Technical Note

Testing for Organic Farming Heavy Metals and Pesticide Residues

Introduction

There is an increasing trend worldwide towards producing food using “Organic” methods. Organic growing systems aim to produce food of optimum quality through a management system that is considered sustainable and non-polluting to the environment.

One of the first steps towards transition of land from ‘conventional’ to recognised ‘organic’ production status, is to test soil for possible contaminants, including heavy metals and pesticide residues, as these may persist in the soil for a considerable time and may affect the quality of food produced.

The range of tests required may be influenced by the land use history, so it is suggested that clients consult with their ‘organic’ certification organisation to determine the individual test profiles needed. Acceptable levels of metals and pesticide residues are set by certification organisations, or by countries to which the food is to be exported.

IANZ Accreditation

Hill Labs is IANZ Accredited for a wide range of tests, including the following;

- Metals
- Organochlorine Pesticides, including DDT
- Multiresidue screening (GC-MS, and LC-MSMS)
- Nutrients Testing (Please request a Soil & Plant Sampling kit which contains information on what to test for, how to collect samples, and a price list).

Toxic Metals

There are 92 naturally occurring elements and about two thirds of these are classified as ‘metals’.

Many metals are needed by people, and animals, in small quantities. These are called the Essential Trace Elements and include iron, copper, cobalt, selenium, molybdenum, zinc, etc. In larger amounts, these elements can be toxic.

Other metals are toxic, even in small doses, and these are often referred to as “Heavy Metals”. This group includes arsenic, cadmium, mercury and lead.

Organic Growing Metals Profile

The sample is digested in hot acid and analysed for arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc by ICP-MS.

Analysis for a wide range of other metals such as thallium, barium, bismuth, uranium, etc, is also available. Please contact us for details.

Pesticide Residues

There are a large number of pesticides which are, or have been, used in New Zealand. Some of these may be tested for in a group (“Multiresidue Suite”). Others may require specific, individual testing, and the laboratory personnel should be consulted if it is necessary to test for a compound not listed.

The group tests are shown on the next page, along with the compounds included and the usual detection limits.

Sample Types Analysed

The tests discussed in this document are mainly carried out on soil samples. Other matrices can be analysed, including composts, biosolids, sludges, etc. The sample type will have an influence on the achievable detection limits and prices - please check with us for more details.

For more information, freephone 0508 HILL LAB 44 555 22 mail@hill-labs.co.nz hill-labs.co.nz

Sampling Procedure

1. **Solids** (These include soil, compost, dry sludge, etc.)

   In order to obtain a representative sample it is necessary to collect a large number (preferably >20) of subsamples from various parts of the property or heap. For heaps of compost, etc, ensure that portions from the centre of the heap are included.

   The subsamples should then be thoroughly mixed in a large plastic container (eg bucket, wheelbarrow) then a portion of the mixed sample placed in a plastic bag (for nutrients and metals) or clean jam jar (for organics) to be sent to the laboratory.

   A sample size of about 500 g is sufficient.

2. **Semi- solids Materials** (Samples such as slurries, wet sludges etc, please discuss with the lab first)

   1. Ensure that the source material is thoroughly mixed. Collect subsamples if necessary, so that the whole of the material is represented.
   2. Tip into a large, wide-mouth jar (eg an Agee jar). Ensure that the lid is on firmly. Rinse and dry the outside of the jar. Label clearly.
   3. Pack the jar inside a sealed plastic bag, and ensure that it is well cushioned within a strong outer container for transport to the laboratory.

   If pesticide residue testing is required, it is desirable to keep samples cool as soon as they are collected, and during transport to the laboratory.

Bio-gro Limits

Maximum permitted levels for Organochlorines in soil

Chemical	Bio-Gro Standard for soil mg/kg
Total DDT (including all isomers)	0.2
Lindane	2.0

Maximum permitted levels for heavy metals in soils and composts

Chemical	Bio-Gro Standard for soil (mg/kg)	Bio-Gro Standard for compost – ingredients other than household waste (mg/kg dry weight compost)	Bio-Gro Standard for compost - ingredients including household waste (mg/kg dry weight compost)
Arsenic	20	20	20
Cadmium	2	1	0.7
Chromium	150	150	70
Chromium (VI)	1	1	0 detectable
Copper	60	60	70
Lead	100	250	45
Mercury	1	1	0.4
Nickel	35	60	25
Zinc	300	300	200

From the Biogro NZ Standards Manual – Organic Production version 2, 4 May 2009.

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Bio-Gro testing suite- Detection limits

Heavy Metals

Detection Limits (mg/kg dry weight)

Name	DL
Arsenic	2
Cadmium	0.1
Chromium	2
Chromium (VI)	0.4
Copper	2
Lead	0.4
Nickel	2
Zinc	4
Mercury	0.1

Multiresidue screen (Multires),

Detection Limits (mg/kg dry weight)

Name	DL
Acetochlor	0.006
Alachlor	0.006
Aldrin	0.01
Alpha-BHC	0.01
Atrazine	0.006
Atrazine - desethyl	0.006
Atrazine - desisoprpyl	0.01
Azaconazole	0.004
Azinphos - methyl	0.01
Benalaxyl	0.005
Bendiocarb	0.006
Benodanil	0.01
Beta-BHC	0.01
Bifenthrin	0.006
Bitertanol	0.01
Bromacil	0.006
Bromophos - ethyl	0.006
Bromopropylate	0.006
Bupirimate	0.006
Buprofezin	0.006

