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Pesticide risk profile for the feeding of avocado and mango processing waste to cattle and sheep

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Abbreviations

ai	active ingredient
APVMA	Australian Pesticide and Veterinary Medicines Authority
bw	body weight
DM	dry matter
ECRP	Existing Chemical Review Program
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
g	gram
GAP	good agricultural practice
ha	hectare
HAFT	Highest average field trial
JMPR	Joint Meeting on Pesticide Residues
kg	kilogram
LOD	Limit of detection for the analytical method, sometimes also used for limit of determination which is the same as LOQ
LOQ	limit of analytical quantitation
mbyp	meat by products
mg	milligram = 0.001 grams
MRL	maximum residue limit
N	Negligible residue (when next to US MRL)
PAFC	primary animal feed commodity
PHI	pre-harvest interval
P_{ow}	octanol water partition coefficient
ppm	parts per million = mg/kg
PSD	Pesticide Safety Directorate
TF	transfer factor = concentration in animal tissue or milk divided by concentration in feed
TRR	total radioactive residue
US EPA	United States of America Environmental Protection Agency
WHP	withholding period
*	before MRL indicates that the residue is at or about the LOQ, *i.e.* should be less than the LOQ.

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Potential for violative residues in cattle and sheep fed avocado and mango processing waste

For by-products to be useful as animal feeds, they must not present safety or health problems to the animals nor present a risk of contaminating the animal product to be sold. In the production and utilization of by-products, all parties must take care to prevent contamination with pesticides, mycotoxins, and other materials that could be dangerous to the animals or contaminate the animal product.

By-products of the avocado and mango industry that can be used in animal feeds are processing waste (from oil production for avocados and juice/pulp production for mangoes). Large quantities of processing waste are potentially available each year for beef cattle feeding.

It is reported that the solid waste comprising stone, fibre and skin from processing mangoes can be utilised, the skin can be processed and used as cattle feed and the seed kernels (after soaking and drying to 10% moisture content) can be fed to poultry and cattle.

Chemical residues in animal feeds may be transferred to the tissues of livestock on feeding. While it is unlikely that the chemical residues present in meat and offal arising from feeding represent a concern regarding food safety they can result in disruption to trade where the relevant Australian and overseas market standards differ.

The observation of chemical product withholding periods does not guarantee that the chemical residues in the feed are such that when fed to livestock, the residues in meat and offal will meet export market requirements.

The aim of the current report is to profile the risk of violative residues in export meat and edible offal posed by the presence of pesticide residues in avocado and mango waste fed to cattle and sheep.

Assessment of currently registered chemicals that may be used on avocado and mango crops

Estimates of residues in livestock tissues and milk are usually made on the basis of the propensity of a chemical to transfer to tissues and milk combined with anticipated animal dietary exposure.

Most experiments in the area of transfer of pesticide residues to animal tissues and milk following ingestion have been designed based on the requirements of regulators. The relevant studies required are livestock metabolism studies (lactating goat or dairy cow) and animal transfer (feeding) studies.

The feeding studies are used to determine transfer factors (TF) that are defined as the ratio of the pesticide residue in the tissue or commodity of interest (fat, muscle, liver, kidney or milk) to the residue in the diet (expressed on a dry matter intake basis).

In utilizing transfer factors derived from feeding or metabolism studies for risk assessment management purposes, the user needs to be aware of the limitations and assumptions used. The TF derived is dependent on the duration of the feeding or dosing, the concentration in the feed or dose level, the nature of the feed (if added to the feed), lactational status, bodyweight, age, sex and breed of the animal studied. For chemicals administered as a mixture, the presence of other chemicals

may alter the metabolism and/or rate of excretion by induction of the various routes of decontamination. The duration of a feeding study required for the steady state concentration to be reached in tissue or milk is a function of the elimination half-life. Residue definitions set by different regulators are not always the same and residue definition is a factor that should also be taken into account when utilizing TF for managing residue risks and trade. Care must be taken in extrapolating TFs from goat metabolism studies to all ruminants as is demonstrated by endosulfan, for which the residue definition is the sum of α-endosulfan, β-endosulfan and endosulfan sulphate, where only low levels of residues are found in goats but significant transfer to tissues occurs for cattle[1,2].

The transfer factors utilised here were calculated from residues reported in the scientific literature using the highest individual animal tissue divided by the nominal feed level. If the highest residue was not reported the average residue divided by the nominal feed level were used instead. In the case of milk the average residue was divided by the nominal feed level.

For the purposes of profiling risk conservative estimates of animal dietary burden (intake) are required. Inclusion in the diet at 100% was used in the current evaluation. Estimates of residues in avocado and mango waste were obtained from scaling of literature studies, MRLs or based on conservative assumptions. The dietary burden is then residue in crop × maximum proportion in diet. To overcome errors that may result from differences in moisture contents of feed items it is accepted practice to calculate dietary burdens for a ration on a dry matter basis, however, as the rate of inclusion used is unrealistically high, a correction for dry matter was not considered necessary.

The estimated residue in animal commodities is:
Residue = TF × dietary burden

Unless stated otherwise, the following assumptions have been used in the risk assessment:

- The avocados/mangos are harvested at maturity and that the fruit waste is derived on processing.
- All the crop was treated at the maximum rate and with the shortest interval between application and harvest permitted by product label[3]
- The maximum rate of incorporation in the ration/diet is 100% (unrealistically high value, producer estimates are 15% when fed *ad libitum*).
- That residue transfer for cattle is greater than for sheep and therefore that the assessment of residues in cattle also covers sheep.

The potential for violative residues in animals is assessed against the Australian, Codex and US tolerances as listed in February 2010[4]. Other markets may have different standards however, for the bulk of Australian meat exports it is assumed that if the lower of these tolerances (or the LOQ of the

[1] Indraningsih, McSweeney, C.S. & Ladds, P.W. (1993) Residues of endosulfan in the tissues of lactating goats. *Aust. Vet. J.,* **70**, 59-62.
[2] Reregistration Eligibility Decision for Endosulfan Case No. 0014 EPA 738-R-02-013 November 2002 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division. http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg)
[3] In general, only one or two product labels were selected per pesticide. There is a possibility that the maximum permitted rate may be higher than identified.
[4] MRLs and approved use patterns change with time. The assessments include the most recent decisions of the Codex Alimentarius Commission (32nd Session, July 2009) with regard to Codex MRLs, US tolerances as listed in the Code of Federal Regulations at February 2010 and MRLs as they appear in Table 1 of the APVMA *MRL Standard* as at February 2010..

analytical method if no Codex or US tolerance exists) can be met, the feeding of avocado and mango waste will not pose an unacceptable risk.

Appendix 1 provides the details of a risk assessment for each of the compounds registered in Australia for use on avocados and mangos.

Most of the compounds registered for use on avocadoes and mangos also have registrations in other crops that are major animal feed commodities. Indeed, for most compounds listed in appendix 1 the major route of exposure for animals to the chemical is expected to be through feeding of these other crops (*e.g.* pasture, cereal waste etc).

