


# OLIVE CARE

## APPROVED SUPPLIER PROGRAM

## FOR SUPPLY OF OLIVES TO PROCESSING

# REFERENCE

# MANUAL

**VERSION 6 AUGUST 2008**

© OliveCare Australia Pty Ltd 2005-2008

All rights and title including copyright to this publication are owned by OliveCare Australia Pty Ltd. Other than for the purposes of and subject to the conditions prescribed under the Copyright Act, no part of it may in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) be reproduced, stored in a retrieval system or transmitted without prior written permission.

If you wish to reproduce or otherwise deal with any part of this publication please contact: OliveCare Australia Pty Ltd PO Box 1306 Nambour Q 4560 Phone: 07 5476 2005

Prepared By:
Gino Russo, OliveCare Australia Pty Ltd.

## CONTENTS

**1. BLANK RECORD TEMPLATES 4**

PRODUCT AND HANDLING SPECIFICATION 4

STOCK USAGE RECORD 7

GROVE APPLICATION RECORD 8

STORAGE RECORD 9

TRAINING REGISTER 10

HARVEST AND TRANSPORT RECORD 11

HARVEST AND TRANSPORT RECORD (CONTRACT HARVESTER) 12

INTERNAL REVIEW CHECKLIST 13

**2. RECOMMENDATIONS FOR MAINTAINING POSTHARVEST QUALITY 20**

OLIVE STORAGE AND TRANSPORT SUMMARY 22

**3. MICROBIOLOGICAL HAZARDS 24**

BOTULISM ASSOCIATED WITH HOME PRESERVED MUSHROOMS 24

PRESERVATION OF VEGETABLES IN OIL AND VINEGAR 25

SMALL-SCALE COMMERCIAL PRESERVATION OF ACID FOODS 27

WATER ACTIVITY 31

LEGAL IMPLICATIONS OF FOOD POISONING INCIDENTS 33

**4. CHEMICAL HAZARDS 34**

REGISTERED CHEMICALS 34

OFF LABEL PERMITS 36

MAXIMUM RESIDUE LIMITS 37

MAXIMUM PERMISSIBLE CONTAMINANTS 37
Heavy Metals 37
Deregistered and Persistent Chemicals 37

**5. WEB ADDRESSES 38**

# 1. BLANK RECORD TEMPLATES

## Product and Handling Specification

### General Description

| | |
|---|---|
| Variety / Type | |
| District | |
| Harvest Period | |
| Customer | |
| Intended use | |

### Product Quality

| | |
|---|---|
| Maturity | |
| Defect Allowances | |

## Storage, Handling, Transport and Labelling Requirements

| | |
|---|---|
| Packaging | |
| Labelling | |
| Storage Conditions | |
| Pulp Temperature | |
| Storage Humidity | |
| Maximum Storage Time | |
| Transport | |

## Food Safety

| | |
|---|---|
| Contaminants | **Physical:**<br><br>**Chemical:**<br>No detectable evidence of contamination from oil, grease or petrochemicals.<br><br>Maximum Residue Limits.<br>The Maximum residue Limits for fresh olives are:<br><br>(Ref. Food Standards *Australian and New Zealand Food Standards Code, Standard 1.4.2.*)<br><br>Maximum Permissible Contaminants<br><br>• Lead Less than 0.1 mg/kg of olives<br><br>(*Ref. Food Standards Australian and New Zealand Food Standards Code, Standard 1.4.2.*)<br><br>**Biological:** |

## Stock Usage Record

| Date Opened | Product Name and Description | Batch Number or Identification and Expiry Date | Initials |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## Grove Application Record

| Date/Time of Application<br><br>Date safe to harvest | Block Ref & Area (Ha) | Grove Stage & Weed Pest or Disease Targeted | Chemicals & Additives Used<br><br>Mulch or Fertiliser used | Recommended Rate / Ha | Dilution Rate / 1000 Ltrs | Total volume of chemical made up Ltrs | Litres of spray applied / Ha<br><br>Kg Mulch or fertiliser applied / Ha | Wind Strength & Direction | Temp<br><br>(°C) | Operator |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Storage Record

| Date / Time Entering Storage | Batch Number or Identification | Cool Room Temperature (°C) (measured at end of day) | Date / Time Dispatched | Initials |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## Training Register

| | | | GHP | | |
|---|---|---|---|---|---|
| **Staff Member's Name** | **Training Course** | **Induction (Personal Hygiene, Olive Quality and Safety)** | **Olive Growing (Grove Maintenance) Procedures** | **Olive Harvesting Procedures** | **Accredited Agricultural Chemical Application** |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |
| | **Date Completed** | | | | |
| | **Initials** | | | | |

**Harvest and Transport Record**

| Date | Block ID | Variety | Amount Harvested | Bin ID (Batch no.) | Transport Date | Destination | Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Harvest and Transport Record (Contract Harvester)

| | | |
|---|---|---|
| Date Harvested | | **No. of Bins harvested** |
| Time harvest started | | |
| Time harvest completed | | **Bin Codes:** |
| Property (Grove) Harvested | | |
| | | |
| | | |
| Block or Patch Harvested | | |
| | | |
| Harvest Crew<br><br>(List staff on duty) | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| **Pre-harvest Inspection** | |
|---|---|
| **Harvest Equipment** | |
| All equipment visibly clean? | 4for OK |
| Harvest Mats | 4for OK |
| Mechanical harvesters | 4for OK |
| All harvest machinery free from leaks | 4for OK |
| **Harvest (Procedure) Inspection** | |
| Olives physically undamaged by staff | 4for OK |
| Olives not permitted to touch the ground | 4for OK |
| Harvested olives free from contamination? | 4for OK |
| Chemical (Oil, grease, petrol hydraulic fluid) | 4for OK |
| Physical (Sticks, stones, leaves, debris, dirt, etc.) | 4for OK |
| **Packing** | |
| **Packing (Bin) Inspection** | |
| Bins visually clean | 4for OK |
| Bins free from physical contaminants (Sticks, stones, leaves, debris, dirt, etc.) | 4for OK |
| Bins free from sharp edges and protrusions | 4for OK |
| Packed olive layer <50 cm? | 4for OK |
| **Transport** | |
| Transport clean and free from contaminants | 4for OK |
| Transport or bins covered | 4for OK |
| Harvested Olives delivered too: | |
| | |
| | |
| Date and Time delivered: | |
| Temperature of olives on delivery | |

