AGRICULTURE AND SCIENCE WORKING TOWARDS A SUSTAINABLE FUTURE FOR SUGARCANE ON ACID SULFATE SOILS—A CASE STUDY

By

R.J. QUIRK1, P.J. McGUIRE2, M.D. MELVILLE3, I. WHITE4 and B.C.T. MACDONALD4

1NSW cane farmer, Stotts Ck, 2487, Australia; 2BSES Ltd, Condong, Australia; 3UNSW, Sydney, Australia; 4ANU, Canberra, Australia

rgquirk@bigpond.com.au; pmcguire@bses.org.au

KEYWORDS: Acid Sulfate Soils, Sustainable Agriculture, Collaborative Science.

Abstract

ACID drainage from cane land in the Tweed Valley in northern New South Wales, Australia, caused a major fish kill in 1987. The resulting hostility from the fishing industry and the community had the potential to close down parts of the NSW sugar industry in the late 1980s. In 1990, two farmers made their farms available as intensive study sites for acid sulfate soils. Over the next 13 years, scientists from several universities and research organisations worked with these farmers to better understand how acid is generated and discharged from the landscape. As a result of this work, new management practices have emerged, many of which are now regarded as best practice for managing acid sulfate soils. The management practices developed have reduced acid export by 80% while cane production has increased by 20%. Many of these practices have been extended and adopted throughout the NSW sugar industry and have been promoted in other parts of Australia and overseas. The partnership established between the farmers and scientists has been very beneficial for all concerned and has led to further research that is continuing.

Introduction

In September 2002, 'The 7:30 Report', a national Australian television current affairs program, reported that 'An unusual collaboration between scientists and a cane farmer is helping solve one of Australia’s pressing environmental problems.' This collaboration has not only produced many media reports favourable to the Australian sugar industry but it has also benefited productivity in the industry.

This is a good news story but it had a very bad beginning. This paper describes: why the collaboration became necessary; its shaky beginnings; and how it eventually flourished to become one of the great win-win stories of the Australian sugar industry.

This work has international implications for two reasons. Firstly, acid sulfate soils occur and are a problem in many cane growing areas of the world. Secondly, and more importantly, this work shows the tremendous benefits of effective collaboration between industry practitioners and researchers.

The problem

The Tweed River floodplain, like many coastal floodplains, contains sediments rich in iron sulfide minerals. These soils are known as acid sulfate soils. When excavated and exposed to air, sulfides in the sediment oxidise to form sulfuric acid and produce a toxic runoff. They have been referred to as 'the soils from hell' (Dent, 1986). These soils have a global distribution in most Holocene-age (less than 10 000 years old) estuarine floodplain sediments (Dent, 1986) and, therefore, are likely to occur beneath many cane-growing areas around the World.

In 1987, heavy rain, following a prolonged dry period, resulted in an acid discharge that strongly acidified the entire 23 km of the Tweed River estuary on the east coast of Australia. All fish species were killed, severely disrupting commercial and recreational fishing for around 18 months. As acid discharges had never been identified before (but are believed to have occurred), cane farmers on the flood plain did not believe their soils and farming practices were to blame, despite extensive drainage in cane land. This
led to strong conflict between the local sugar industry and commercial fishers, recreational fishers, oyster farmers and environmentalists. One solution recommended was to re-flood parts of the flood plain. This would have had serious consequences for the viability of Condong Sugar Mill. Subsequent research has shown that this approach would not have contained extensive quantities of acid already existing in the profile (Quirk et al., 2002).

Strange bedfellows

Early discussions between land-holders, sugar mill staff and researchers achieved little. The initial reaction of farmers towards the scientists was, 'How do we get rid of these guys before they cause a problem' (The 7:30 Report, 2002). Land-holders and mill staff rejected the idea that the acid problem arose on cane land. They wanted to further lower the watertable in order to improve cane production. In addition, there was a feeling that farmers were being blamed for the problem (White et al., 2003).