The conclusion of the analysis is the risk of residue violations in meat and edible offal posed by the feeding of avocado/mango waste derived from avocado/mango crops treated with currently registered products is low for the majority of chemicals. Based on the available information, the following pesticides are identified as requiring further investigation and/or development of additional risk management strategies:

Pesticide (Crop)	Tissue	Residue (mg/kg)		Decline information located	
		Estimated[1]	Target[2]	Crop	Animal
Dicofol (mango)	Fat	0.5/2.5	0.01	No	No
Prochloraz (avocado + mango)[3]	Liver	1.4	0.01	No	No

[1]residue in tissue estimated using assumptions outlined above, *eg.* feeding at the unrealistic rate of 100% of the diet
[2]target residue = lowest of Australian, Codex and US MRL or in absence of these the LOQ (often assumed to be 0.01 mg/kg)
[3]Used as a post-harvest dip. Note the current label contains a feeding restraint "Do not graze stock on treated fruit or by-products from treated processed fruit to livestock.

The current assessment has only identified pesticides of concern and not considered industry based QA programs that address the potential for residues in animal feeds to transfer to animals and mitigate risks; The National Vendor Declaration (NVD) form for traded livestock and the Commodity Vendor Declaration (CVD) and By-product Vendor Declaration (BVD) forms which are used for traded livestock feedstuffs.

Appendix 1

Alpha-cypermethrin
-is an insecticide used for the control of garden weevil in avocados (PER 6316). The application rate is 5 g ai/hL.
The harvest WHP is 7 days.

Alpha-cypermethrin residues decline with typical half-lives of 30 and 5 days for soil and foliage respectively. The half-life for the decline of residues in animal tissues is approximately 7 days.

There are Australian, Codex and USA MRLs for cypermethrin in animal tissues. The relevant MRLs for cattle fat are 0.5, 0.2 and 1 mg/kg for Australia, Codex and the USA respectively. The respective milk MRLs are 1 [in the fat = 0.04 mg/kg whole milk], 0.05 F mg/kg and 2.5 F mg/kg for Australia, Codex and the USA. The US also has separate MRLs for zeta cypermethrin of 1 mg/kg for cattle fat and 2.5 mg/kg in milk fat (reflecting a residue of 0.1 mg/kg in whole milk). The Australian MRL for avocado is T0.2 mg/kg.

The TF for fat is 0.1[5,6]. If residues in avocado waste are present at the same level as the MRL, anticipated residues in fat are 0.2×0.1 = 0.02 mg/kg if fed at 100% of the diet. Anticipated residues in whole milk (TF 0.003-0.1) are also 0.02 mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Amitrole
-is a herbicide used to control weeds in a variety of situations. The application rate for orchards is as a directed spray to couch and broadleaf weeds and grasses at 0.275 g ai/100 L water.
Do not apply later than 56 days before harvest.

There are Australian but no Codex or US MRLs for amitrole in animal commodities. The Australian MRLs, including milk, have all been set at *0.01 mg/kg. The Australian MRL for avocado is *0.01 mg/kg.

The JMPR have stated that "*There do not appear to be any grounds for assuming that livestock grazing on plant materials growing on land that had been treated with amitrole for the control of weeds would absorb or retain significant amounts of amitrole or its metabolites*"[7].

It is anticipated that animal product residues will be below typical method LOQs.

Azoxystrobin
-is a strobulurin fungicide used for control of stem-end rot and anthracnose on avocados and mangoes. Application is at 20 g ai/hL.
The harvest WHPs are 7 days for avocados and 3 days for mangoes

[5] Chen-AW; Fink-JM; Letinski-DJ; Barrett-GP; Pearsall-JC (1997) Residue of cypermethrin and its major acid metabolites in milk and tissues from dairy bovines treated with cypermethrin. *J. Ag. Food Chem.* 45: 12, 4850-4855.
[6] 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982 http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm
[7] 1974 JMPR. Evaluations of some pesticide residues in food. FAO/AGP/1974/M/11; WHO Pesticide Residues Series No. 4, 1975

There are Australian, US and Codex MRLs for animal commodities. The Australian MRLs for animal tissues have been set at *0.01 mg/kg while the milk MRL is 0.005 mg/kg. The US MRLs for animal commodities are set at 0.03, 0.01 and 0.07 mg/kg for cattle fat, meat and meat by-products respectively and 0.006 mg/kg for milk. The Codex MRL for edible offal is 0.07, meat (fat) 0.05 and milk is 0.01 mg/kg. Australian MRLs have been set for avocados at 1 mg/kg and mangoes at 0.5 ppm.

Residues in tissues of lactating cows were ≤0.01 mg/kg after feeding at levels up to 25 ppm in the diet for 28 days[8].

It is anticipated that animal product residues will be below typical method LOQs.

Beta-cyfluthrin
- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on avocadoes for the control of fruit spotting bugs. The application rate is up to 1.25 g ai/100 L. Cyfluthrin residues decline with typical half-lives of 60 and 3-5 days for soil and foliage respectively. Residues in cattle from pour-on application decline with a half-life of <14 days, a shorter half-life would be expected for tissue residues when animals are on "clean feed".
The harvest WHP is 7 days.

There are Australian, USA and Codex MRLs for cyfluthrin. The relevant MRLs for cattle fat are 0.5, 1 and 2 mg/kg for Australia, Codex and the USA respectively. The relevant MRLs for cattle milk are 0.1, 0.04 and 5 mg/kg for milk fat (1 mg/kg in whole milk) for Australia, Codex and the USA respectively. The Australian MRL for avocado is 0.1 mg/kg.

Residues in the animal diet from avocado waste would not be expected to lead to exposure of greater than 1 ppm in the diet (incorporation at 100% of the diet). TF fat = 0.05[9]. Estimated residues in fat are 1×0.05 = 0.05 mg/kg. The TF for milk is 0.005 giving anticipated residues of 1×0.005 = 0.005 mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Bifenthrin
- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on avocados for control of garden weevil (APVMA Permit, WA only). The application rate is up to 6 g ai/100. Bifenthrin residues decline with typical half-lives of 26 and 7 days for soil and foliage respectively.
The harvest WHP is 7 days.
Do not graze any treated area or cut for stock food.

There are Australian, Codex and USA MRLs for bifenthrin in animal tissues. The relevant MRLs for cattle fat are 2, 0.5 and 1 mg/kg for Australia, Codex and the USA respectively. The MRLs for milk are 0.5 mg/kg, *0.05 mg/kg (cattle milk) and 1 mg/kg (milk fat, 0.1 mg/kg for whole milk). The Australian MRL for avocado is T0.1 mg/kg. There are also MRLs for fodder and forage of pulses at 1 and 5 ppm respectively.