**Internal Review Checklist**

## Control of Food Safety and Quality

| Site and Premises | OK | Not OK | Comments |
|---|---|---|---|
| Has the grove been assessed for potential persistent chemical contamination to olives? | | | |
| If persistent chemicals are present, is the grove suitably managed to prevent contamination of olives? | | | |
| **Pest and Weed Control** | **OK** | **Not OK** | **Comments** |
| Has an Agsafe accredited supplier supplied all chemicals purchased? (Check Chemical Inventory records) | | | |
| Are all chemicals stored in a secure area in their original containers? (Check chemical storage areas) | | | |
| Is a Stock Usage Record filled out describing the chemical used and the date the chemical is opened? (Check Stock Usage records) | | | |
| **Chemical Use** | **OK** | **Not OK** | **Comments** |
| Are all chemicals used suitable for use in an Olive Grove? (Check chemical registrations and off-label permits) | | | |
| Has an approved person calibrated chemical application equipment? (Check Grove Application records or Calibration records for calibration date and the name of the person calibrating. Check training records for Chemical Accreditation Course of operator) | | | |
| Have all chemical treatments in the grove been recorded? Did an approved person supervise their application? (Check Grove Application Record and Training Records) | | | |

| Mulching and Fertilising | OK | Not OK | Comments |
|---|---|---|---|
| Are all mulches and fertilisers used free from Heavy Metals and Persistent Chemicals?<br>(Check specifications and written assurances for each mulch or fertiliser found on site) | | | |
| Is there a mulching / fertilising procedure in place that prevents contact of mulch / fertiliser with olives?<br>(Review mulching / fertilising procedures and talk to staff applying mulch / fertiliser) | | | |
| Are all mulches and fertilisers stored in a secure area that prevents contamination of olives?<br>(Check chemical storage areas) | | | |
| Are all mulches and fertiliser purchased recorded in the Stock Usage Record?<br>(Check Stock Usage record) | | | |
| Are all applications of mulch and / or fertiliser recorded in the Grove Application record?<br>Did a trained person apply them?<br>(Check Grove Application Records and Training Records) | | | |
| **Irrigation:** | **OK** | **Not OK** | **Comments** |
| Does the irrigation method prevent contact of water with olives?<br>(Review Irrigation procedures and talk to staff who irrigate the grove) | | | |
| If water contacts olives, has an analysis of irrigation water been performed that assures the safety of the irrigation water?<br>(Check irrigation technique and water analysis results. Ensure water was analysed by an independent laboratory at the start of each season and that it is potable.) | | | |

| Pre-Harvest Inspection (Grove) | OK | Not OK | Comments |
|---|---|---|---|
| Has a pre-harvest inspection procedure been developed that maximises crop yield?<br>(Review Pre-harvest Inspection procedure and talk to staff who perform Grove Pre-Harvest Inspection) | | | |
| Does the procedure include a review of chemical applications to confirm that:<br>• Only registered chemicals have been applied;<br>• Chemicals have been applied according to label instructions by an approved person;<br>• Withholding periods have been met.<br>(Check completed Pre-harvest records and Grove Application records for withholding periods) | | | |
| Does the pre-harvest inspection procedure include an inspection of the grove to ensure olives comply with Product and Handling Specifications. | | | |
| **Pre-Harvest Inspection (Equipment Preparation)** | **OK** | **Not OK** | **Comments** |
| Has a pre-harvest inspection procedure been developed that prevents olives from becoming contaminated during harvesting?<br>(Review Pre-harvest Inspection procedure and talk to staff who prepare harvest equipment) | | | |
| Does the procedure include a review of harvest equipment to confirm that equipment is well maintained, clean and free from contaminants and sharp edges? | | | |

| Harvest | OK | Not OK | Comments |
|---|---|---|---|
| Has a harvest procedure been developed that minimises damage and contamination of harvested olives?<br>(Review harvest procedure, talk to staff who harvest olives.) | | | |
| Are Harvest records complete?<br>(Review Harvest records, ensure the location of harvested batches in the grove and their destination is recorded.) | | | |
| **Olive Packing** | **OK** | **Not OK** | **Comments** |
| Has a packing procedure been developed that ensures:<br>• All bins are inspected before use and have no sharp or protruding edges and are washed if required;<br>• All bins are packed no deeper than 50 cm;<br>• All packed bins are marked with the grove name and address, date of harvest and olive variety or a batch code.<br><br>(Review harvest procedure, talk to staff who harvest olives.) | | | |
| **Storage** | **OK** | **Not OK** | **Comments** |
| Has a storage procedure been developed that ensures harvested olives are stored:<br>• In a hygienic area;<br>• For a period that ensures they will be processed within 7 days of harvest, and<br>• Under conditions that do not exceed 25 °C (measured in the middle of the bin)?<br><br>(Review storage procedure, talk to staff who store harvested olives.) | | | |
| If cool rooms are used, are temperatures monitored and recorded?<br>(Check storage records)<br>Are thermometers calibrated?<br>(Check calibration records) | | | |

| Storage and Transport | OK | Not OK | Comments |
|---|---|---|---|
| Has a storage procedure been developed that ensures harvested olives are transported:<br>• Under cover;<br>• In a well ventilated area and<br>• Do not exceed 25 °C (measured in the middle of the bin)?<br><br>(Review transport procedure, talk to staff who store harvested olives.) | | | |

| Cleaning and Sanitation | OK | Not OK | Comments |
|---|---|---|---|
| Are all tools and utensils coming into contact with olives cleaned and sanitised?<br>(Inspect equipment used in grove) | | | |
| Are all cleaning and sanitising agents used food grade?<br>(Inspect Chemical Store and Chemical Inventory Record) | | | |
| Are all cleaning chemicals and sanitisers stored in a secure storage area? (Inspect Chemical Store) | | | |
| **Personal Hygiene** | **OK** | **Not OK** | **Comments** |
| Do all personnel wash their hands with the sanitiser provided: | | | |
| Before handling olives? | | | |
| After using the toilet? | | | |
| After contact with any potentially contaminating material?<br>(Review Personal Hygiene Procedures, observe and talk to staff) | | | |
| Do all personnel wear clean clothing?<br>(Review Personal Hygiene Procedures, observe and talk to staff) | | | |
| Are personnel with communicable diseases are prevented from handling olives.<br>(Review Personal Hygiene Procedures and staff records, talk to staff) | | | |

| Sanitary Facilities and Amenities | OK | Not OK | Comments |
|---|---|---|---|
| Are toilets maintained in a clean and sanitary condition?<br>(Inspect facilities) | | | |
| Are hand washing and sanitising facilities provided for staff?<br>(Inspect facilities) | | | |
| Are separate areas away from the grove provided for staff to eat and drink?<br>Are they maintained in a clean and sanitary condition?<br>(Inspect facilities) | | | |
| **Pest Control** | **OK** | **Not OK** | **Comments** |
| Is a Pest (or vermin) control program operating in the grove to minimise damage and contamination of olives?<br>(Review Pest Control Procedures, Inspect grove) | | | |
| Are grove inspections for pests (or vermin) carried out at least once each week?<br>(Review Pest Control Procedures, talk to staff) | | | |

| Product Identification and Traceability | OK | Not OK | Comments |
|---|---|---|---|
| Are all batches of harvested olives identified with the grove name and address, harvest date and olive variety or a batch code?<br>(Review procedures, inspect harvested olives and review records) | | | |
| Perform a product trace from raw materials through to processing facility.<br>Identify:<br>• Any chemicals applied<br>• Any fertiliser / mulch applied<br>• Compliance with withholding periods<br>• Date of harvest<br>• Date of transport<br>• Transport provider<br>• Processor<br>(Review records.) | | | |

| Training | OK | Not OK | Comments |
|---|---|---|---|
| Is the Training Register complete and up to date?<br>(Check Training records) | | | |
| Are all staff performing any duties at critical steps in the growing / harvesting process trained?<br>Are they aware of their duties and responsibilities with respect to olive quality and food safety?<br>(Review Training Record. Talk to staff and determine if they understand their responsibilities.) | | | |

Completed by: Date;

(Print Name and Sign)

## 2. RECOMMENDATIONS FOR MAINTAINING POSTHARVEST QUALITY




# Olive

**Recommendations for Maintaining Postharvest Quality**

Carlos H. Crisosto, Elizabeth J.Mitcham, and Adel A. Kader
Department of Pomology, University of California, Davis, CA 95616

## Maturity Indices

**Green olives.** Size and color (even, pale green with a minimum of whitish spots (lenticels) through a straw color. An olive is considered mature if it exudes a characteristic white juice when squeezed.
**Black olives.** Color, removal force; fruits reach this stage about 3-4 months after the green stage.

