

Recycled Organic Matters

Centre for Recycled Organics in Agriculture (CROA)

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Introduction

Welcome to the first issue of Recycled Organic Matters for 2007. The past 12 months have been a busy time at CROA with the establishment of some new projects and the continuation of several existing projects. This issue provides an update on a selection of these projects and other activities.

Dr Warwick Dougherty – guest editor.

New projects

Composting animal mortalities

A trial is currently underway at EMAI to assess the feasibility of using composting as a means of managing animal mortalities arising from exotic disease outbreaks, such as foot and mouth disease, as well as drought, floods, fire and natural causes.

The aims of the project are to determine whether composting is a viable option for managing livestock mortalities; evaluate the potential risks associated with composting; develop protocols and standard operating procedures for composting animal mortalities; and build stakeholder confidence in the use of composting as an option for managing large numbers of livestock mortalities.

This is a collaborative project involving numerous sections of NSW DPI. The role of CROA staff in the project is to undertake monitoring and evaluation to compare the effectiveness of different options (surface disposal, static pile composting and above-ground burial) for managing livestock mortalities.

Three options are being compared in the trial, viz. static pile composting, above ground burial and surface disposal. The project commenced in March 2007 with the construction of the windrows



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and burial of 35 cattle carcasses. Temperature monitoring has revealed temperatures of the carcasses subjected to composting are consistently between 50-60°C, suggesting conditions are adequate to pasteurise the carcasses and the material immediately adjacent to them. In contrast, temperatures surrounding the carcasses subjected to above ground burial were only 20-25°C.

Fecal coliforms and *E.coli* have been used as indicators for evaluating the survival of disease causing organisms in each of the management options. After 4 weeks, none of the indicators survived in the static pile composting treatments, although viable cultures were obtained from the surface disposal and above ground burial treatments.

These results are very encouraging and demonstrate composting is a viable option for managing animal mortalities and reducing biosecurity risks associated with them. Monitoring and evaluation will conclude in September with the 5th and final sampling.

Dr Chris Dorahy – 0437 407 443



Research at EMAI is showing composting is an effective way of managing livestock mortalities.

Effect of heavy metals on plant and microbial health

Research into the impacts of heavy metals on plant and microbial health is underway at CROA in a collaborative project with CSIRO. The research is utilising the trial plots from the National Biosolids Research Project (see later article) that have undergone a period of equilibration between the added heavy metals and soil. This three year research project is being funded by the Environmental Trust.

In particular, the effects of soil copper and zinc on microbial fixation of atmospheric nitrogen associated with leguminous pasture species is being investigated. Pasture species composition is also being examined.

The research will also examine whether the sensitivity of microbial populations to metals persists over time and if not, determine the causes for the decrease by examining the bioavailability of metals and/or whether the microbial populations have developed tolerance to the conditions.

These investigations are the first of their kind in Australia and reflect a growing awareness of the need to examine the effects of soil contamination on more than just crop yields.

Mark Whatmuff – 08 8303 728)



Biosolids treated pastures at CROA

Restoring tsunami-affected vegetable soils

CROA is involved with a new project looking at restoring the fertility of tsunami affected soils used for vegetable production in Aceh, Indonesia. The objectives of the project are to identify constraints to the re-establishment of vegetable production on tsunami-affected soils, discover sustainable methods for overcoming these constraints and build technical capacity among researchers, extension specialists and vegetable farmers in Aceh using integrated soil and crop management.

The project is funded by the Australian Centre for International Agricultural Research (ACIAR) and is in collaboration with AVRDC - The World Vegetable Centre, Assessment Institute for Agricultural Technology (AIAT or BPTP), Indonesian Vegetables Research Institute (IVegRI), Universitas Syiah Kuala, Dinas Pertanian Tanaman Pangan NAD and AUSTCARE. It is also closely linked with two other ACIAR projects which are led by NSW DPI.