[8] APVMA Animal Residue Data Sheet – Azoxystrobin (October 2002)
http://www.apvma.gov.au/residues/stockfeed.shtml
[9] 1998 JECFA Residues of some veterinary drugs in animals and foods. Forty-eigth meeting of the Joint FAO/WHO Expert Committee on Food Additives, 1998, FAO Food and Nutrition Paper 41/10

Assuming levels in Australian avocado pulp at the MRL and a maximum TF of 0.3[10] would give residues in fat of 0.1×0.3 = 0.03 mg/kg, lower than the relevant international tolerances. The TF for milk is 0.02 giving anticipated residues in milk of 0.1×0.02 = 0.002 mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Bioresmethrin
-is a synthetic pyrethroid insecticide and is used by quarantine officers for detection of insect pests at 1 g ai/tree.

There are no Australian, EU, Codex or US MRLs for bioresmethrin in animal commodities. The Australian MRL for Mango is T0.5 mg/kg.

The use is only for quarantine inspection/detection purposes on individual trees and not likely to result in large quantities of treated fruit.

The APVMA utilised a transfer factor of 0.1 in its assessment of bioresmethrin based on a metabolism study in lactating dairy animals for resmethrin, the value of 0.1 was a conservative estimate noting the duration of dosing and small number of animals involved.

It is anticipated that animal product residues will be below typical method LOQs.

Buprofezin
is an insecticide used for the control of mango scale. The application rate is 26.4 g ai/hL.
The harvest WHP is 28 days
Do not allow livestock to graze grasses or weeds under treated trees

There are Australian, US and Codex MRLs for buprofezin in animal commodities. The Australian, Codex and US MRLs for edible offal and meat (fat) are all *0.05 mg/kg. The Australian and Codex MRLs for milk *0.01 and the US MRL for milk is 0.03 mg/kg . The CodexThe Australian MRL for mangoes is 0.2 mg/kg. The US MRL for citrus fruit is 2.5 mg/kg and the MRL for pulp (dried) is 7.5 ppm so could assume a processing factor of 3 for whole mango fruit to pulp based on citrus data.

Residues of buprofezin were not detected in the tissues of cows following dosing at rates equivalent to feeding levels of 5, 15 and 50 ppm in the diet[11]. The method LOQ was 0.05 mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Carbaryl
- is a carbamate insecticide used for the control of various insects in crops. It is registered on avocadoes for control of red-shouldered leaf beetles at application rates of up to 100 g ai/hL and on mangoes for control of leafhoppers, plant hoppers and scale at rates of up to 100 g ai/hL.
The harvest WHP is 3 days.

Carbaryl residues decline with typical half-lives of 10 and 7 days for soil and foliage respectively.

[10] 1992 JMPR - Pesticide Residues in Food – 1992 evaluations. Part II. Toxicology. WHO, WHO/PCS/93.34, Geneva, 1993
[11] 1999 JMPR - Pesticide Residues in Food - 1999 Evaluations, Part I Residues FAO Plant Production and Protection Paper 157. FAO and WHO 2000

There are Australian, Codex and USA MRLs for carbaryl in animal tissues. The Australian and Codex residue definition is carbaryl for both plant and animal commodities. The Australian MRLs for edible offal and meat are T0.2 mg/kg while that for milk is T*0.05 mg/kg. The Codex MRL for kidney is 3 mg/kg and liver 1 mg/kg while the MRL for meat is 0.05 mg/kg. The Codex milk MRL is 0.05 mg/kg. The Australian MRL for avocadoes is 10 mg/kg and for mangoes 5 mg/kg.

The USA residue definition is the sum of carbaryl and 1-napthol expressed as carbaryl for plant commodities, the sum of carbaryl, 1-napthol, 5,6-dihydrodihydroxycarbaryl and 5,6-dihydrodihydroxynapthol expressed as carbaryl for animal tissues. The US tolerance for cattle meat and fat is 1 mg/kg and that for milk 0.5 mg/kg. The US also has tolerances of 100 ppm for various forages.

No data were located for residues of carbaryl in avocado or mango. However, it is considered unlikely that residues in fruit waste would greatly exceed 10 ppm when prepared from fruit with maximum pulp residues of 5-10 ppm. The TF for kidney is 0.007 for the Australian/Codex residue definition and 0.012 for the US residue definition[12] giving rise to anticipated maximum residues in kidney from feeding processing waste of 0.007×10 = 0.07 mg/kg and 0.012×10 = 0.12 mg/kg respectively for the Australian/Codex and USA residue definitions.
The TF for milk is 0.0002 for the Australian/Codex residue definition and 0.002 for the US residue definition giving rise to anticipated maximum residues in milk from feeding avocado/mango waste of 0.0002×10 = 0.002 mg/kg and 0.002×10 = 0.02 mg/kg respectively for the Australian/Codex and USA residue definitions.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Carbendazim
- is a systemic fungicide used for the post-harvest control of anthracnose and stem end rot in mangoes. It is registered on mangoes as a post-harvest dip at 50 g ai/100L (500 ppm).
Not required when used as directed.

There are Australian but no Codex or US MRLs for carbendazim. The relevant MRL for cattle meat is 0.2 mg/kg for Australia. MRLs for milk are all *0.1 mg/kg. There is an Australian MRL for mangoes at 5 mg/kg. The Codex MRL for mangoes is 2 mg/kg though an MRL is proposed at 5 mg/kg.

In studies in which dairy cows were fed either carbendazim or benomyl at levels of 2, 10, or 50 ppm in the diet for 28 days, no carbendazim residues were found in samples of lean muscle, liver, kidney or fat although in the carbendazim feeding study low-level residues of 5-HBC were observed in the liver (0.01 mg/kg) and kidneys (0.06 mg/kg) of cows in the group receiving 50 ppm carbendazim[13]. However, residues of this compound were also apparent in a kidney sample in the control group. One week after the end of treatment with the test material no residues were detectable in any tissue sample.

It is anticipated that animal product residues will be below typical method LOQs.

[12] 2002 JMPR. Pesticide Residues in Food - 2002 Evaluations – Part I: Residues Volume 1, FAO Plant Production and Protection Paper 175/1. FAO and WHO 2003
[13] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

Chlorpyrifos
- is an organophosphate insecticide used for the control of various insects in crops. It is registered on avocadoes with an application rate of up to 1 kg ai/ha (50 g ai/hL) and mangoes at 50 g ai/hL. The harvest WHP is 7 days for avocado and 21 days for mango.

There are Australian, Codex and USA MRLs for chlorpyrifos in animal tissues. The Australian and Codex residue definition is chlorpyrifos while the USA definition includes the metabolite TCP. The MRLs for cattle fat are T0.5, 1 and 0.3 mg/kg for Australia, Codex and the USA respectively. The MRLs for milk are T0.2 [milk in the fat] mg/kg, *0.01 mg/kg and 0.01 mg/kg (0.25 mg/kg for milk fat). There is an Australian MRL for avocados of 0.5 mg/kg and on mangoes at *0.05 mg/kg.

The maximum transfer factor for feeding cattle at 10 ppm in the diet was 0.016 for cattle fat and at 30 ppm 0.0007 for milk[14]. Residues from feeding avocado pulp with residues of 0.5 ppm at 100% of the diet would be 0.5×0.016 = 0.008 mg/kg; below the Australian, Codex and USA MRLs for fat. Anticipated residues for milk would be 0.5×0.0007 = 0.00035 mg/kg. Even if the residues concentrated 10× they would not lead to residues on concern in animals consuming pulp.