## Quality Indices

**Green olives.** Color; freedom from mechanical damage, shrivelling, surface blemishes, scale and other insect injury, and decay. These olives are processed according to the California black-ripe style or Spanish green style canned olives.
**Black olives.** Color, freedom from defects, oil content (12 to 25% depending on cultivar). These are processed (Greek or Italian style) or used for oil extraction.

## Optimum Temperature

5 - 7.5°C (41-45.5°F); temperatures below 5°C(41°F) cause chilling injury of fresh olives.

## Optimum Relative Humidity

90-95%

## Rates of Respiration

| Temperature | 5°C(41°F) | 7.5°C(45.5°F) | 10°C(50°F) | 20°C(68°F) |
|---|---|---|---|---|
| Range (ml $CO_2$/kg·hr) | 5 - 10 | 8 - 12 | 12 - 16 | 20 - 40 |

To calculate heat production multiply ml $CO_2$/kg·hr by 440 to get Btu/ton/day or by 122 to get kcal/metric ton/day.

## Rates of Ethylene Production

Less than 0.1 (green olives) or 0.5 (black olives) µl ethylene/kg·hr at 20°C(68°F).

## Responses to Ethylene

Olives produce very little ethylene but are moderately sensitive to ethylene action above 1 ppm (loss of green color and flesh firmness).

## Responses to Controlled Atmospheres (CA)

Optimum CA 2 - 3% $O_2$+ 0 - 1% $CO_2$; delays senescence and softening for up to 12 weeks at 5°C (41°F) or 9 weeks at 7.5°C (45.5°F).
$O_2$ below 2% can cause off-flavors.
$CO_2$greater than 5% may increase the severity of chilling injury if olives are kept below 7.5°C (45.5°F).
**Note:**The above information is for fresh green olives; fresh black olives should be processed as soon after harvest as possible.

## Physiological Disorders

**Chilling injury (CI).** CI can be a major cause of deterioration if fresh olives are stored before processing for longer than 2 weeks at 0°C (32°F), 5 weeks at 2°C (36°F), or 6 weeks at 3°C (38°F). Symptoms include internal browning that begins in the flesh around the pit and radiates outward toward the skin as time progresses. Skin browning indicates an advanced state and/ or greater CI severity. The order of cultivar susceptibility to CI is Sevillano (most susceptible) - Ascolano - Manzanillo - Mission (least susceptible).
**Nailhead.** This disorder is characterized by surface pitting and spotting. It results from the death and collapse of epidermal cells, which create air pockets underneath the fruit skin. Symptoms are observed on olives kept at 10°C (50°F) for 6 weeks or longer or 7.5°C (45.5°F) for 12 weeks or longer.
**Carbon dioxide injury.** Symptoms (internal browning and increased decay incidence and severity) result from exposure to more than 5% $CO_2$ for longer than 4 weeks.

## Pathological Disorders

Postharvest diseases occur if the olives have been chilled (exposed to temperatures below 5°C=41°F), mechanically damaged, not cooled promptly to the optimum temperature range of 5 to 7.5°C (41 to 45.5°F), or exposed to undesirable atmospheres (above 5% $CO_2$and/or below 2% $O_2$).
Return to Produce Facts




Postharvest Technology Research and Information Center
Department of Pomology
University of California
One Shields Ave., Davis, CA 95616-8683
Send comments and questions to Postharvest Technology Research and Information Center
Copyright ©1996-2000. All rights reserved
Produce/ProduceFacts/Fruit/olive.html updated July 3, 2000

## Olive Storage and Transport Summary

# Fruit & Vegetables Storage and Transport Database V1.0

*©CSIRO/Sydney Postharvest Lab*
*Sydney, Australia +61-2-9490-8333*

## FULL SUMMARY

Printed by **Sydney Postharvest Lab.** for ***Sample Viewer*** on **3 December 1997**

| Cultivar/ Maturity | Crop | Alternate Names | Botanical Name |
|---|---|---|---|
| **Fresh** | Olive | | *Olea europaea* ssp. *europaea* |
| | | **Botanical Family** | **Plant Part** |
| | | Oleaceae | Fruit |

## Refrigerated Container / Coolroom Recommendations

| **Optimum Product Temperature =** | **5 .0- 10.0°C** |
|---|---|

**Temperature Set Points** for

| Air Delivery Control = | **5.0 - 6.0°C** | Return Air Control = | **6.0 - 7.0°C** |
|---|---|---|---|

**Ventilation (Air Exchange) Settings** for

| 6 m (20') Containers = | **30 $m^3$/h = 20 cfm** | 12 m (40') Containers = | **60 $m^3$/h = 35 cfm** |
|---|---|---|---|
| Fresh Air Exchange | **100 %/ hour** | | |

| **Acceptable product temperature at loading into container =** | **4..5- 10.0°C** |
|---|---|

## Key Properties *(For extra information and original references see detailed output)*

| Storage Time (days)@ | Humidity % RH | Freezing Point C | Ventilation Rate | Storage Time Ambient (~20°C) |
|---|---|---|---|---|
| **28 - 42** | **85 - 90** | **-1.4** | **Moderate** | |

@ For procesing 90 days at 4° C

## Other Properties *(For extra information and original references see detailed output)*

| Ethylene Production | Ethylene Sensitivity | Odour Effects | Affected by Odour of | Water Loss Rate (%/week)* | Compatibility with Ice | Bruising Susceptibility |
|---|---|---|---|---|---|---|
| Low @ | Moderate | | | | No | Very High |
| @ 4 - 40 nM ethylene /kg/h at ~20°C | | | | | | |

## Controlled Atmosphere, Respiration *(For extra information and original references see detailed output)*

| Benefit of Controlled or Modified Atmosphere = | **Fair, (+21 days)** |
|---|---|

| **Controlled Atmosphere Conditions** | | |
|---|---|---|
| **Oxygen %** | **Carbon Dioxide %** | **Temp. $^{o}$C** |
| 2 - 3 | 0 - 1 | 10 |

| **Respiration (Watts/ tonne)**[@] | | | | | | **Specific heat** |
|---|---|---|---|---|---|---|
| **0$^{o}$ C** | **5$^{o}$C** | **10$^{o}$C** | **15$^{o}$C** | **20$^{o}$C** | **25$^{o}$C** | **(kJ/kg/$^{o}$C)** |
| - | - | - | 45 - 105 | 54 - 150 | 75 -180 | 3.52 |

