Allergen Bureau

# UNEXPECTED ALLERGENS IN FOOD

**Revised & updated**

**January 2021**

*Informing the food industry*

allergenbureau.net

Allergen Bureau

**Disclaimer**

Material included in this publication is made available on the understanding that the Allergen Bureau is not providing professional advice, that the Unexpected Allergens in Food resource is intended as a guidance document which may assist in a total approach to allergen management, allergen communication and labelling, and that using the Unexpected Allergens in Food resource does not guarantee that a consumer will not suffer an allergic response.

If you intend to use information provided in this publication, you must exercise your own skill, care, and judgement, evaluate the accuracy, completeness and relevance of any information or recommendation for your purposes, and obtain your own professional advice.

The Allergen Bureau provides no warranty and does not guarantee the accuracy or completeness of the material contained in this publication, or in any recommendation obtained from it, including regarding compliance with food labelling laws and regulations or the management of the risk of product liability and personal injury.

The Allergen Bureau disclaim all liability to any person in respect of any loss or liability suffered in connection with the reliance, whether wholly or partly, on any information contained in this publication.

# CONTENTS

# 1. INTRODUCTION

In Australia and New Zealand, it is a mandatory requirement to declare certain allergens when present in food. The details for these requirements are set out in the Australia New Zealand Food Standards Code (the Code).

Allergens can be present in foods in various ways. They can be added intentionally as: -

- an ingredient; or
- an ingredient of a compound ingredient; or
- a food additive (including its components/ ingredients); or
- a processing aid (including its components/ ingredients.

The Code also requires certain allergens to be declared when they are present as a derivative of such a food. Sometimes identifying the allergen is straightforward (such as peanut oil being a product of peanuts) but quite often it is not immediately evident that allergens are present, particularly when some additives and processing aids are the derivative of an allergen. Examples include the additive lecithin (Food Additive Code number 322) which can be a product of soy, and the processing aid lactoperoxidase which is a milk derived protein.

Allergens can be present in foods in other unexpected ways. Ingredients and foods can be described using technical terminology or names that may not be obviously associated with the allergen. An example is hydrolysed vegetable protein, which can be a product of soy and, in the food industry, is commonly known as HVP. Allergens can be used as part of the manufacturing process, for example, as free flowing agents, lubricants, or clarifying agents. Allergens can also be used as part of an ingredient manufacturing process such as feedstocks and substrates for the growth of bacteria, yeasts, and enzymes.

Allergens may also be present in foods in the form of cross contact. The Allergen Bureau's Voluntary Incidential Trace Allergen Labelling (VITAL®) Program defines cross contact as a residue or other trace amount of a food allergen that is unintentionally incorporated into another food. Some reasons why cross contact may occur are due to: -

- agricultural co-mingling into a raw material; or
- carry over due to using an ingredient that contains cross contact; or
- processes using shared manufacturing equipment or concurrent lines; or
- inadequate cleaning of equipment.

Identifying the allergens present in foods and ingredients can be a complex process which requires consulting with suppliers and obtaining detailed raw material specifications. By ensuring that all allergens, including the unexpected ones, are identified, and included in the product risk assessment, the food industry can meet regulatory requirements, mitigate the need for allergen recalls and withdrawals, and provide important information to consumers with food allergy.

## 1.1 About this guide

This document (this Guide) provides the food industry with a list of foods, ingredients and raw materials that may unexpectedly contain allergens, and a list of questions food business operators (FBOs) can ask their suppliers which support the allergen risk review process. This Guide is a revised and updated version of the 2011 Unexpected Allergens in Food guide. This edition provides an expanded and updated list of foods, as well as new information about agricultural co-mingling, food fraud and some case studies that show the complexity in the supply chain, where allergens may be unexpectedly incorporated as a result of agricultural co-mingling in food.

Thank you to the FBOs, comprising of processors, manufacturers, traders, and retailers who kindly shared their allergen-investigation expertise. FBOs who wish to suggest the addition of a food are invited to contact the Allergen Bureau: info@allergenbureau.net.

In this Guide, 'allergens' are the foods that require mandatory declaration as described in the Code.

## 1.2 Scope

This Guide is relevant to all areas of the food industry, including but not limited to:

- growers
- primary producers
- food ingredient manufacturers, importers, and suppliers – both local and imported
- FBOs of packaged food for bulk sale including business to business
- FBOs of packaged retail ready foods
- FBOs in food service and hospitality
- importers of packaged foods.