It is anticipated that animal product residues will be below typical method LOQs.

Dichlobenil
- is a selective herbicides used for the control of certain annual grasses and broad leafed weeds in orchards. It is applied to grass/weeds in the orchard. The application rate is up to 6 kg ai/ha (band 2 m wide × 5 km).
No harvest WHP required.
Do not graze livestock on treated areas

There are no Australian, Codex or USA MRLs for dichlobenil in animal commodities. The Australian MRLs are 0.1 mg/kg for citrus fruit, pome fruit, stone fruit, grapes and tomatoes. No MRLs have been established in Australia for avocadoes or mangoes. In the US tolerances have been established for the combined negligible residues of the herbicide dichlobenil (2,6-dichlorobenzonitrile) and its metabolite 2,6-dichlorobenzoic acid in or on the raw agricultural commodities: hazel nut 0.1 mg/kg, stone fruit 0.15 mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Dicofol
- is an organochlorine miticide used for the control of various pests in a variety of crops. In mangoes it is used for the control of mango bud mite and tea red spider mite. The application rate is up to 48 g ai/hL.
The harvest WHP is 7 days.
Do not graze or cut for stock food.

There are no Australian or USA MRLs for animal commodities. The Australian and Codex residue definitions differ. The Australian residue definition is the sum of dicofol + 2,2,2-trichloro-1-(4-chlorophenyl)-1-(2-chlorophenyl)ethanol calculated as dicofol while the Codex residue definition for animal commodities is the sum of dicofol + 2,2-dichloro-1,1-bis(4-chlorophenyl)ethanol (p,p'-FW152) calculated as dicofol. There is a Codex MRL of 3 for cattle fat, 0.1 mg/kg for milk (F) and

[14] 2000 JMPR. Pesticide Residues in Food - 2000 Evaluations – Part I, FAO Plant Production and Protection Paper 165. FAO and WHO 2001 http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm

1 mg/kg for cattle edible offal. There is an Australian MRL for mangoes at 5 mg/kg (fruits other than strawberries).

Residues in soil and foliage decline with typical half-lives of 16- 60 days and >6 months respectively.

The TF for fat for the Australian and Codex residue definitions are 0.05-0.1 for Australia and 0.3-0.5 for the Codex residue definition[15]. Assuming residues in fruit pulp are at the same level as the MRL and are is fed at 100% of the ration, the anticipated residues in fat are 5×0.5 = 2.5 mg/kg for the Codex residue definition. Anticipated residues in milk are 5×0.04 = 0.2 mg/kg for the Codex and 5×0.006 = 0.03 for the Australian residue definition. Residues above LOQ are expected if mango waste derived from dicofol treated mangoes are fed to animals.

Dicofol can contain up to 1000 mg/kg DDT and related compounds[16], an application rate of 60 g ai/hL corresponds to a potential application of DDT at 1.2 g/ha assuming 2000L/ha spray volume. The TF for fat and milk fat are estimated to be 1.8 and 2.1 respectively. If residues of DDT are present at the same ratio to dicofol as in the technical active ingredient the anticipated residues in mango waste are 5/1000×1.8 = 0.009 mg/kg in subcutaneous fat and 5/1000×2.1 = 0.01 mg/kg in milk fat.

Livestock residues (dicofol) may exceed international and/or domestic market standards.

Dimethoate

- is an organophosphate insecticide used for the control of various insects in crops. It is registered on avocados and mangoes for the control of fruit fly for which the application rate is up to 30 g ai/hL. The harvest WHP is 7 days.

It is also registered as a post-harvest dip for the control of fruit fly with an application rate of 40 g ai/100 L (400 ppm).

There are Australian, Codex and USA MRLs for dimethoate in animal tissues. The Australian MRLs for animal commodities have been set at *0.05 mg/kg while the US ones are set at 0.02 mg/kg. There are Australian MRLs of 5 mg/kg for fruits (includes avocados) and 1 mg/kg for mangoes.

A metabolism study with lactating goats dosed orally with dimethoate suggests that residues are not expected in animal tissues[17].

It is anticipated that animal product residues will be below typical method LOQs.

Endosulfan

- is an organochlorine insecticide used for the control of various pests in a variety of crops. In avocados it is used with a maximum application rate of 735 g ai/ha (70 g ai/100 L) while in mangoes the maximum rate is 70 g ai/100 L.

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[15] 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

[16] Australian Pesticides And Veterinary Medicines Authority, Minimum Compositional Standards (MCS) for Active Constituents as of 30 January 2004, http://www.apvma.gov.au/tgac/mincompstandards.pdf

[17] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

The harvest WHP is 14 days for avocado and 7 days for mango.
Do not graze orchards after application.
ESI: Livestock that have been grazing on or fed treated crops should be placed on clean feed for 21 days prior to export slaughter.

There are Australian, Codex and USA MRLs for animal commodities. The Australian and Codex MRL for cattle fat is 0.2 mg/kg while the US MRL is 13 mg/kg. The Australian MRL for milk is 0.02 mg/kg, USA 2 mg/kg for milk fat and Codex 0.1 F mg/kg. There are Australian MRLs for avocados and mangoes set at 2 mg/kg (assorted tropical and sub-tropical fruit inedible peel).

The APVMA publication "*The reconsideration of approval of the active constituent Endosulfan, registration of products containing Endosulfan and their associated labels, draft final review report*", May 2004 contains details of Australian residue trials on avocado and mango.

In a trial conducted with an application rate of 140 g ai/hL (2× the label rate) and harvest 0, 14, 21 and 28 days after application, residues in whole fruit at were 1.2 mg/kg at day 0 declining to 0.16 mg/kg at day 21. At 14 days after application, residues in peel were 1.2 mg/kg while those in flesh were 0.025 mg/kg. At 28 days after application, residues in peel were 0.95 mg/kg and in flesh 0.047 mg/kg. The distribution of residues in peel rather than in pulp is a characteristic of endosulfan residues in fruit with inedible peel and is repeated for citrus, persimmons etc. The highest residue trials observed according to Australian GAP were 0.065 mg/kg for avocado and 0.22 mg/kg for mango though on combining the data for tropical and subtropical fruit, inedible peel, an MRL of 2 mg/kg was recommended by the APVMA.

The TF for fat is 0.3-0.4[18]. Feeding avocado or mango waste at 100% of the diet would result in maximum anticipated residues of 2×0.4 = 0.8 mg/kg. Based on the available information, feeding of pulp derived from avocados or mangoes treated with endosulfan may pose a risk with respect to residues, especially if concentration of residues occurs on processing. However, residues should be below the Codex MRL if animals are kept on "clean feed" for 21 days prior to slaughter. The label ESI is 21 days.

The TF for milk is 0.02. Residues in milk would be 2×0.02 = 0.04 mg/kg. The TF for cream is 0.12. Residues in cream would be 2×0.12 = 0.24 mg/kg.