The project started in January 2007 and activities

to date include assessing soil and other crop management constraints to vegetable production post-tsunami. Four field trials have also been established, which aim to address these issues. One of these trials is examining the use of compost for improving soil physical fertility.

A Communications Forum was held on 8th August 2007 with the aim of promoting project outcomes to date and fostering linkages between various stakeholders. The project will conclude in 2009 and the outcomes will be used to enable rehabilitation of vegetable production to help restore and enhance food security, nutrition and livelihoods in Aceh.

Dr Chris Dorahy – 0437 407 443



Assessing vegetable soils inundated by the 2004 tsunami in Aceh.



Compost is being evaluated for its potential restore the fertility of tsunami-affected vegetable soils in Aceh.

Promoting the fertiliser value of poultry litter

The Australian Chicken Meat Industry has identified a need to improve the management of poultry litter generated from meat poultry production to encourage its beneficial reuse and minimise potential risks associated with it. In response, the Rural Industries Research and Development Corporation (RIRDC) and the NSW Department of Primary Industries has developed a proposal aimed at identifying and addressing impediments, which prevent or limit the use of litter as fertiliser.

The first stage of the project involves bringing together stakeholders from around Australia to develop a nationally integrated strategy for promoting the fertiliser value of poultry litter. The second stage, which is subject to successful delivery of Stage 1, will involve field research aimed at implementing the strategy. Stage 1 commenced in July 2007 and will conclude in October 2007.

Dr Chris Dorahy – 0437 407 443

Continuing projects

Guidelines for RO in Catchment Mgt

Over the past five years, the NSW DPI has been working in collaboration with the Department of Environment and Climate Change and Hawkesbury-Nepean CMA on a number of projects aimed at promoting the use of composted mulches and soil conditioners for restoring degraded catchments.

The projects have been very successful and have shown that composts can reduce sediment transport by up to 90% and promote vegetation establishment on previously degraded sites.

In order to bring together the experience gained from these projects, the NSW DPI has developed a set of guidelines to provide stakeholders involved in land rehabilitation and catchment management a practical framework for promoting and implementing the use of composted mulches and soil conditioners, whilst minimising any potential risks associated with them.

The guidelines are intended to promote best management practices with respect to applying composted soil conditioners and mulches in catchment and land rehabilitation projects.

The guidelines are aimed at people and organisations

involved with catchment management and land rehabilitation projects, which address gully and hillslope erosion; saline discharge areas; degraded soil environments; and other relevant catchment works, such as sediment control.

They are designed to assist potential users work through the issues that need to be taken into account when considering using composts in catchment management and land rehabilitation. These include: specifying the type and quality of product; understanding the benefits and potential risks; application methods and depths; site considerations; and purchasing the products.



Before (top) and after (bottom) compost application to a degraded site near Bungonia.

Case studies from HNCMA are also included to provide users with examples of how composts have been used to rehabilitate degraded catchments.

The guidelines are at the publication stage and will be released at a field day in

Goulburn within the next few months.

Dr Chris Dorahy – 0437 407 443

National Biosolids Research Program

The CROA field site is a key component of the National Biosolids Research Program (NBRP) that has been underway since 2002. The aim of this project is to assess the effects of biosolids applications and the associated nutrients and heavy metals on plant growth, product quality and the health of soil microbial and invertebrate populations.

Biosolids were applied at a range of rates in 2003 to both the flat and night paddocks at CROA. In addition metals were added to soils as metal salts in order to examine the effect of metal concentrations on plant, microbial and invertebrate health. Grain and pasture crops have been grown on the plots over the last 3 years.

To date, yields have generally increased with increasing rates of biosolids addition. This effect is more prominent on the less fertile flat paddock site where biosolids application has continued to promote greater pasture growth than control treatments more than 3 years after application. The final wheat crop in this trial was sown in July 2007.