[@] 1 Watt/tonne = 20.4 kCal/ tonne/ day = 82.1 Btu/ ton/ day = 73.3 Btu/ 2000lbs/ day
= 0.167 mls/$CO_2$/ kg/ hour = 7.0 umol $CO_2$/ kg/ hour

## Compatibility in Mixed Storage *(For extra information and original references see detailed output)*

| Not compatible with crops that | **Produce ethylene** |
|---|---|
| Odour taint incompatibility with | |

**(Fruits and vegetables that produce significant ethylene levels -**

| | | | |
|---|---|---|---|
| Asian pear | Apple | Apricot | Avocado |
| Banana | Breadfruit | Cantaloupe | Cherimoya |
| Chinese gooseberrries | Custard apple | Feijoa | Fig |
| Honeydew melon | Jackfruit | Kiwifruit | Litchi |
| Lychees | Mango | Mangosteen | Melon |
| Muskmelon | Nashi | Nectarines | Papayas |
| Passionfruit | Pawpaw | Peach | Pear |
| Plums | Pineapple | guava | Rambutan |
| Rockmelons | Sapodilla | Sweetsop | Tomato |
| Zapote | | | |

## Seasonable Availability *(For extra information and original references see detailed output)*

| **Country** | **Start Season** | **End Season** | **Start Peak** | **End Peak** |
|---|---|---|---|---|
| Australia | Feb | Jun | Mar | May |
| | | | | |

TO HOME PAGE **Sydney Postharvest Laboratory** **Revised June 1998 (N. Uddin)**

# 3. MICROBIOLOGICAL HAZARDS

## Botulism associated with home preserved mushrooms

In June 1995 *Food Safety & Hygiene* commented on two separate incidents of food poisoning by *Clostridium botulinum* in **Italy** associated with roasted eggplant in oil.

Two clinical cases of botulism, one fatal, have now been reported in members of a family in the **United Kingdom** who ate home preserved mushrooms bottled in oil. The affected people had been given the mushrooms while on holiday in southern Italy by members of their family. The mushrooms were consumed without heating. Botulism toxin type B and the organism that produces it were subsequently detected in the mushrooms by the Public Health Laboratory Service Food Hygiene Laboratory (at Colindale).

Contamination of food products with *C. botulinum* which grows in the absence of air may or may not affect the taste of the food. Early recognition of the symptoms of botulism and treatment with antitoxin are extremely important because the antitoxin can inactivate the toxin formed by the bacteria only before it binds with neuromuscular receptors. When death occurs, it is usually because of respiratory failure in the victim.

The production and sale of vegetables in oil is becoming more common. These products may be sold through normal retail outlets or at neighborhood markets. Botulism is very rare in this country but it is necessary to take strict precautions when producing this style of product if the risk of food poisoning is to be avoided. The Food Science Australia Fact Sheet, 'Preservation of vegetables in oil and vinegar' outlines a recommended procedure for their manufacture.

It is essential that sufficient acid, usually in the form of vinegar, is included in the formulation. As noted in the 1995 article, it is a requirement of the Australian Food Standards Code that this class of product has a pH below 4.6. The pH value is a measure of the acidity of a food. Foods with a pH below 4.6 do not in general support the growth of food poisoning bacteria including C. botulinum.

(Reference: A bulletin for the Australian Food Industry August 1998. *Produced by Food Science Australia Information Services PO Box 52, North Ryde 1670. Tel +61 2 9490 8397 Fax +61 2 9490 8499* )

FOOD SCIENCE AUSTRALIA
A JOINT VENTURE OF CSIRO AND AFISC

**Food Science Australia Fact Sheet**

# Preservation of vegetables in oil and vinegar

Revised January 2000

It is now a relatively common practice to bottle vegetables and herbs and spices in either oil, vinegar or a mixture of both. This is done both commercially and domestically and the products should be refrigerated below 4°C.

Products which are treated in this way include chopped garlic, garlic cloves, sun-dried tomatoes, chilli, ginger, egg plant, capsicum, mushrooms and various mixtures of these and similar materials. While these products are safe if refrigerated, they represent a potential food poisoning hazard unless certain basic precautions are taken in their preservation.

This fact was unfortunately highlighted in Canada and the United States in the 1980s when two serious outbreaks of botulism occurred in which chopped garlic in oil was clearly identified as the source of botulism toxin. Botulism is a rare disease, particularly in this country, but because of its severe, debilitating symptoms and relatively high mortality rate remains a major hazard in home preserves.

Authorities in Canada and the United States reacted to the above incidents by preventing the sale of garlic-in-oil products in which refrigeration was the only barrier to the growth of the bacterium, *Clostridium botulinum* the organism which causes botulism. These products are now required to contain an additional barrier to *C. botulinum* such as acidification.

In 1991 Australian authorities took similar precautions by regulating that this class of product must not have a pH greater than 4.6. The pH of a product is a measure of its acidity. Foods with a pH below 4.6 do not in general support the growth of food poisoning bacteria including *C. botulinum*. The necessary pH adjustment for these products can be achieved only by adding acid to the vegetable material. Vinegar, which is a solution of acetic acid, is the usual choice. Citric acid and lemon juice are other possible acidifying agents.

Attempts to preserve these products without acidification seem to be based on two false assumptions. The first of these is that the addition of oil has a preservative effect. This is incorrect. The only function of the oil is to prevent oxidation from the air in the container which can lead to discolouration of some foods. By excluding air from the surface of the vegetable, one is establishing anaerobic conditions which actually favour the growth of some types of bacteria. Unfortunately, *C. botulinum* is one of these bacteria.

The other incorrect assumption which is often made is that some herbs and spices, and especially garlic, have significant anti- microbial properties. The preservative effect of these materials including garlic is slight and inconsistent as the botulism incidents in Canada and the United States prove.

It is therefore essential that sufficient acid is added to the vegetable before oil is poured on so that any *C. botulinum* or other potentially dangerous bacteria can not grow. Vinegar prepared for domestic use contains 4 percent acetic acid. Vinegar should be added to the vegetable component of these preserves before any oil is added so that the ratio of vegetable to vinegar by weight is not greater than three to one. For example, to make 400 grams of preserved garlic, one would mix 300 grams of garlic with 100 grams of vinegar. The resultant mixture will then contain approximately one percent acetic acid which would ensure a final pH below 4.6. This will not guarantee that the prod- ucts will not spoil if not kept properly refrigerated, but it will ensure they do not become toxic.

If vegetable products e.g. tomatoes, are dried prior to being stored in oil, a different set of circumstances applies. Correctly dried vegetables and herbs will not support the growth of food poisoning bacteria but they may still support the growth of spoilage organisms such as yeasts and

moulds. Moulds will usually only be a problem on exposed surfaces but yeasts bring about fermentation in the absence of air.

