

## **WEED BIOSECURITY BREACH THROUGH COCO PEAT IMPORTS**

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### **ABSTRACT**

*Coco peat (coir or coconut fibre) is widely used in the nursery industry. During 2008/09 some 44 plant species were identified in imports of the coco peat, with 31 species being new to New Zealand. These weeds comprised a multitude of growth forms from semi-aquatic to dryland, prostrate to small trees and included grasses, sedges and broadleaf species. Several plant nurseries around New Zealand were found to have been affected by this incursion. The biosecurity breach was managed at these sites through a combination of methods, including hand removal and the use of a pre-emergence herbicide. Risk assessments concluded that these weeds pose a low risk to New Zealand, primarily because they are tropical and not well suited to New Zealand's temperate climate.*

**Key words:** Coco peat, biosecurity, weed seeds, weed incursion, risk assessment.

### **INTRODUCTION**

Since humans started domesticating plants for their own use, they have been responsible for moving species around the globe. By 8000 BC all the major land masses except Antarctica were occupied by humans. Prior to the agricultural revolution plants had to be collected by hand so only the most important crop species would have been moved with these human migrations and there was less chance of inadvertently spreading unwanted species (McNeill 1984). However, with mechanisation and the period of great colonisation from the 1400s onwards there was an increase in the movement of plant species around the world, including ornamental garden plants. As Oceania was the last large area to be colonised and that only relatively recently, the impacts of introduced species is more evident and better documented (Atkinson and Cameron 1993). Although some introductions were strongly opposed, such as heather (*Calluna vulgaris*) 100 years ago, it was not until relatively recently (1970s) that strong measures have been put in place to limit the introduction of unwanted organisms into Australia and New Zealand. Fortunately

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this was in time to help curb the flow associated with the third mass invasion of new species, that originating from the increase in global travel and relative ease of importing goods by an increasingly affluent population. However, many of the common weeds of agriculture and horticulture were not deliberately introduced but were contaminants associated with something desirable. During the initial colonisation period weed seeds were often contaminants of pasture and crops seeds. Today's strict border biosecurity is designed to minimise such accidental entry pathways, but every so often a breach does occur. This paper reports on one such breach that occurred recently.

### **Weed Seeds in Coco Peat**

Coco peat is processed coir (the fibrous material found between the hard, internal shell and the outer coat of a coconut) and is imported in the form of compressed briquettes which are a Group A product, MAF Import Health Standard for coco peat (Anon.). It is used extensively, either alone or in potting mix, by the nursery trade for growing potted plants and by the vegetable industry as a hydroponic substrate (Anon. 2008a). The importation of coco peat is a relatively recent event, as a result of the high cost, decreasing availability, and environmental concerns about the use of locally mined natural peat. Pure coco peat has proven to be an ideal growing medium for many New Zealand native species, especially monocots such as flax (*Phormium tenax*) and cabbage tree (*Cordyline australis*). It is also made into long briquettes for the hydroponics industry, where typically four plants of a crop such as tomatoes (*Solanum esculentum*) or cucumber (*Cucumis sativus*), are grown in each briquette for about 12 months, after which the briquettes are dumped. Diluted with bark, pumice and other materials, coco peat is included in potting mixtures and is distributed throughout New Zealand for commercial and domestic use (Anon. 2008a). Normally, nurseries control weeds in potted plants with Rout® (20 g/kg oxyfluorfen and 10 g/kg oryzalin) but this herbicide cannot safely be used on many native monocots. Potted native plants have three main markets, export, home gardens and commercial replanting.

In February 2008, an astute nurseryman discovered strange looking plants growing from the potting mix he used (Popay et al. 2008). After an initial enquiry, the suspect plants were delivered to Ruakura Research Centre, where they were acknowledged as not being presently found in New Zealand and held for further verification in a containment glasshouse. The Ministry of Agriculture and Forestry (MAF) was immediately informed and began an investigation. Inspections of other nurseries found more foreign plant species, while the source of the infestations was identified as coco peat imported from Sri Lanka. Plants from five other nurseries were taken to Ruakura

for identification. They were generally grown for up to 9 months for identification, sampled for herbarium records and then destroyed. The following summer the pots were emptied and the coco peat from the bottom half of the pots collected. This was broken up and laid out in trays to a depth of 20 mm to see if any more foreign species would emerge.

Many new seedlings germinated in the trays, including several species that had not previously been found in the nurseries. In total 44 species were identified (Tables-1 and -2), all being listed in the Flora of Ceylon (Dassanayake and Fosberg, 1990-2006). Of these, 31 species were deemed to be new to New Zealand (Table-1) while 13 were already present (Table-2). The seedling emergences in the trays also gave an estimate of the number of seeds in the contaminated coco peat. Assuming that when the coco peat was placed in the pots the contaminant seeds were evenly distributed and that no seeds germinated from the lower half of the 300 mm deep pots due to depth constraints (James *et al.*, 2002), the seedlings that emerged subsequently in the trays provide a good estimation of the original seed population in the coco peat. From these numbers it is estimated that the seed contamination was up to 18,000 seeds/m<sup>3</sup>. The majority of the seeds were from quick maturing species with a prostrate plant form, including *Eleutheranthera ruderalis*, the two *Mollugo* spp., the two *Phyllanthus* spp., *Oldenlandia corymbosa* and *Richardia brasiliensis*. These species are first colonisers of bare ground and would possibly be first to grow on coco peat stored outside, thus explaining their presence in such high numbers.

