it with lime. However, this form of treatment is only a temporary solution because, over a few years most of the lime will be washed away by runoff or leached out with groundwater adversely affecting nearby aquatic ecosystems and costing the land owner a lot of money. Some terrestrial ecosystems can also be adversely affected by exposure to large quantities of lime. Virotec's ViroSoil™ Technology has none of these disadvantages. ViroBind™ reagent, used as part of a total ViroSoil™ Technology solution, will outperform and outlast lime, particularly in the treatment of unoxidised sulphidic soils or subsurface acidity, and cannot be deactivated by iron- or aluminum-oxyhydroxide precipitates.

Moreover, ViroBind™ reagent can not accelerate sulphide decomposition, and will not cause the formation of gypsum that can precipitate in soil pores and adversely affect soil texture and drainage.

A project using ViroSoil™ Technology was established on a farm in the lower Tweed Valley region. Large parts of the farm had moderate ASS problems and there was a need for a long-term solution.

VIROTEC TOTAL SOLUTION

ViroSoil™ Technology neutralises actual acidity in the soil, prevents potential acidity from becoming actual acidity, enhances phosphate retention in the soil, and actively promotes plant growth.

ViroSoil™ Technology also prevents the leaching of heavy metals and metal uptake by plants or soil fauna (e.g. worms) by binding them as new, chemically and physically stable mineral phases with very low solubilities or incorporating them into existing minerals. These new mineral phases remain stable, even if there are large changes in acidity, redox conditions and temperature over time.

BACKGROUND

Acid Sulphate Soils are a serious environmental problem that threatens huge economic losses to agriculture and land development. They form when iron monosulphides (e.g. greigite or melnikovite) and disulphides (e.g. pyrite) when exposed to oxygen and moisture, and react to produce sulfuric acid; one tonne of pyrite alone can produce 1.5 tonnes of sulfuric acid. This acid can leach metals from the soil, cause phosphate to be bound such that it is not available to plants, and has adverse impacts on both the soil and nearby aquatic environments. In ASS-affected areas the soils

commonly show substantially reduced fertility and in some areas that have large acid scalds can be completely devoid of vegetation.

In addition to its direct effects, the acid can increase the availability of toxic elements to plants while decreasing the availability of essential elements that plants require for healthy growth, thereby decreasing agricultural productivity. Once it reaches aquatic environments, this metal bearing acid can kill aquatic organisms and has been linked to outbreaks of 'red spot' ulceration of fish. Unlike lime, which can be leached from the soil, ViroBind™ reagents are largely insoluble and non-dispersive, and their addition to sulphidic soils or sediments can improve desirable soil properties as well as eliminating their acid generating potential or metal release capacity.

TREATMENT METHODS

Three plots were used to determine the effectiveness of ViroSoil™ Technology to neutralise soil acidity and promote healthy plant growth. The first area was left untreated as a control plot; additional MBOs were added to the second plot to make it more of a challenge to treat, and both MBOs and ViroBind™ reagent were added to the third plot. (The MBOs had a sulphide-S content of 0.48%, which is equivalent to a high iron monosulphide mineral content of roughly 1.5%.)

The areas were cultivated using a tractor mounted rotary hoe. Three different native tree species and three different crop types were planted in each plot along with one species of pasture grass. The plots were then watered and mulched to promote soil water retention.

RESULTS

Table 1 shows that the use of ViroBind™ reagent greatly increased the biomass of the radish crop planted. The ViroBind™ reagent treatment was highly effective and produced double the weight of radishes.

More than twice as many maize plants germinated in the ViroBind™ reagent treated soil than in the acid sulphate soil substrate (Table 2), and their subsequent survival rate was substantially higher.



ViroBind™ reagent being mixed with the Acid Sulphate Soil to neutralise acidity and promote crop growth.

TABLE 1: PLANT MASS OF RADISHES PLANTED

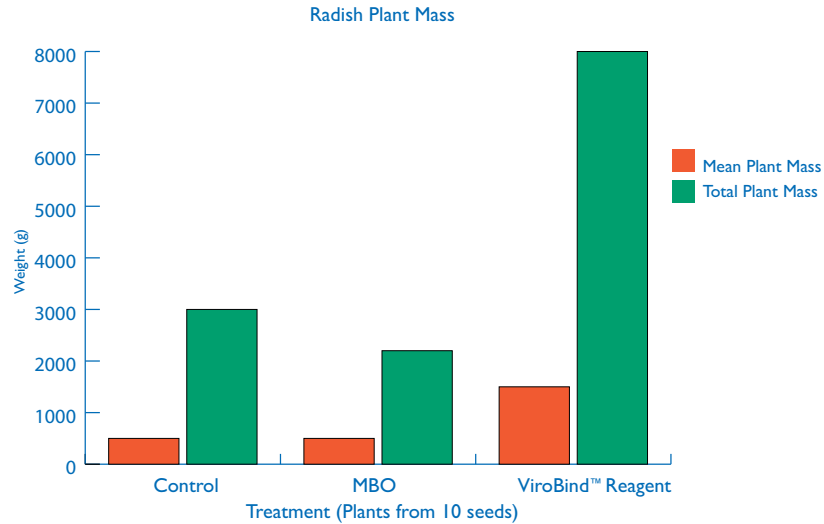
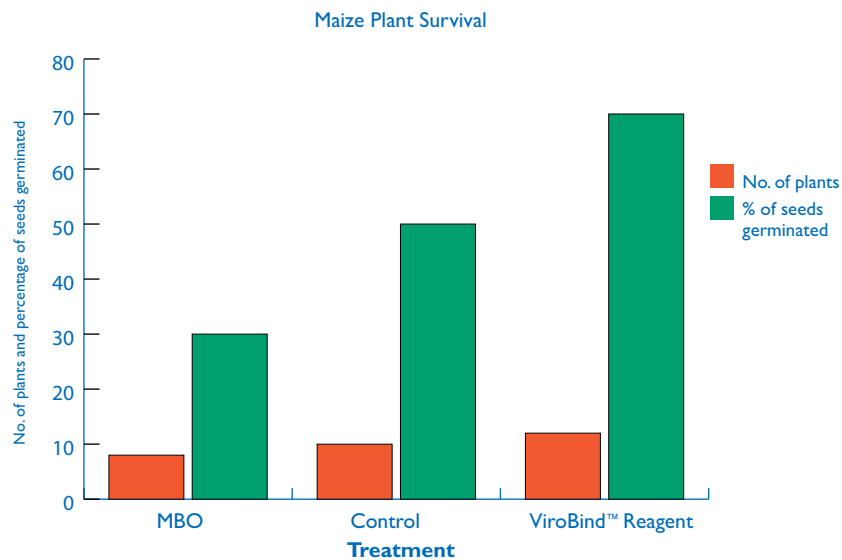


TABLE 2: SURVIVAL RATE OF MAIZE SEEDS PLANTED IN THREE DIFFERENT SOIL TREATMENTS



CONCLUSION

The application of ViroSoil™ Technology to extreme ASS resulted in the successful elimination of acid scald areas and a reduction of potential acid sulphate soil impacts. Furthermore, because the ViroBind™ reagent, unlike lime, does not readily leach from soil, the potential for the soil to become acidic in the future has been minimised. Separate projects have also been found that the addition of ViroBind™ reagent increases the plant nutrient and moisture retention capacity of soils.

The improvement in soil properties and in soil pH resulting from the application of ViroBind™ reagents substantially improved seed germination rates and subsequent plant survival, and increased total biomass productivity. From this it can be concluded that the application of ViroSoil™ Technology is an effective short- and long-term solution to the problems of Acid Sulphate Soils.