Vegetables and herbs to be packed in oil without treatment with vinegar should be dried almost to crispness. Tomatoes, including sun-dried tomatoes, are a special case. The pH of fresh tomatoes is normally just below 4.6. When the tomatoes are dried, the natural acid components are concentrated and the pH is reduced. It will often be close to 4.0 in the dry product and therefore the risk of food poisoning is eliminated. No such safeguard exists with other vegetables, however, and these must be either acidified or properly dried before being covered with oil. This includes small quantities of garlic or herbs which may be added to other preserved vegetables as flavourings.

**Discolouration of bottled garlic in vinegar**

Users of bottled garlic in vinegar are occasionally alarmed to find that the product has turned green or blue-green. These colour changes do not make the product unsafe but are obviously undesirable.

The problem of garlic changing colour is associated with the addition of acid which changes the normal pH of the product. This is precisely what is required to ensure that the garlic remains safe but the change in acidity brings about chemical changes in pigments in the garlic.

All plant materials contain various pigments some of which change colour as the pH of the plant tissue is changed by the addition of vinegar or other acids. The most common of these pigments are the anthocyanins which may be blue, colourless or red depending on the pH.

These pigments may be involved in some colour changes observed in preserved garlic but American scientists have identified another more general explanation.

Certain amino acids, natural components of foods, are responsible for many of the pigment characteristics of the onion family which includes garlic. The American scientists have shown that the outstanding difference in composition between garlic which turns green and garlic which does not is the presence of much higher levels of one particular amino acid in the green garlic.

It is not possible to tell by looking at untreated garlic whether it is likely to become green on crushing and acidification. However the work reported indicates that if garlic bulbs are stored for four weeks at a temperature above 23°C prior to processing, the production of the green pigment is prevented.

This may not be practical at the domestic level, but could be a valuable precaution for commercial producers.

©Food Science Australia, 16 Julius Avenue Riverside Corporate Park Delhi Road (PO Box 52) North Ryde NSW 2113 Australia

FOOD SCIENCE AUSTRALIA
A JOINT VENTURE OF CSIRO AND AFISC

**Food Science Australia Fact Sheet**
Revised March 2000

# Small-scale commercial preservation of acid foods

**Acid foods**
Acidity is an important factor affecting the growth and survival of bacteria and other micro-organisms in foods.
Food with high acidity can be safely processed by a small manufacturer. Low acid foods usually require more complex processing equipment and specially trained staff.

The production of shelf stable acid foods, that is heat treated foods which may be safely stored at room temperature, appears to be growing in popularity. Frequently these are mixed foods well received at a domestic or catering level which a manufacturer wishes to launch commercially. Example are vegetables, relishes, mushrooms marinated in vinegar, and pickled seafoods including octopus and mussels.

Most foods naturally contain acids. Depending on the type and amount of acid present, they are called high acid or low acid foods (see the figure below). The amount of acid present, and therefore the foods ability to support the growth of food poisoning bacteria, is measured by the pH of the food. The pH scale extends from 0 to 14. A pH of 7 is neutral; a pH above 7 is called alkaline. Very few foods have a pH above 7 but many staple foods have a pH in the range 4.5 to 7.0. The pH value of 4.5 is critical in food processing because below this pH, *Clostridium botulinum*, the most dangerous and most heat resistant of the food poisoning bacteria, is unable to grow.

## The pH scale (a measure of acidity)

### pH values

```
0    1    2    3    4    5    6    7    8    9    10   11   12   13   14
Strongly acidic                                        Strongly alkaline
                      4.5
ACID FOODS             |                LOW ACID FOODS
(pH less than 4.5)     |             (pH between 4.5 & 7)
                       |
                       |                meat
apples                 |  banana*       poultry
apricots   pears       |  pawpaw*       seafood
cherries   plums       |  mango*        vegetables (
lemons     pineapple   |  melons*       - asparagus  - mushrooms
oranges    raspberries|                - beans      - peas
peaches    tomatoes*   |                - beetroot   - peppers
pickled vegetables     |                - carrot     - sweet corn
                       |                - garlic     - etc.

* These products have a pH of about 4.5 and should only be bottled with the
 addition of citric acid
```

In the previous figure, those foods with a pH value greater than 4.5 are termed low acid and require pressure cooking to make them shelf stable.

Those with a pH less than 4.5 are called acid foods and may be safely processed at temperatures around 100°C - the boiling point of water. Pressure equipment is not required.

Low acid products can be made acid by adding sufficient food acids such as vinegar (acetic acid) or citric acid to reduce the pH to below 4.5.

Shelf stable acid products have been successfully produced in very large quantities. Canned and bottled fruit and tomato products dominate this group of foods while various pickled and fermented foods such as gherkins and olives are familiar items of trade. It is not the purpose of this leaflet to discuss the processing of major items of commercial production such as fruit and tomato products. Rather it is to point out to potential manufacturers the microbiological problems they face when trying to transfer successful kitchen procedures to a product which will be stable on supermarket shelves.

## Spoilage of processed acid foods

Under some conditions some food poisoning bacteria have been shown to grow in foods with a pH below 4.5. However many years' commercial experience indicates that provided the equilibrium pH of a food or food mixture is below 4.5, the risk of food poisoning is virtually eliminated. There are, however, numerous harmless micro-organisms that may spoil these foods if processing is not sufficient or if the closure of the container leaks. These include non-sporing and spore forming acid tolerant bacteria, yeasts and moulds.

## Non-sporing bacteria

The most important group of bacteria which spoil acid foods are the lactic acid producing bacteria usually *lactobacilli*. Many produce gas and are capable of vigorously fermenting a wide range of foods. They are very acid tolerant and are capable of growth at pH values below 3.5. While able to tolerate more heating than most yeasts and moulds, lactobacilli can be controlled by moderate heat treatment at temperatures in the range of 85°-90°C.

## Yeasts

Due to their low heat resistance, yeasts should not pose a problem in heat-processed acid foods although they can be a serious problem if they gain entry to the product after heating is completed. Some yeasts can grow at pH values around 3.0 but fortunately are killed by temperatures greater than 85°C.

## Moulds

Moulds vary greatly in heat resistance but again the greatest risk with spoilage of acid foods is if they gain entry after heating is completed. Most vegetative and sporing forms of mould will be controlled in acid foods by temperatures greater than 85°C. A few moulds are extremely heat resistant and it is not practical to nominate processes which will kill these moulds in all acid foods without causing heat damage to the food itself. Commercially, one attempts to ensure that contamination with these moulds is avoided or raw material likely to be contaminated, e.g. some fruit pulps, is checked for their absence before use.

## Spore-forming bacteria

Some bacteria form heat resistant bodies as part of their normal life cycle. These heat resistant bodies are called spores and are important in determining the heating procedure necessary to produce a food which will not spoil.

The best way to minimise the risk of spoilage of acid preserves by this type of organism is to maintain the pH as low as possible and preferably not greater than 4.0. Some manufacturers are reluctant to alter their formulations to reduce the pH and this means a more severe cook is required if the pH is in the 4.0- 4.5 range and particularly if the pH is near 4.5.