Weed risk assessments were carried out on 22 of the early identifications (Tables-1 and -2). These generally concluded that the species would pose little or no threat to New Zealand because they were adapted to a warmer climate. Taken individually this is a reasonable assessment. However, taken collectively the risk is statistically much greater. Two of the species (*Amaranthus spinosus* and *Leucaena leucocephala*) and several of the genera are in Daehler's (1998) list of 381 global natural area invaders. Both these species have been reported in New Zealand previously but have not become established, possibly only due to low propagule pressure. Propagule pressure is regarded as the most significant factor in trying to predict why weed species become established in a new country (Kolar and Lodge, 2001). The volume of imported risk goods is a good indicator of both the propagule pressure and probability that an introduction is likely to result (Reaser *et al.* 2008; Simberloff, 2009). Daehler (1998) also found that species in the Poaceae and Fabaceae families were more likely to become invasive than members of other families. Of the

introduced weeds found in coco peat, only two were Fabaceae but seven were Poaceae.

There are other areas of concern which made this incursion a higher threat. One is the wide range of plant forms, from sedges (which generally grow best in damp environments) to grasses, herbs, shrubs, climbers and trees (Tables 1 and 2). Thus they are likely to threaten a range of environments. It also indicates that they came from a variety of sources. For example *Carica papaya* (cultivated for its fruit) and *Ficus religiosa* (cultivated for its religious association) were both found in the coco peat. Contamination with multiple species of variable types, e.g. arable and aquatic, is likely to be explained by the traditional method of sun drying husks on the ground and then soaking them in water-filled open troughs or ponds, a process called retting. Normally, if a commodity was contaminated with multiple species they would be expected to be from a similar habitat.

Another area of concern is that the growth form of some introduced species was different from that already present here. This was most noticeable with *Amaranthus deflexus*. In New Zealand it has a procumbent to decumbent growth habit and a brown flower/seedhead, while the introduced species has an upright growth habit and a more purplish flower/seedhead. *A. deflexus* is currently not as problematic in New Zealand as other *Amaranthus* spp. but a more upright form could become so due to it being a better competitor for light in crops. Hybridisation of the two growth forms of this species is also a potential risk. Furthermore, at least two of the introduced weeds (*A. deflexus* and *Erigeron karvinskianus*) are already well established here, with the latter being a serious weed of the natural environment and banned under the National Pest Plant Accord (Anon. 2008b). So although the weed risk assessments for individual species concluded they pose only a small risk, due to their origin being a much warmer climate, at least two of the introduced species are already growing well in New Zealand. The risk of one or more of the new species becoming established and problematic will increase if further entry of their seeds into New Zealand is not prevented. Many of the native monocots, grown in pure coco peat and not treated with herbicides, were destined for planting along roadsides and revegetation of construction and old industrial sites such as mines etc. This practice could have directly introduced these weeds into natural ecosystems.

### **Post-Incursion Actions**

The immediate response to the incursion was to hold all current stocks of coco peat and fumigate them before they could be used. Further, no plant pots were allowed to leave the nurseries with any weeds in them. To alert nurseries regarding this issue, MAF produced two booklets containing comprehensive identification photographs of

all the weeds found in the nurseries (Anonymous, 2008c). These were circulated to all the nurseries in New Zealand. A training folder "The Complete Story on Weeds Imported from Sri Lanka with Coco Peat" was also produced and training workshops were held for Pest Plant Officers from the most vulnerable regions (Northland, Auckland, Waikato and Bay of Plenty Regional Councils). These officers were then able to carry out nursery inspections and identify and destroy the unwanted plants.

The MAF Import Health Standard (IHS), "Importation of Coco peat and Coir fibre Products" (Anon.), was updated after a visit to Sri Lanka to conduct an audit of the processing facilities. The revised IHS now details five Options for Entry Conditions, including fumigation with ethylene oxide (Bullians et al. 2009) in the country of origin or heat treatment in New Zealand, or approved grow-out tests, either in the country of origin or in New Zealand, which show the absence of contaminants. A number of pre-border general conditions were also included in the standard to mitigate the risk of contaminated seed in coco peat, including: coco peat must be kept clean and free of seeds, pests, soil, animal material and any other contamination; no imported coco peat is to be produced from the traditional method of retting husks in open troughs or ponds; washing or rinsing of coco peat, chips or crush must be carried out with bore water, not pond or dam water; coco peat drying areas must be buffered underneath from contact with soil; and a plant free buffer zone of 3 m must be maintained around the coco peat drying areas unless concrete walls are built on the perimeter of concrete pads.

The updated IHS also details the monitoring protocols presently in place. If the goods arrive from an approved facility in the country of origin, or with approved certification of compliance (fumigation), then no inspection of the consignment is required. However, if the goods are not accompanied by the appropriate paper work, the coco peat must be held at a transition facility and inspected (grow-out testing required) before clearance is given. The Audit Team, as part of the Border Standards Directorate, oversees and audits the above for compliance and can revise the IHS as required.