Nonetheless, strong support by local government officers, and a willingness by a few farmers to investigate the problem and try new practices, ensured that a tentative collaboration began.

Learning together

Day-to-day contact and informal discussions between farmers and researchers led each group to a better appreciation of the other's views, aspirations and understanding. The critical moment of the process occurred when two key farmers recognised the problem occurred in their soils and took ownership of the problem.

With understanding came respect and finally trust. According to White et al. (2003):

'It became increasingly clear to researchers that their task was to provide viable options to farmers, not single prescriptive solutions. Researchers' message that acid sulfate soils were a natural phenomenon throughout the world, brought about a dramatic shift in attitude. Farmers began to talk about their acid sulfate soils... Once that happened, farmers became partners and initiators of research. Goodwill and a willingness to listen and learn from the other party ensured that a reluctant partnership turned into cooperation and finally to true collaboration.

Outcomes

The following management practices have been widely adopted throughout the NSW sugar industry and are underpinned by scientific field studies in cane land (see citations):

- Laser grading – to improve surface runoff and reduce infiltration. This in turn reduces the frequency of the acidic watertable reaching the soil surface (White et al., 1993).
- Infilling of some field drains – to reduce the conduit for acid flows and increase the production area.
- Development of shallower drains – to avoid intruding into the acid layer and make for easier drain maintenance (White et al., 1996).
- Liming of drains to neutralise acid releases (Melville and White, 1996).
- Liming of cane fields – to maintain soil pH above that required by the crop.
- Opening of flood gates in dry periods – to let tidal water back-flow into the drain. This stops the drain sludge drying and acidifying; it also allows fish passage (Quirk et al., 2002).
- Use of mounded cane rows – to improve surface drainage.

Most of these changes in practice both improved productivity and reduced acid outflows. Because these were 'win-win' changes, adoption has been both widespread and rapid.

Measurements of water and acid flows at the main study site (McLeod's Ck) show acid outflows have been reduced by up to 80 percent (Collins, 2001). Cane production on Robert Quirk's farm has increased from under 7000 tonnes to more than 10 000 tonnes in the 10 years to the 2003 season. In that time, yield per hectare 'has increased from 4% below district average to 6% above average (J. Tait, pers. comm.).

But perhaps the biggest change was the change in attitude and a willingness to take on new ideas and practices. This change occurred not only with the farmers and scientists but also with regulators. Recognition by government of both the new management practices and the successful working partnership resulted in the NSW sugar industry gaining self regulation for managing ASS (Beattie et al., 2005). The NSW sugar industry was the first agricultural industry in Australia to achieve this kind of self regulation (Beattie et al., 2001).
Conclusion

The NSW sugar industry is now seen as a world leader on an issue that, less than a decade ago, many thought would spell its end. This has been made possible by embracing research, working with regulatory agencies, and keeping the whole industry informed and involved through a major extension campaign.

Acid sulfate soils represent an emerging global environmental problem including many coastal sugar producing areas. Hence, some of the technical solutions described may be applicable in those areas. However, the more important conclusion is that a solution was found only because of effective collaboration between the industry and the scientific community.

There are many issues that bring industry into conflict with government, the community and other industries. The authors believe that a pro-active and engaging approach not only produces the best outcome for all parties but also builds valuable relationships between the parties.

As ‘The 7:30 Report’ concluded, ‘The farm is (now) an environmental showpiece.’

There are many others issues that face sugarcane growing areas where a similar approach is desirable. Such issues include:

- Nutrient management;
- Pesticide runoff;
- Erosion and siltation;
- Habitat preservation and provision.

So we haven’t finished yet...