Noting that residues in avocadoes and mangoes are not expected to significantly exceed 0.2 ppm and that derived waste would not be expected to be incorporated at more than 30% of the diet, livestock residues are not anticipated to exceed international and/or domestic market standards.

Epoxiconazole
-is a conazole fungicide used to treat banana leaf spot and leaf speckle, including those interplanted into avocados. The application rate is up to 75 g ai/ha.
The harvest WHP is 1 day for avocados and bananas.

The Australian MRLs (mg/kg) are Edible offal (mammalian) 0.05, Meat (mammalian) *0.01, Milks *0.005 and Avocado 0.5 and Banana 1. The US MRL for banana is 0.5 mg/kg.

[18] Reregistration Eligibility Decision for Endosulfan Case No. 0014 EPA 738-R-02-013 November 2002 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division. http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg

Lactating dairy cattle were dosed at 4 ppm (0.12 mg/kg bw) and 41 ppm (1.2 mg/kg bw) for 28 days[19]. Residues in milk for the 4 ppm dose group were <0.001 mg/kg for 20 of 27 daily samples, with a maximum observable residue of 0.002 mg/kg. Residues in tissues at slaughter were <LOD except for liver for which the maximum residue was 0.04 mg/kg. For the 41 ppm dose group a detectable residue in fat of 0.02 mg/kg was observed in a single animal. Residues partitioned into cream such that the concentration relative to whole milk was 14×.

It is anticipated that animal product residues will be below typical method LOQs.

Fenbutatin oxide
- is a miticide. Application to avocados is at an application rate of up to 21 g ai/hL.
The harvest WHP is 14 days.
Do not graze or feed animals on cover crops in sprayed orchards

There are Codex but no Australian or US MRLs for fenbutatin oxide in animal tissues. The Codex MRLs are 0.2 mg/kg for edible offal and *0.05 mg/kg for meat mammalian and milk. The Codex MRL for bananas is 10 mg/kg. The Australian MRL for avocados and mango is 5 mg/kg.

Feeding at 96 ppm for 28 days resulted in residues of up to 0.06 mg/kg in fat and 0.22 mg/kg in liver/kidney and 0.11 mg/kg in cream and <0.02 mg/kg in skim milk (US residue definition)[20]. Anticipated residues in fat are 5×0.0006 = 0.003 mg/kg (feeding at 100% of diet), less than likely regulatory method LOQs for fat.

It is anticipated that animal product residues will be below typical method LOQs.

Fenthion
- is an organophosphate insecticide used for the control of various insects and nematodes. It is registered on avocados and mangoes for the control of fruit fly. The application rate is up to 41.25 g ai/hL.
The harvest WHP is 7 days.
There is also a post-harvest application for fruit fly with a dip rate of 41.25 g ai/100 L (412 ppm).

There are Australian and US (due to expire 1/4/06) but no Codex MRLs for fenthion in animal tissues (cattle). The relevant Australian and USA MRLs for fenthion in animal tissues are 1 mg/kg in Australia and 0.1 mg/kg in the US. The relevant milk MRLs are T0.2 and 0.01 (N) mg/kg (expire 4/1/03) respectively. The MRL for avocados and mangoes is 5 mg/kg.

Residues in tissues of lactating dairy cows fed at a nominal feed level of 7.6 ppm were all <0.05 mg/kg[21]. The TF for milk is 0.002.

It is anticipated that animal product residues will be below typical method LOQs.

[19] Public Release Summary on Evaluation of the new active EPOXICONAZOLE in the product OPUS 75 FUNGICIDE, APVMA November 2003, Canberra, Australia.
[20] 1979 JMPR - Pesticide Residues in Food - 1979 Evaluations, Part I Residues FAO Plant Production and Protection Paper 20 Suppl. FAO and WHO 1980
[21] 2000 JMPR. Pesticide Residues in Food - 2000 Evaluations – Part I, FAO Plant Production and Protection Paper 165. FAO and WHO 2001 http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm

Fluazifop-p
- is a selective post-emergent herbicide used for the control of certain grasses in crops such as canola, cotton, sunflower, legumes and pastures. The application rate for avocados and mangoes is up to 0.212 kg ai/ha.
A WHP is not required when used as directed for avocados but is 14 days for mangoes.

There are Australian and USA but no Codex animal tissue MRLs for fluazifop. The relevant Australian MRLs are *0.05 for edible offal and meat and 0.1 for milk. The US tolerances for animal commodities have all been set at 0.05 mg/kg (fluazifop-butyl). The Australian MRLs relevant to avocado and mango are *0.02 mg/kg and 0.05 mg/kg, respectively.

It is anticipated that animal product residues will be below typical method LOQs.

Fosetyl-Aluminium
-is a fungicide used for the control of root rot in avocados. It is applied as foliar spray, at 300 g ai/hL.
The harvest WHP is 1 day.

The Australian MRL for avocado is 5 mg/kg. Animal metabolism studies show that the major components of the residue are phosphorous acid and aluminium[22].

It is anticipated that animal product residues will be below typical method LOQs.

Glufosinate ammonium
-is a non-selective foliar herbicide used for the control of broadleaf weeds and grasses in crops such as cotton, maize, sorghum and winter cereals as well as pastures. It is applied as a shielded spray to avocado and mango trees. The application rate is up to 1 kg ai/ha.
No harvest WHPs are required.
Do not graze or cut treated areas for stock food for 8 weeks after application

The relevant Australian MRLs are the same at 5 mg/kg for offal, 0.1 mg/kg for meat and *0.05 mg/kg for milks. The Codex MRLs are *0.1 mg/kg for edible offal, *0.05 mg/kg for meat mammalian and *0.02 mg/kg for milks. The relevant USA MRL is 6 mg/kg for cattle mbyp while the MRLs for meat and fat are 0.15 and 0.4 mg/kg respectively. The US MRL for milk is 0.15 mg/kg. There is an Australian MRL for mixed pasture of 15 mg/kg and the avocado and mango MRLs are 0.2 mg/kg.

The JMPR have reported that residues were <0.01 mg/kg in edible offal and meat of cattle fed at the equivalent of 27 ppm in the diet[23].

It is anticipated that animal product residues will be below typical method LOQs.

Glyphosate
-is a non-selective foliar herbicide used for the control of broadleaf weeds and grasses in crops such as cotton, maize, sorghum and winter cereals as well as pastures. It is applied as a shielded spray to

[22] [22] Reregistration Eligibility Document. Aluminum tris(*o*-ethyl-phosphonate) (referred to as fosetyl-Al) December 1990 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division
[23] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

avocado and mango orchards. The application rate is up to 3.24 kg ai/ha (fruit not treated, shielded spray).
No harvest or grazing WHPs are required.

The relevant Australian MRLs set at 2 mg/kg for offal and 0.1 mg/kg for milk while Codex MRLs set at 5 mg/kg for offal and *0.05 mg/kg for milk. . The relevant USA MRL is 5 mg/kg for cattle meat by products. The primary animal feed commodity MRL for glyphosate is 150 mg/kg, the avocado and mango MRLs are both *0.05 mg/kg. It is considered unlikely that residues in fruit and waste would exceed the PAFC MRL.