It is a matter of judgment if the heat process given to acid foods should be designed to take account of spore-forming bacteria. The decision has to be made on the basis of the pH of the product and the association of spore formers with raw materials used in the product.

# Processing conditions for acid products

## Sauces, purees and jams

Many of the products which come into this category are quite thick and heat rather slowly. This type of product is traditionally processed in the food industry by heating outside the final container and it is then filled sufficiently hot into the final container to sterilise the container and closure. It is this procedure which is recommended for products which are relatively uniform in consistency, e.g. tomato-based pulps, jams and sauces.

Products should be filled as hot as possible into the final container. To achieve an effective process for products with a pH below 4, the fill temperature should be not less than 85°C and preferably between 90° and 95°C. In most cases the container will be glass and should be prewarmed to not less than 60°C before filling. This will avoid the risk of breakage through heat shock. If metal cans are used then obviously pre-warming is not necessary. Small processors should always consider this option, although for marketing reasons most prefer glass containers.

After filling, the containers are immediately closed and should be held for at least 3 minutes in air before water cooling. Unless the product suffers serious heat damage during extended cooling, it is preferable to air cool products packed in this manner to give an extra safety margin. While the containers are held in air, they should be in an inverted or at least horizontal position. The heat and acidity of the hot-filled product are relied upon to sterilise the container and closure -- hence the need to invert the closed container or, if this is not practical, to lie the containers horizontally for 3-5 minutes.

Plastic containers in general do not seal well enough for hot fill operations to be successful and most common plastics distort at the high temperatures necessary to complete the process. They should therefore not be used for hot fill operations unless the product is to be stored under refrigeration.

If there is any doubt about the temperature at which the product is being filled maintaining a temperature of 85øC at the time of filling, then a subsequent process for a few minutes in a boiling water bath is recommended. Temperatures during hot filling or processing should be checked regularly either by thermocouple measurement or by taking stab temperatures with a suitable probe thermometer (not mercury-in-glass or other breakable type).

## Food pieces in syrup or brine

Acid products which contain food pieces in syrup or brine can also be processed by the hot fill procedure. However this is not always practical, uneven distribution of solid and liquid being one problem. It is necessary to ensure that the proportion of food pieces to liquid remains the same each time a batch of food is manufactured and processed. If more than small variations in the proportion of solid to liquid occur, then the heating characteristics of the mixed food can change from batch to batch. In these cases processing in a boiling water bath is necessary. The product can still be pre-heated if convenient so that only a short time of heating in the container is necessary to achieve a minimum temperature throughout the pack of 85°C.

Regular checking of internal temperatures is necessary. If glass jars or bottles are used the caps may be left a half-turn short of full closure, the closure being completed at the time the cook is terminated. Thermocouples should preferably be used to record internal temperatures. If this is inconvenient, then stab temperatures may be taken using a suitable probe thermometer.

The temperature should be measured as close as possible to the geometric centre of the jar. Where pieces of food are present, e.g. pickled seafoods, temperatures will vary greatly between solid and liquid phases. The thermometer probes should be placed in the middle of a large piece of the food at the desired point in the container. A sufficient number of containers should be tested to cover possible variations.

For foods and food mixtures processed in this way, with a pH of 4.0 or lower, the slowest heating point in the container should be held at a temperature of not less than 85°C for at least two minutes. Inversion of containers processed in this way is not necessary although air cooling is to be preferred for those products which will not suffer serious heat damage.

When the pH of an acid food is in the range 4.0 to 4.5, the risk of spoilage from spore-forming bacteria must be taken into account. The National Food Processors Association (U.S.A.) recommends processes for these foods of not less than 5 minutes at 93°C for foods with a pH between 4.0 and 4.3, and not less than 10 minutes at 93° when the pH is above 4.3.

## Foods packed in oil

A number of the foods which come into this category have oil added to them as part of a traditional recipe. The oil is usually added in addition to vinegar in products such as eggplant in vinegar, pickled capsicum or pickled octopus.

It is important to note that the oil has no preservative effect on the food although it may help protect the colour of some foods. The equilibrium pH of the food must always be below 4.5. It is desirable to pour off as much oil as possible before blending solid and liquid components to measure the pH of the mixture.

## Measurement of pH

pH is an important factor in the processing of many foods. It is a critical factor when a heat process is being based on those organisms which can grow at the pH of the food.

While narrow range pH papers may be useful during product development, measurement of pH during production runs must be made on a properly standardised glass electrode pH meter. A number of acceptable commercial units are available. We can provide names of suppliers if required.

It is the equilibrium pH of the food after processing that is of particular importance. Products consisting of solids suspended in brine, syrup or oil should be blended to a puree in an electric blender before a pH reading is taken.

## Further reading:

Hersom, A.C. and Hulland, E.D., **Canned Foods: Thermal Processing and Microbiology**, 7th Ed., Churchill Livingstone, 1980.
National Canners Association Laboratory. **Manual for Food Canners and Processors**, vol. 1., Avi Publishing Co., 1968.

©Food Science Australia, 16 Julius Avenue Riverside Corporate Park Delhi Road (PO Box 52) North Ryde NSW 2113 Australia

FOOD SCIENCE AUSTRALIA
A JOINT VENTURE OF CSIRO AND AFISC

CSIRO AFISC Australian Food Industry Science Centre

**Food Science Australia Fact Sheet**
February 2000

# Water Activity

**Water activity in food**
Water in food which is not bound to food molecules can support the growth of bacteria, yeasts and moulds (fungi). The term water activity ($a_w$) refers to this unbound water.

The water activity of a food is not the same thing as its moisture content. Although moist foods are likely to have greater water activity than are dry foods, this is not always so; in fact a variety of foods may have exactly the same moisture content and yet have quite different water activities.

**The typical water activity of some foodstuffs**

| **Type of product** | **Water Activity** ($a_w$) |
|---|---|
| Fresh meat and fish | .99 |
| Bread | .95 |
| Aged cheddar | .85 |
| Jams and jellies | .8 |
| Plum pudding | .8 |
| Dried fruit | .6 |
| Biscuits | .3 |
| Milk powder | .2 |
| Instant coffee | .2 |

**Measuring water activity ($a_w$)**
The water activity scale extends from 0 (bone dry) to 1.0 (pure water) but most foods have a water activity level in the range of 0.2 for very dry foods to 0.99 for moist fresh foods.

Water activity is in practice usually measured as equilibrium relative humidity (ERH).

The water activity ($a_w$) represents the ratio of the water vapour pressure of the food to the water vapour pressure of pure water under the same conditions and it is expressed as a fraction. If we multiply this ratio by 100, we obtain the equilibrium relative humidity (ERH) that the foodstuff would produce if enclosed with air in a sealed container at constant temperature. Thus a food with a water activity ($a_w$) of 0.7 would produce an ERH of 70%.

**Predicting Food Spoilage**
Water activity ($a_w$) has its most useful application in predicting the growth of bacteria, yeasts and moulds.