REFERENCES


LE PARTENARIAT DE L’AGRICULTURE ET DE LA SCIENCE POUR UNE PRODUCTION DURABLE DE LA CANNE À SUCRE DANS LES SOLS SULFATÉS ACIDES—NE ÉTUDE DE CAS

R.J. QUIRK1, P.J. McGUIRE2, M.D. MELVILLE3,
I. WHITE4 et B.C.T. MACDONALD4

1NSW canefarmer, Stotts Ck, 2487, Australia; 2BSES Ltd, Condong, Australia; 3UNSW, Sydney, Australia; 4ANU, Canberra, Australia
gquirk@bigpond.com.au; pmcguire@bses.org.au

MOTS-CLES: Sols Sulfatés Acides, Agriculture Durable, Science Partenariale.

Résumé
L’ÉCOULEMENT d’eau acide des sols sous canne à sucre dans la vallée de Tweed au nord de l’état de la Nouvelle-Galles du Sud (NGS), en Australie, a causé une forte mortalité de poissons en 1987. L’animosité suscitée dans l’industrie de la pêche et dans le public aurait pu mener à la fermeture d’une partie de l’industrie sucrière du NGS à la fin des années 1980. En 1990, deux cultivateurs ont mis leur exploitation à la disposition des chercheurs pour une étude intensive sur les sols sulfatés acides. Au cours des 13 années suivantes, des scientifiques de différentes universités et organisations de recherche ont travaillé avec ces planteurs pour mieux comprendre comment l’acide était produit et dégagé dans l’environnement agricole. Les résultats obtenus ont permis de définir de nouvelles pratiques de gestion dont plusieurs sont aujourd’hui considérées comme la meilleure façon de gérer les sols sulfatés acides. Ces nouvelles pratiques de gestion ont réduit de 80% le mouvement des acides, alors que la production cannière a augmenté de 20%. Plusieurs de ces pratiques ont été étendues et adoptées non seulement à travers l’industrie sucrière du NGS, mais encore dans d’autres parties de l’Australie et à l’étranger. Le partenariat établi entre cultivateurs et chercheurs a été très bénéfique à toutes les parties concernées et a mené à davantage de recherche dont les travaux se poursuivent.

AGRICULTURA Y CIENCIA TRABAJANDO HACIA UN FUTURO SOSTENIBLE PARA CAÑA DE AZÚCAR EN SUELOS CON SULFATOS ACÍDOS – UN ESTUDIO DE CASO

R.J. QUIRK1, P.J. McGUIRE2, M.D. MELVILLE3,
I. WHITE4 y B.C.T. MACDONALD4

1NSW canefarmer, Stotts Ck, 2487, Australia; 2BSES Ltd, Condong, Australia; 3UNSW, Sydney, Australia; 4ANU, Canberra, Australia
gquirk@bigpond.com.au; pmcguire@bses.org.au

PALABRAS CLAVE: Suelos con Sulfatos Ácidos, Agricultura Sostenible, Ciencia Colaboradora.

Resumen
EL DRENADO de ácidos desde tierras cañeras al Valle Tweed en el norte de New South Wales, Australia, causó una gran mortalidad de peces en 1987. La hostilidad resultante de la industria pesquera y de la comunidad tuvieron el potencial de cerrar partes de la industria azucarera de New South Wales a finales de los años 80’s. En 1990, dos finqueros pusieron a disposición sus fincas como sitios de estudios intensivos para suelos con sulfatos ácidos. En los siguientes 13 años, científicos de varias universidades y organismos de investigación trabajaron con los finqueros para comprender mejor cómo el ácido es generado y descargado del lugar. Como resultado de este trabajo, nuevas prácticas de manejo han emergido, muchas de las cuales se ven actualmente como las mejores prácticas para el manejo de suelos con sulfatos ácidos. Las prácticas de manejo desarrolladas han reducido las exportaciones de ácidos en un 80% mientras que la producción de caña ha aumentado en un 20%. Muchas de éstas prácticas se han extendido y adoptado en toda la industria azucarera de New South Wales y han sido promovidas a otras partes de Australia y al extranjero. La asociación establecida entre los finqueros y los científicos ha sido muy beneficiosa para todos los involucrados y ha llevado a más investigaciones que continúan a la fecha.