It is anticipated that animal product residues will be below typical method LOQs.

Haloxyfop-R
- is a selective post-emergent herbicide used for the control of certain grasses in crops such as grain legumes, oilseeds (including cotton) and legume pastures. The application rate for avocado and mango orchards is up to 416 g ai/ha as a directed spray.
No harvest WHP required

There are Australian but no USA or Codex animal tissue MRLs for haloxyfop. The relevant Australian MRLs are 0.5 mg/kg for edible offal, 0.02 mg/kg for meat (fat) and 0.02 mg/kg for milk. The Australian MRL relevant to avocados and mangoes is *0.05 mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Mancozeb
- is a dithiocarbamate fungicide used on a variety of crops. It is used on mangoes at an application rate of up to 150 g ai/100 L or 2.25 kg ai/ha.
The harvest WHP is 14 days
Do not feed crops and or trash to livestock.

There are Australian, Codex and US MRLs for mancozeb in animal commodities. The Australian MRL for edible offal is 2 mg/kg while the Codex MRL is 0.1 mg/kg, both as CS_2. The USA residue definition is zinc ethylenebisdithiocarbamate and the MRL 0.5 mg/kg for liver and kidney. The Australian and Codex MRLs for milk are *0.2 mg/kg and *0.05 mg/kg respectively.

The Australian PAFC MRL is 50 ppm and the mangoes MRL 1 mg/kg. Residues in fruit waste/pulp would be expected to be much less than 50 ppm. The target tissue is liver. The TF for liver (45 ppm feeding study)[24] was 0.003 giving an anticipated maximum residue from the feeding of mango pulp at 100% of the diet of 2×0.003 = 0.006 mg/kg, less than the relevant international MRLs. The TF for milk was <0.008.

It is anticipated that animal product residues will be below typical method LOQs.

Metalaxyl
- is a fungicide used on a variety of crops. It is used on avocados at 5 g ai/m^2.
The harvest WHP is 7 days.

[24] 1993 JMPR - Pesticide Residues in Food - 1993 Evaluations, Part I Residues FAO Plant Production and Protection Paper 124. FAO and WHO 1994

There are Australian and US but no Codex MRLs for metalaxyl in animal commodities. The Australian and Codex residue definition is parent compound. The Australian MRL for edible offal and for meat is *0.05 mg/kg while the milk MRL is *0.01 mg/kg. The US residue definition is the sum of metalaxyl and its metabolites containing the 2,6-dimethylaniline moiety, and N-(2-hydroxymethyl-6-methylphenyl)-N-(methoxyacetyl)-alanine methyl ester, each expressed as metalaxyl equivalents. The USA MRLs are 0.4 mg/kg for fat, liver and kidney and 0.05 mg/kg for meat and meat by-products and 0.02 mg/kg for milk. The Australian MRL for avocados is 0.5 mg/kg.

In a lactating goat metabolism study conducted at a dose level equivalent of feeding at 7 ppm, radioactive residues in tissues, expressed in metalaxyl equivalents, were all <0.06 mg/kg[25]. It is considered unlikely that feeding of fruit waste derived from metalaxyl treated avocados would generate tissue residues above regulatory LOQs.

It is anticipated that animal product residues will be below typical method LOQs.

Methidathion
- is an organophosphate insecticide used for the control scale, mealy bugs and aphids etc. The application rate is up to 50 g ai/hL for avocados and mangoes. Methidathion residues decline with typical half-lives of 7 and 3 days for soil and foliage respectively.
The harvest WHP is 21 days for mangoes and 7 days for avocados.

There are Australian and Codex but no USA MRLs for methidathion in animal tissues. The Australian (Codex) and USA residue definitions differ: methidathion (Australia, Codex), sum of methidathion, its oxygen analogue, the sulfoxide and the sulfone (USA). The Australian and Codex that apply to animal tissues are 0.5 and *0.02 mg/kg respectively. The corresponding milk MRLs are 0.5 [in the fat] and 0.001 mg/kg.. The Australian MRL for avocado is 0.5 mg/kg and mango 2 mg/kg. The US MRL for mango is 0.05 mg/kg.

No residues of methidathion were observed in tissues of cows fed at up to 50 ppm in the diet when measured by the Australian or USA residue definitions[26].

It is anticipated that animal product residues will be below typical method LOQs.

Methomyl
- is a carbamate insecticide used for the control of ectropis looper on avocados (permit). The application rate is up to 32.5 g ai/hL. Methomyl residues decline with typical half-lives of 7 and 4 days for soil and foliage respectively.
The harvest WHP is 3 days.

There are Australian and Codex but no USA MRLs for methomyl (as thiodicarb) in animal tissues. The Australian and Codex MRLs for animal tissues and milk are the same at 0.05 and *0.02 mg/kg respectively . The Australian MRL for avocado is *0.1 mg/kg and for mango T*0.05 mg/kg.

[25] 1982 JMPR Pesticide Residues in Food - 1982 Evaluations, FAO Plant Production and Protection Paper 49. FAO and WHO 1983
[26] Methidathion Reregistration Eligibility Decision Residue Chemistry Considerations Shaughnessy No. 100301; Case No. 0034 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

No residues of methomyl/thiodicarb were observed in tissues (<0.01 mg/kg) of cows fed at up to 86 ppm in the diet when measured by the Australian or USA residue definitions[27]. There is no expectation of residues in animal tissues.

It is anticipated that animal product residues will be below typical method LOQs.

Methoxyfenozide
- is an insecticide used for the control of avocado leafroller in avocadoes. The application rate is up to 6 g ai/hL.
The harvest WHP is 14 days

There are Australian, Codex and USA MRLs for methoxyfenozide in animal tissues. The Australian MRLs have all been set at the LOQ (*0.01 mg/kg). The Codex MRLs are 0.05 mg/kg for fat, 0.02 mg/kg for edible offal and 0.01 mg/kg for milk. The US tolerances are 0.5 mg/kg for fat, 0.02 mg/kg for meat and 0.1 mg/kg for milk. The Australian MRL for avocadoes is 0.5 mg/kg.

Based on available cattle feeding studies, there is no expectation of residues in animal tissues when fed at a maximum of 22 ppm in the diet

It is anticipated that animal product residues will be below typical method LOQs.

Oxyfluorfen
- is a diphenyl ether herbicide used for the control of weeds in various crops. The application rate is up to 18 g ai/ha.
There is no harvest WHP.
Do not graze treated weeds

There are Australian and US but no Codex MRLs for oxyfluorfen in animal commodities. The Australian MRLs have all been set at *0.01 and the US ones at 0.01 mg/kg. The Australian MRL for tropical fruit inedible peel is *0.01 mg/kg. The TF for fat is 0.035 and for milk is 0.003[28].

It is anticipated that animal product residues will be below typical method LOQs.

Paclobutrazol
-is a triazole plant growth regulator that is applied to mangoes as a collar drench at up to 5 g ai/tree.
The harvest WHP is not specified.