Plant growth and soil microbes have proven to be sensitive to soil Cu and Zn concentrations. At one of the

CROA sites, tests designed to indicate the respiration rate of the soil microbial population as well as soil microbial population's ability to mineralise added nitrogen have indicated potential toxicity effects from excessive Cu and Zn.

A position paper detailing the derivation and recommendation of soil and biosolids quality guidelines for cadmium, copper and zinc arising from the experimental data from all the NBRP sites will be released in 2008. This information will form the basis of new Biosolids Use Guidelines.

Mark Whatmuff (08 8303 7284)



Biosolids research project plots being prepared prior to sowing wheat in 2007

Granulated biosolids use in the turf industry

Research funded by Sydney Water investigating the benefits and risks associated with the application of biosolids granules to turf has just been completed. Sydney Water identified turf farms and recreational turf as potential land uses for granulated biosolids. Research was required to evaluate the environmental risks of surface application of the granules as the NSW

EPA's biosolids guidelines currently prohibit the surface application of biosolids.

The effect on production and runoff water quality of various rates of granule application was compared with current inorganic fertiliser and poultry litter management practices during this 3 year project. Rainfall simulation studies evaluated impacts on runoff water quality – nutrients, heavy metals, pathogens.



Rainfall simulations on biosolid granules plots

Rainfall simulation showed that runoff water from the biosolids granules plots had much lower concentrations of phosphorus and nitrogen than the runoff from poultry litter plots with similar nitrogen loading rates. Concentrations of heavy metals in runoff were below water quality guidelines. The risk from pathogens in the granules was low with *E. coli* and faecal coliforms in both the granules and runoff being below detection limits.

Production and environmental risk data generated by this research has been used to determine appropriate application rates of granules for the turf industry. A final report on this research has now been presented to Sydney Water and will form the basis of future use of granulated biosolids in the turf industry.

Simon Eldridge – 0245 882115

Compost for the vegies and mulch for the vines

This project aims to quantify the agronomic and environmental benefits of using composted garden organics (CGO) in agricultural cropping systems in NSW. The first phase of the project identified that vegetable growing areas within the Sydney Basin could benefit from soil conditioners made from CGO, whilst vineyards in the Hunter Valley and Central West NSW could be good markets for CGO mulches.

The second phase of the project has involved establishing an experiment at CROA, as well as field trials in vineyards in Central West NSW, to quantify the respective benefits of CGO soil conditioners and mulch on crop productivity and soil physical, chemical and biological characteristics.

Three vegetable crops – broccoli, eggplant, capsicum have been grown at CROA and a fourth crop (leeks) was planted in May 2007. Vegetable production data so far suggest the compost treated plots are producing similar yields to those using conventional farmers practice – a combination of poultry manure and inorganic fertilisers.

Compost has increased soil organic carbon concentrations, improved soil structural stability, and increased soil microbial biomass – these being indicators of improving soil health.



Darren Fahey harvesting capsicum at the Compost for vegies trial at CROA

Six field experiments were also established in September 2006 in vineyards across central west NSW to examine the effect of applying composted mulch under grape vines. The first season's data indicates that mulch has the potential to increase grape production in areas of the vineyard which were previously low yielding.

Both series of experiments will be monitored for a range of agronomic and soil parameters over the next two years, and the results used to construct benefit-cost analyses.

Dr Yin Chan – 0245 882108

Staff updates

Brett Enman joined CROA as a Technical Officer in March 2007 to provide assistance on the animal mortality project, as well as other projects at CROA. Brett has an Environmental Science degree and returned to Australia after travelling extensively through Asia and South America.

Warwick Dougherty received his PhD from the University of Adelaide in December 2006 for his thesis entitled 'The mobilisation of soil

phosphorus in surface runoff from intensively managed pastures in south-east Australia'.

Mark Whatmuff returned to his PhD studies at the University of Adelaide after a 12 month secondment to CSIRO Land and Water. He is expected to complete his PhD late in 2007.

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