Name	DL
Butachlor	0.006
Captafol	0.04
Captan	0.02
Carbaryl	0.006
Carbofuran	0.006
Carbofenothion	0.006
Carboxin	0.006
Chlorfenvinphos	0.006
Chlorfluazuron	0.02
Chlorothalonil	0.006
Chlorotoluron	0.02
Chlorpropham	0.01
Chlorpyrifos	0.006
Chlorpyrifos methyl	0.006
Chlozolinate	0.006
Chordane -cis	0.01
Chordane -trans	0.01
Chordane -total	0.04
Coumaphos	0.01
Cyanazine	0.006

Name	DL
Cyfluthrin	0.01
Cyhalothrin	0.01
Cypermethrin	0.01
Cyproconazole	0.008
Cyprodinil	0.006
DDD (2,4')	0.01
DDD (4,4')	0.01
DDE (2,4')	0.01
DDE (4,4')	0.01
DDT (2,4')	0.01
DDT (4,4')	0.01
Delta-BHC	0.01
Deltamethrin	0.01
Demeton-s-methyl	0.01
Diazinon	0.006
Dichlobenil	0.006
Dichlofenthion	0.006
Dichlofluanid	0.006
Dichloran	0.03
Dichlorvos	0.01

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Multiresidue screen (Multires), continued

Name	DL
Dicofol	0.03
Dicrotophos	0.02
Dieldrin	0.01
Difenconazole	0.01
Dimethoate	0.01
Dinocap	0.07
Diphenylamine	0.01
Disulfoton	0.007
Diuron	0.02
Endosulfan I	0.01
Endosulfan II	0.01
Endosulfan sulphate	0.01
Endrin	0.01
Endrin aldehyde	0.01
Endrin ketone	0.01
EPN	0.006
Esfenvalerate	0.008
Ethion	0.006
Etrimphos	0.006
Famphur	0.006
Fenamiphos	0.008
Fenarimol	0.006
Fenitrothion	0.006
Fenpropathrin	0.007
Fenpropimorph	0.02
Fensulfothion	0.006
Fenthion	0.006
Fenvalerate	0.008
Fluazifop-p-butyl	0.006
Fluometuron	0.006
Fluralaxyl	0.01
Flusilazole	0.006
Fluvalinate	0.01
Folpet	0.01
Haloxyfop-r-methyl	0.006
Heptachlor	0.01
Heptachlor epoxide	0.01
Hexachlorobenzene	0.01
Hexaconazole	0.006
Hexazinone	0.003

Name	DL
Hexythiazox	0.06
Imazalil	0.03
Iodofenphos	0.006
Indoxacarb	0.006
IPBC	0.03
Iprodione	0.006
Isazophos	0.006
Isofenphos	0.006
Kresoxim methyl	0.006
Leptophos	0.006
Lindane (gamma-BHC)	0.01
Linuron	0.006
Malathion	0.006
Metalaxyl	0.006
Methamidophos	0.03
Methacrifos	0.008
Methidathion	0.006
Methiocarb	0.006
Methoxychlor	0.01
Metolachlor	0.006
Metribuzin	0.006
Mevinphos	0.02
Myclobutanil	0.006
Naled	0.03
Nitrofen	0.01
Nitrothal - isopropyl	0.006
Norflurazon	0.01
Omethoate	0.03
Oxadiazon	0.006
Oxychlordane	0.003
Oxyfluofen	0.006
Paclobutrazol	0.008
Parathion - ethyl	0.006
Parathion - methyl	0.006
Penconazole	0.006
Pendimethalin	0.006
Permethrin	0.009
Pirimicarb	0.008
Pirimiphos - methyl	0.006
Phorate	0.01

Name	DL
Phosmet	0.006
Phosphamidon	0.02
Prochloraz	0.03
Procymidone	0.006
Prometryn	0.004
Propachlor	0.006
Propanil	0.03
Propazine	0.004
Propetamphos	0.006
Propham	0.006
Propiconazole	0.006
Prothiofos	0.006
Pyrazophos	0.006
Pyrifenox	0.008
Pyrimethanil	0.006
Quintozene	0.01
Quizalofop-p-ethyl	0.006
Simazine	0.006
Sulfentrazone	0.06
Sulfotep	0.01
TCMTB	0.01
Tebuconazole	0.006
Tebufenpyrad	0.006
Terbacil	0.006
Terbufos	0.01
Terbumeton	0.006
Terbuthylazine	0.005
Terbuthylazine-desethyl	0.006
Terbutryn	0.006
Tetrachlorvinphos	0.006
Thiabendazole	0.03
Thiobencarb	0.006
Thiometon	0.01
Tolyfluanid	0.004
Triadimefon	0.006
Triazophos	0.007
Trifluralin	0.01
Vinclozolin	0.006

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Other optional profiles- Detection limits

Detection Limits (mg/kg dry weight)

Acidic Herbicides (Acidherb)	
Name	**DL**
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	0.01
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.011
2,4-Dichlorophenoxybutanic acid (2,4-DB)	0.01
Acriflurfen	0.01
Bentazone	0.01
Bromoxynil	0.01
Clopyralid	0.01
Dicamba	0.01
Dichlorprop	0.01
Fluazifop	0.01
Fluroxypyr	0.01
Haloxyfop	0.01
MCPA	0.01
MCPB	0.01
Mecoprop	0.01
Oryzalin	0.02
Pentachlorophenol (PCP)	0.01
Picloram	0.01
Quizalofop	0.01
2,3,4,6-tetrachlorophenol (TCP)	0.01
2,4,5-Trichlorophenoxypropionic acid (245TP, Silvex, Fenoprop)	0.01
Triclopyr	0.01

DDT Profile (DDT)	
Name	**DL**
2,4'-DDE	0.005
2,4'-DDD	0.005
2,4'-DDT	0.005
4,4'-DDE	0.005
4,4'-DDD	0.005
4,4'-DDT	0.005
Total DDT isomers	0.03

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