There are no Australian, Codex or US MRLs for paclobutrazol in animal tissues.
The Australian MRL for assorted tropical fruit inedible peel is *0.01 mg/kg, avocado T0.1 and mango T1 mg/kg.

Residues of paclobutrazol in a goat metabolism study where goats were orally dosed at the equivalent of 10 ppm for 7 days were 0.018 mg/kg in liver and <0.001 mg/kg in fat. No significant residues were detected in milk[29].

[27] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002
[28] Reregistration Eligibility Decision (RED) Oxyfluorfen List A Case 2490, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division
[29] Evaluation of fully approved or provisionally approved products. Issue 142: Evaluation on paclobutrazol, September 1995, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK

It is anticipated that animal product residues will be below typical method LOQs.

Paraquat
- is a herbicide used for the control of weeds in various crops. The application rate is up to 3.2 L/ha as a directed spray = 800 g ai/ha.
Do not graze or cut sprayed vegetation for stock food for at least 1 day after application.
Remove stock from treated areas 3 days before slaughter.

The Australian MRLs for paraquat in edible offal and milk are 0.5 and *0.01 mg/kg while Codex MRLs are 0.05 and *0.005 mg/kg respectively. The US MRL for kidney is 0.5 mg/kg and for milk 0.01 mg/kg. Residues in soil and foliage decline with typical half-lives of *ca.* 1000 and 30 days respectively. The MRL for fruits is *0.05 mg/kg in both Australia and the US. For residues in kidney to be less than the US MRL of 0.3 mg/kg, cattle would have to fed at less than ca. 80 ppm in the diet. Noting the application rates and that the MRL for fruits is *0.05 mg/kg, it is considered unlikely that residues in fruit and derived waste would exceed 80 ppm.

It is anticipated that animal product residues will be below typical method LOQs.

Pendimethalin
-is a selective herbicide used for the control of annual ryegrass and certain broadleaf weeds in cotton, cereals etc. It is applied to avocado and mango orchards at an application rate of up to 3.96 kg ai/ha as a directed spray.
No harvest or grazing WHPs are required.

There are no Codex or US MRLs for pendimethalin in animal tissues while the Australian MRLs are all *0.01 mg/kg. Residues decline in soil and foliage with typical half-lives of 90 and 50 days respectively. The Australian MRL for fruit is *0.05 mg/kg. The US EPA notes that animal metabolism studies in goats conducted at exaggerated feeding levels indicate that there is no reasonable expectation for residues of pendimethalin in tissues[30].

It is anticipated that animal product residues will be below typical method LOQs.

Piperonyl butoxide (PBO)
- is a synergist used to increase the effectiveness of various synthetic pyrethroid (SP) insecticides. It is registered for use with pyrethrin in the control of insect pests on fruits. The application rate is up to 31 g ai/hL.
The harvest WHP is 1 day

There are Australian and Codex but no US MRLs for PBO in animal commodities. PBO is exempt from the requirement for tolerances in the US. The Australian MRLs for animal tissues have all been set at 0.1 mg/kg. The Codex MRL for mammalian meat (fat) (except cattle) is 2 mg/kg and for cattle meat (fat) 5 mg/kg. The Australian MRL for milks is 0.05 mg/kg. There is an Australian MRL of 8 mg/kg for fruits.

[30] Reregistration Eligibility Decision Pendimethalin List A Case 0187, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

The TF for PBO in fat is 0.004 (feeding at 100 ppm in the diet)[31] resulting in an anticipated maximum residue from feeding avocado and mango pulp/waste at 100% of the diet of 8×0.004 = 0.032 mg/kg, less than the relevant Australian, proposed Codex and US MRLs and likely regulatory method LOQ.
The TF for PBO in milk is 0.0001 (feeding at 100 ppm in the diet) resulting in an anticipated maximum residue from feeding at 100% of the diet of 8×0.0001 = 0.0008 mg/kg, less than the relevant Australian, proposed Codex and US MRLs and likely regulatory method LOQ.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Prochloraz
-is an imidazole fungicide used for the control of Anthracnose in avocadoes and mangoes. The application rate is 25 g ai/100 L as a post-harvest spray.

Do not graze stock on … treated fruit or by-products from treated processed fruit to livestock.

There are Codex but no Australian or US MRLs for prochloraz in animal commodities. The Codex MRLs are 10 mg/kg for edible offal, 0.5 mg/kg for cattle fat and *0.05 mg/kg for cattle meat and milk. The Australian MRL for avocado and mango is 5 mg/kg.

The 1990 JMPR reported a feeding study in which cattle were dosed at rates of 10, 30 and 100 ppm for 28 days[32]. At the lowest dose level, residues of 2.8, <0.05, 0.5 and 0.1-0.2 mg/kg, respectively, were found in liver, muscle, kidney and fat. Residues above LOQ may occur in kidney and liver if livestock are fed waste derived from treated fruit crops. Fruit treated post-harvest is unlikely to be fed to animals or processed in to animal feed.

Livestock residues may exceed international and/or domestic market standards.

Propiconazole
-is a DMI fungicide used for the control of various fungal diseases in bananas (Black sigatoga, leaf spot and leaf speckle etc) interplanted with avocados. Application is at up to 100 g ai/ha.
The harvest WHP is 1 day.

There are Australian, Codex and US MRLs for propiconazole in animal commodities. The Australian MRLs (propiconazole) are 1 mg/kg for edible offal, 0.1 mg/kg for meat and *0.01 mg/kg for milk. The Codex MRLs in animal commodities are set at *0.01 mg/kg. The US residue definition is the sum of propiconazole and its metabolites determined as 2,4-dichlorobenzoic acid, expressed as parent compound. The US MRLs are 2 mg/kg for liver and kidney, 0.05 mg/kg for fat and meat by-products (except liver and kidney) and milk. The Australian MRL for avocado is *0.02 mg/kg.

The Australian use-pattern is such that low levels of residues are expected in avocados and derived animal feeds. Animal transfer studies were reported by the 1987 JMPR at feeding levels of 15-100 ppm for cows and 4.5 ppm for goats resulted in undetectable parent residues in milk and tissues

[31] 2002 JMPR. Pesticide Residues in Food - 2002 Evaluations – Part I: Residues Volume 1, FAO Plant Production and Protection Paper 175/1. FAO and WHO 2003
[32] 1990 JMPR. Pesticide Residues in Food - 1990 Evaluations, Part I Residues FAO Plant Production and Protection Paper 103/1. FAO and WHO 1990

(<0.05 mg/kg)[33]. After feeding cows for 14 days at 15 ppm the total residues were undetectable in milk and 0.63 mg/kg in kidney.

It is anticipated that animal product residues will be below typical method LOQs.

Pyrethrins
- is a natural pyrethroid insecticide used for the control various insect pests in fruit crops. The application rate is up to 7.7 g ai/hL.
The harvest WHP is 1 days.