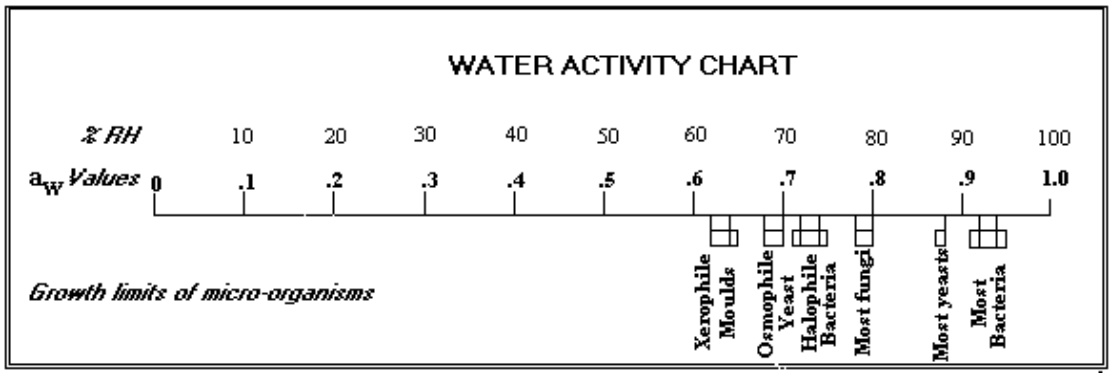
For a food to have a useful shelf life without relying on refrigerated storage, it is necessary to control either its acidity level (pH) or the level of water activity ($a_w$) or a suitable combination of the two. This can effectively increase the product's stability and make it possible to predict its shelf life under known ambient storage conditions.

Food can be made safe to store by lowering the water activity to a point that will not allow dangerous pathogens such as *Clostridium botulinum* and *Staphylococcus aureus* to grow in it.

The diagram below illustrates the water activity ($a_w$) levels which can support the growth of particular groups of bacteria, yeasts and moulds. For example we can see that food with a water activity below 0.6 will not support the growth of osmophilic yeasts. We also know that *Clostridium botulinum*, the most dangerous food poisoning bacterium, is unable to grow at an $a_w$ of .93 and below.

The risk of food poisoning must be considered in low acid foods (pH > 4.5) with a water activity greater than 0.86 $a_w$.

*Staphylococcus aureus*, a common food poisoning organism, can grow down to this relatively low water activity level. Foods which may support the growth of this bacterium include cheese and fermented sausages stored above correct refrigeration temperatures.




**Semi-moist foods**
For foods with a relatively high water activity correct refrigeration is always necessary. These include most fresh foods and many processed foods such as soft cheeses and cured meats.

However many foods can be successfully stored at room temperature by proper control of their water activity ($a_w$).

These foods can be described as semi-moist and include fruit cakes, puddings and sweet sauces such as chocolate and caramel.

When these foods spoil, it is usually the result of surface mould growth. Most moulds cease to grow at a water activity level below about 0.8, but since some moulds will grow slowly at this $a_w$, it is usually recommended that products of this type do not have an $a_w$ greater than 0.75.

While this will not ensure complete freedom from microbial spoilage, those few yeasts and moulds which do grow at lower water activities need only to be considered when special shelf life conditions must be met For example a commercial shelf life over twelve months might be required for confectionery; in these circumstances an $a_w$ below 0.6 would be required.

**Testing water activity ($a_w$)**
A number of electronic instruments are available for measuring water activity ($a_w$).

A reliable method based on refractometry has been developed at the Sydney Laboratory and kits are available for sale by Food Science Australia. A refractometer with a precision of 0.001 is adequate.

Alternatively product samples may be tested for you at the Sydney Laboratory.

(For details of both kits and testing services contact Dr Bob Steele on (02) 9490 8333).

©Food Science Australia, 16 Julius Avenue Riverside Corporate Park Delhi Road (PO Box 52) North Ryde NSW 2113 Australia

# Legal implications of food poisoning incidents

The personal and financial costs of food poisoning incidents are relatively well documented. Food poisoning symptoms can lead to no more than an uncomfortable few hours. At the other end of the scale, however, the result can be death or permanent disability. When legal claims are made against individual food manufacturers, the damages in large cases can amount to millions of dollars. Such cases have been seen in recent years in Australia and overseas.

In June 1997, *Food Safety and Hygiene* bulletin reported on impending legal action following a hepatitis A contamination of oysters in Wallis Lakes, NSW. Approximately 300 people were reported to be seeking damages as a result of illness caused by consumption of contaminated oysters.

Mr Justice Wilcox in a Federal Court Action released a judgement on 5 March of this year in the case of one of these claimants, Grant Ryan of Sydney. Mr Ryan brought a claim on behalf of himself and 185 other people against the Great Lakes Council, the State of New South Wales and various oyster producers and distributors. Mr Ryan claimed all respondents were negligent.

In his judgement, Justice Wilcox found only one negligence claim viable against each respondent which he described as 'management failure'.

In his summary, Justice Wilcox said: 'It was common ground at the hearing that the hepatitis A epidemic was caused by the victims consuming oysters contaminated by the hepatitis A virus and that this stemmed from widespread human faecal pollution of the waters of the lake.… The evidence also established that there were numerous facilities (such as septic tanks, pit toilets, sewerage pumping stations and watercraft) that were potential sources of human faecal pollution of the lake. The existence of these pollution sources was well known to the Council and, to a lesser extent, officers of the State and the Barclay companies (growers and distributors).

… I find this case proved.… In my opinion, all three sets of respondents were equally culpable. If any one of them had fulfilled its duty to oyster growers, the epidemic would not have occurred. It is appropriate they share equally the burden of the damages ($30,000) awarded in this case.'

The finding against the Council and the State highlight the fact that food safety is everybody's business. Imminent changes to food safety legislation on a national basis will not change this.

(Reference: A bulletin for the Australian Food Industry May 1999. *Produced by Food Science Australia Information Services PO Box 52, North Ryde 1670. Tel +61 2 9490 8397 Fax +61 2 9490 8499* )

# 4. CHEMICAL HAZARDS

## Registered Chemicals

National Registration Authority
for Agricultural and Veterinary Chemicals

## Product Enquiry Results

Select a Product Code to view details of the Product.