It is difficult to determine the effectiveness of the above procedures in the short term. However, various Pest Plant Officers from the regional councils carry out regular inspections of nurseries and no new species were found in 2009 or 2010, which would indicate that the instigated procedures are working well.

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**Table 1. List of species found in Cocopeat which are new to New Zealand.**

<b>Species</b>	<b>Family (Mabberly 2008)</b>	<b>Plant form</b>
<i>Brachiaria subquadripara</i> <sup>1</sup> (Trin.) A. Hitchc.	Poaceae	grass
<i>Cleome rutidosperma</i> <sup>1</sup> DC.	Cleomaceae	herb
<i>Cleome viscosa</i> <sup>1</sup> L.	Cleomaceae	herb
<i>Cyanotis axillaris</i> (L.) Sweet	Commelinaceae	herb
<i>Cyperus distans</i> <sup>1</sup> L.	Cyperaceae	sedge
<i>Cyperus haspan</i> L.	Cyperaceae	sedge
<i>Cyperus iria</i> L.	Cyperaceae	sedge
<i>Dactyloctenium aegyptium</i> <sup>1</sup> (L.) Willd.	Poaceae	grass
<i>Digitaria longiflora</i> (Retz.) Pers.	Poaceae	grass
<i>Echinochloa glabrescens</i> Munro ex Hook	Poaceae	grass
<i>Eclipta prostrata</i> <sup>1</sup> (L.) L.	Asteraceae	herb
<i>Eleutheranthera ruderalis</i> <sup>1</sup> (Swartz) Sch. Bip.	Asteraceae	herb
<i>Evolvulus nummularis</i> (L.) L.	Convolvulaceae	climber
<i>Fimbristylis complanata</i> (Retz.) Link	Cyperaceae	sedge
<i>Fimbristylis cinnamometorum</i> <sup>1</sup> (Vahl) Kunth	Cyperaceae	sedge
<i>Kyllinga polyphylla</i> Willd. ex Kunth	Cyperaceae	sedge
<i>Lindernia ciliata</i> <sup>1</sup> (Colsmann) Pennell	Linderniaceae	herb
<i>Lindernia crustacea</i> <sup>1</sup> (L.) F. Muell.	Linderniaceae	herb
<i>Melochia corchorifolia</i> L.	Sterculiaceae	herb
<i>Mollugo nudicaulis</i> <sup>1</sup> Lam.	Molluginaceae	herb
<i>Mollugo oppositifolia</i> <sup>1</sup> L.	Molluginaceae	herb
<i>Muntingia calabura</i> L.	Tiliaceae	tree
<i>Oldenlandia corymbosa</i> <sup>1</sup> L.	Rubiaceae	herb
<i>Passiflora foetida</i> L.	Passifloraceae	climber
<i>Perotis indica</i> <sup>1</sup> (L.) Kuntze	Poaceae	grass
<i>Phyllanthus debilis</i> <sup>1</sup> Klein ex Willd.	Euphorbiaceae	herb
<i>Physalis angulata</i> L.	Solanaceae	herb
<i>Richardia brasiliensis</i> <sup>1</sup> Gomés.	Rubiaceae	herb
<i>Scoparia dulcis</i> <sup>1</sup> L.	Plantaginaceae	herb
<i>Spermacoce assurgens</i> <sup>1</sup> Ruiz & Pavon.	Rubiaceae	herb
<i>Trianthema portulacastrum</i> <sup>1</sup> L.	Aizoaceae	herb

<sup>1</sup> Species for which a weed risk assessment was carried out.

**Table 2. List of species found in Cocopeat which are already present in New Zealand.**

<b>Species</b>	<b>Family (Mabberly 2008)</b>	<b>Plant form</b>
<i>Amaranthus spinosus</i> L.	Amaranthaceae	herb
<i>Amaranthus deflexus</i> L.	Amaranthaceae	herb
<i>Axonopus compressus</i> (Sw.) P. Beauv.	Poaceae	grass
<i>Carica papaya</i> L.	Caricaceae	tree
<i>Eragrostis tenella</i> <sup>1</sup> (L.) P. Beauv. Ex Roem. & Schult.	Poaceae	grass
<i>Erigeron karvinskianus</i> DC.	Asteraceae	herb
<i>Euphorbia hirta</i> L.	Euphorbiaceae	herb
<i>Ficus religiosa</i> L.	Moraceae	tree
<i>Kyllinga nemoralis</i> <sup>1</sup> L.	Cyperaceae	sedge
<i>Leucaena leucocephala</i> (Lam.) De wit	Fabaceae	tree
<i>Ludwigia hyssopifolia</i> <sup>1</sup> (G. Don.) Exell	Onagraceae	herb
<i>Mimosa pudica</i> L.	Fabaceae	shrub
<i>Phyllanthus amarus</i> Schum.	Euphorbiaceae	herb

<sup>1</sup> Species for which a weed risk assessment was carried out.

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