There are US but no Australian or Codex MRLs for pyrethrins in animal commodities. The MRLs applicable to fat (target tissue) have been set at 1 mg/kg and for meat and meat byproducts 0.05 mg/kg. There is an Australian MRL of 1 mg/kg for fruits while in the US pyrethrins are exempt from the requirement for a tolerance when applied to growing crops.

In a feeding study with lactating cows, residues in tissues of animals dosed orally at a level equivalent to 5 ppm in the feed had residues in tissues that were <LOQ (0.038 mg/kg) for muscle, liver and kidney and 0.048-0.075 mg/kg in fat[34]. Feeding avocado or mango pulp with residues of 1 ppm should not result in tissues residues above typical LOQs for pyrethrins unless there is significant concentration upon processing.

It is anticipated that animal product residues will be below typical method LOQs.

Spinosad
- is an antibiotic insecticide used for the control of mango tip borer in mango orchards. The application rate is up to 1.2 g ai/hL.
The harvest WHP is 7 days.

There are Australian, Codex and USA MRLs for spinosad in animal commodities. The Australian and US MRLs applicable to cattle meat (fat) are 2 and 50 mg/kg respectively. The respective milk MRLs are T0.1 and 7 (85 mg/kg for whole milk fat) mg/kg. The Codex MRL is 3 mg/kg for cattle fat and 2 mg/kg for fat of other mammals and 1 mg/kg for cattle milk (5 mg/kg for milk fat). There is an Australian MRL at 0.3 mg/kg for assorted tropical fruit – inedible peel.

The TF for cattle fat is 0.5-0.6[35] giving an anticipated maximum residue in cattle fat from feeding of fruit waste at 100% of the diet of 0.5×0.6 = 0.3 mg/kg.
The TF for cattle milk is 0.05 giving an anticipated maximum residue in cattle milk from feeding of fruit waste at 100% of the diet of 0.5×0.05 = 0.025 mg/kg.
Note: It would be unreasonable to feed animals at 100% of the diet and the estimates are conservative. It is considered unlikely that residues from feeding fruit or processed waste from treated avocado or mango crops will lead to unacceptable residues in animal commodities.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

[33] 1987 JMPR Pesticide Residues in Food - 1987 Evaluations, Part I Residues FAO Plant Production and Protection Paper 86/1. FAO and WHO 1988
[34] 2000 JMPR. Pesticide Residues in Food - 2000 Evaluations – Part I, FAO Plant Production and Protection Paper 165. FAO and WHO 2001
[35] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002

Tebufenozide

- is an insecticide. Application to avocados is for control of leaf rollers and is at an application rate of 6 g ai/hL.
The harvest WHP is 14 days.
Do not graze any treated area or cut for stock food

There are Australian and US MRLs but no Codex MRL for tebufenozide in animal tissues. The Australian residue definition is parent compound. The animal tissue MRLs have all been set at *0.02 mg/kg while the milk MRL is *0.01 mg/kg.

The US residue definition for animal commodities is the sum of tebufenozide and its metabolites benzoic acid, 3,5-di-methyl-1-(1,1-dimethylethyl)-2-((4-carboxymethyl)benzoyl)hydrazide), benzoic acid, 3-hydroxymethyl,5-meth-yl-1-(1,1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide, the stearic acid conjugate of benzoic acid, 3-hydroxymethyl,5-methyl-1-(1,1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide and benzoic acid, 3-hydroxymethyl-5-methyl-1-(1,1-dimethylethyl)-2-(4-(1-hydroxy-ethyl)benzoyl)hydrazide.
The US MRLs are 0.1 mg/kg for fat, 0.08 mg/kg for meat and meat by-products and 0.04 mg/kg for milk. The Australian MRL for avocado is 0.5 mg/kg.

The Australian MRL for avocado is 0.5 ppm.

In a lactating cow feeding study, animals were dosed at levels equivalent to 6, 18 or 60 ppm in the feed for 28 consecutive days[36]. The TFs for fat are 0.003 and 0.005 for the Australian and US residue definitions respectively (18 ppm feeding level). Using the TF for the US residue definition and assuming feeding of avocado waste at 100% of the diet, anticipated residues in fat are $0.5 \times 0.005 = 0.0025$ mg/kg, less than typical regulatory method LOQs for animal tissues (0.02 mg/kg).
The TFs for milk are 0.0003 and 0.001 for the Australian and US residue definitions respectively (18 ppm feeding level). Using the TF for the US residue definition and assuming feeding of avocado waste at 100% of the diet, anticipated residues in fat are $0.5 \times 0.001 = 0.0005$ mg/kg, less than typical regulatory method LOQs for milk (0.01 mg/kg).

It is anticipated that animal product residues will be below typical method LOQs.

Trichlorfon

- is an organophosphate insecticide used for the control of various insects in crops. It is registered on avocados at an application rate of up to 100 g ai/100 L.
Do not harvest for 2 days after application.

There are no Codex MRLs for trichlorfon in animal tissues. The Australian MRL for cattle fat is 0.1 mg/kg, and the US tolerance is 0.5 mg/kg. The Australian MRL for milks is *0.05 mg/kg while no milk MRL has been set in the US. The Australian MRL for fruits is 0.1 mg/kg. Residues decline in soil and foliage with typical half-lives of 10 and 3 days respectively.

[36] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002

Following peroral uptake of the trichlorfon (12.5 and 20 ppm in feed), no trichlorfon residues were detected (<0.1 ppm) in any of the examined tissues and organs (brain, heart, kidney, steak, fat) after a four-week feeding period[37].

It is anticipated that animal product residues will be below typical method LOQs.

Trifluralin

- is a selective herbicide of the dinitroaniline class and is used for the control of grass and broadleaf weeds in crops including orchards. It is applied to orchards as a shielded or directed spray to bare ground. The application rate is up to 1.1 kg ai/ha.
No harvest or grazing/feeding WHPs required.

There are no Codex or US MRLs for trifluralin in animal tissues. The Australian MRLs for meat (mammalian) and milk are *0.05 mg/kg.

The US EPA evaluation of trifluralin states that based on a goat metabolism study where animals were fed at exaggerated rates there is no expectation of finite residues of trifluralin in animal tissues[38]. Residues decline in soil and foliage with typical half-lives of 60 and 3 days respectively.

It is anticipated that animal product residues will be below typical method LOQs.

Uniconazole-p

-is a DMI fungicide used for the enhancement and improvement of fruit shape and reduction in vegetative growth. Application to avocados is at rates of up to 100 g ai/hL.
A harvest WHP is not required.

There are no Australian, Codex and US MRLs for uniconazole-p in animal commodities. The Australian MRL for avocado is 0.5 mg/kg. Application is at flowering when fruit are not present and as such no residues are expected in fruit or derived pulp.

It is anticipated that animal product residues will be below typical method LOQs.

[37] 1971 JMPR. Evaluations of some pesticide residues in food. AGP/1971/M/9/1; WHO Pesticide Residues Series No. 1, 1972

[38] Reregistration Eligibility Decision, Trifluralin, List A Case 0179, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division EPA 738-R-95-040, April 1996