| Product Code | Product Category | Product Name |
|---|---|---|
| 31393 | AgChem | ROUNDUP HERBICIDE BY MONSANTO |
| 31394 | AgChem | ROUNDUP CT BROADACRE HERBICIDE BY MONSANTO |
| 31396 | AgChem | SQUADRON HERBICIDE BY MONSANTO |
| 31399 | AgChem | NUFARM GLYPHOSATE 360 HERBICIDE |
| 31401 | AgChem | FARMCO GLYPHOSATE 360 HERBICIDE |
| 31814 | AgChem | SURFLAN 500 FLOWABLE HERBICIDE |
| 39276 | AgChem | APL GLYPHOSATE 360 HERBICIDE |
| 40521 | AgChem | COUNTRY GLYPHOSATE 360 HERBICIDE |
| 45289 | AgChem | GLYCEL 360 HERBICIDE |
| 46019 | AgChem | RICOCHET 360 HERBICIDE |
| 46020 | AgChem | RANGER 360 HERBICIDE |
| 46021 | AgChem | HARPOON 360 HERBICIDE |
| 46064 | AgChem | SANOS 360 NON SELECTIVE HERBICIDE |
| 46673 | AgChem | SUPERWAY GLYPHOSATE 360 HERBICIDE |
| 47207 | AgChem | FARMOZ MITI-FOL EC MITICIDE |
| 47234 | AgChem | DAVID GRAYS GLYPHOSATE 360 HERBICIDE |
| 47848 | AgChem | CM GLYPHOSATE 360 HERBICIDE |
| 48068 | AgChem | GENEREX GLYPHOSATE 450L |
| 48070 | AgChem | GENEREX GLYPHOSATE 360L |
| 48201 | AgChem | KELTHANE MF MITICIDE |
| 48447 | AgChem | AGCHEM GLYPHOSATE 360 HERBICIDE |
| 48482 | AgChem | ROUNDUP DRY HERBICIDE BY MONSANTO |
| 48518 | AgChem | ROUNDUP BIACTIVE HERBICIDE BY MONSANTO |
| 48600 | AgChem | NOMIX G READY-T0-USE, NON-SELECTIVE HERBICIDE |
| 48630 | AgChem | NUFARM WEEDMASTER HERBICIDE |
| 49011 | AgChem | OZTEC GLYPHOSATE 360 NON SELECTIVE HERBICIDE |
| 49101 | AgChem | SUMMIT GLYPHOSATE 360 HERBICIDE |
| 49102 | AgChem | SUMMIT GLYPHOSATE 450 HERBICIDE |
| 49419 | AgChem | KEN-UP HERBICIDE BY KENSO |
| 49507 | AgChem | OZCHEM GLYPHOSATE 360 |
| 49614 | AgChem | DALGETY GLYPHOSATE 360 NON SELECTIVE HERBICIDE |
| 49909 | AgChem | NUFARM WEEDMASTER 360 HERBICIDE |
| 50523 | AgChem | QUANTUM GLYPHOSATE 450 HERBICIDE |
| 50536 | AgChem | NIHIL NON SELECTIVE HERBICIDE |
| 50856 | AgChem | ARTFERN GLYPHOSATE 360 HERBICIDE |
| 51144 | AgChem | TOMEN SELECT HERBICIDE |
| 51166 | AgChem | ROUNDUP CUSTOM HERBICIDE BY MONSANTO |
| 51266 | AgChem | TRIGGER DRY-FLO 840 BROAD SPECTRUM HERBICIDE |
| 51620 | AgChem | CHEMAG GLYPHOSATE 360 HERBICIDE |
| 51962 | AgChem | ROHM AND HAAS KELTHANE EC MITICIDE |
| 52190 | AgChem | SELECT HERBICIDE |

| | | |
|---|---|---|
| 52430 | AgChem | NUFARM CREDIT BROADHECTARE HERBICIDE |
| 52473 | AgChem | PESTMASTER AQUA-TECH GLYPHOSATE 360 HERBICIDE |
| 52755 | AgChem | ROTAM ROPHOSATE 360 GLYPHOSATE HERBICIDE |
| 52894 | AgChem | NICH-FOSATE HERBICIDE |
| 53246 | AgChem | RICHGRO GLYPHOSATE 360 HERBICIDE |
| 53290 | AgChem | ECHEM GLYPHOSATE 360 HERBICIDE |
| 53494 | AgChem | NET-CHEM GLYPHOSATE 360 HERBICIDE |
| 53576 | AgChem | NUFARM WEEDMASTER DUO DUAL SALT TECHNOLOGY HERBICIDE |
| 53798 | AgChem | NUTURF RAZOR SHARP HERBICIDE |
| 53852 | AgChem | 4FARMERS GLYPHOSATE 360 HERBICIDE |
| 53877 | AgChem | CROP CARE GLYPHOSATE 360 HERBICIDE |
| 54028 | AgChem | GULLF AG CLEARUP 360 HERBICIDE |
| 54461 | AgChem | HALLEY GLYPHOSATE 360 HERBICIDE |
| 54593 | AgChem | DOW AGROSCIENCES KELTHANE EC MITICIDE |
| 54904 | AgChem | GULLF AG CLEARUP BIO 360 HERBICIDE |

56 Products extracted.

[New PUBCRIS Search][Help with Search][Home Page]
*This site is optimised for browsers which support tables and frames*
nra.contact@nra.gov.au
©National Registration Authority, Canberra, Australia
**Copyright © Commonwealth of Australia 2001**

(Reference: National Registration Authority web site (www.nra.gov.au), December 2001)

## Off Label Permits

Please Visit the Australian Olive Association for the latest permits www.australianolives.com.au

or www.apvma.gov.au

(NB: It is your responsibility to be aware of the latest chemical permits)

## Maximum Residue Limits

The Maximum residue Limits for fresh olives are:

Please visit the APVMA Website and download the latest information

Download the PDF Document

"Maximum residue limits of agricultural and veterinary chemicals and associated substances in food commodities."

Do a search (Press Control F on your Keyboard and type the word Olive)

and you should find 21 references to "olive" ( Current as of October 2005)

http://www.apvma.gov.au/residues/mrl_standard.shtml

(Ref. www.apvma.gov.au)

## Maximum Permissible Contaminants

### *Heavy Metals*

| Heavy Metal | Residue Limit | Heavy Metal | Residue Limit |
|---|---|---|---|
| Lead | 0.1 mg/kg | | |

(*Reference. Food Standards Australian and New Zealand - Food Standards Code,*)

### *Deregistered and Persistent Chemicals*

| Chemical | Residue Limit | Chemical | Residue Limit |
|---|---|---|---|
| Aldrin | ND* | Heptachlor | ND* |
| BHC (alpha and beta) | ND* | Hexachlorobenzene | ND* |
| Chlordane | ND* | Lindane | ND* |
| Total DDT (DDD, DDE and DDT) | ND* | Methoxychlor | ND* |
| Dieldrin | ND* | Toxaphene | ND* |
| Endrin | ND* | | |

ND: Not Detectable (*Reference: National Registration Authority December 2001*)

## 5. WEB ADDRESSES

OliveCare Australia Pty Ltd http://www.olivecare.com.au

NOAH Australia Pty Ltd http://www.noahaustralia.com.au

Olive Directory http://www.olivedirectory.com

FSANZ (Food Standards Australia and New Zealand)
http://www.foodstandards.gov.au

APVMA (National Registration Authority)
http://www.apvma.gov.au

CSIRO Post Harvest Laboratory
http://www.postharvest.com.au/Default.html

Food Science Australia
http://www.foodscience.afisc.csiro.au/

NATA (National Association of Testing Authorities)
http://www.nata.asn.au/

Standards Australia
http://www.standards.com.au

Codex Alimentarius Commission
http://www.codexalimentarius.net/

U.S. Food & Drug Administration - “Bad Bug Book”
http://vm.cfsan.fda.gov/~mow/intro.html

Centre for Food Safety and Applied Nutrition.
http://vm.cfsan.fda.gov/

FSA (UK Food Standards Agency)
http://www.food.gov.uk/