# 2. UNEXPECTED ALLERGENS IN FOOD

Food allergens can be present in ingredients and raw materials in ways that are not immediately obvious. As described in the introduction, the ingredient name alone may not be an indicator of the allergens present. In addition to this, some ingredients may be sourced from suppliers who have limited understanding, or different interpretations, of the Australian and New Zealand allergen declaration requirements, noting that these requirements (although similar) are not the same as other international allergen regulations.

All FBOs who sell foods and ingredients within Australia and New Zealand are encouraged to refer to the *Food Industry Guide to Allergen Management and Labelling for Australia and New Zealand* which is co-written by Allergen Bureau and the Australian Food and Grocery Council (AFGC) and is freely available on both websites. This document describes industry best practice guidance for the management of allergens, allergen labelling, and allergen communication. It also outlines the Australia and New Zealand regulatory requirements for allergen declaration, briefly discusses international food allergen regulation and explains how foods that are imported into Australia and New Zealand must comply with the Code.

## 2.1 Food and food additives

Table 1 is a guide to assist FBOs with identifying allergens that may occur in ingredients, additives, and processing aids. A robust vendor assurance program should include the questions in this table and ensure that they have been addressed and the outcomes recorded for each relevant ingredient. Refer to the section on Raw Material Specification Assessment in the Allergen Bureau's Allergen Risk Review website (info.allergenbureau.net/) for further information.

Although a wide variety of resources have been used in the preparation of this table, it is not a comprehensive list. Many additives and ingredients, even when appearing similar, can be produced at different manufacturing sites, and from a range of raw materials from various sources. It is important to check all information from suppliers carefully and obtain clarification where allergen information is unclear or incomplete. It is not sufficient to simply assume that the allergen information provided by an ingredient supplier is complete - clarification of information is important to prevent any omissions or misunderstandings and demonstrate due diligence.

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Acidity regulator – lactate (326, 327, 328, 329) | What is it derived from (e.g. lactic acid (**milk**) or whey (**milk**), pork, etc.)? |
| Acidity regulator – lactic acid (270) | What is it derived from (e.g. **milk**, tomatoes, molasses, potato, maize starch, **wheat** starch)? |
| Albumin / albumen | What is it derived from (e.g. **egg**, **milk** etc.)? |
| Amylase (alpha & beta) | What is it derived from (e.g. pig, **wheat**, **barley**, **soy** etc.)? |
| Antioxidants | What are they derived from (e.g. **soy**, **egg**)? |
| Baking powder / bicarbonate of soda | Does this contain any carriers or bases or anti-caking agents (e.g. **wheat** flour, rice flour etc.)?<br>Is the line shared with other foods (e.g. **milk**)? |
| Banana chips | What oil was used in the preparation of this product? **Peanut** oil has been reported to have been used. Refer to section on Fat / Oil. |
| Beta-carotene | Does it contain tocopherols and what are they derived from (e.g. **soy**)? Refer to section on Tocopherols.<br>Is it microencapsulated? If so, what is the capsule/coating derived from (e.g. **fish**)? |
| Beta-galactosidase | Does it contain **milk**? |
| Beverage whitener | Does it contain **wheat**, **soy**, casein (**milk**) etc.? |
| Binders | Do they contain **milk**, **egg**, cereals containing **gluten**? |
| Bran / cereal brans | Is it a product of / does it contain (**wheat**, **oats**, **rye**, **barley**, **spelt**)?<br>Refer to Table 2 (Allergens associated with agricultural co-mingling).<br>Is the line shared with other foods (e.g. **lupin**, **soy**, other cereals containing **gluten**)? |
| Breadcrumbs | Do they contain **sesame** seeds?<br>Are all possible bread sources considered (i.e. this is often a 'rework' product)? Other bread sources can contain **lupin**, **soy** etc. in addition to a range of cereals.<br>Is the bread used for the breadcrumbs glazed with **milk** or **egg**? |
| Brine | Check for allergens (e.g. casein (**milk**)). |
| Caramel | What is it derived from (e.g. **wheat**, maize, sugar beet, cane sugar etc.)? |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Carotenoids | Are they microencapsulated? If so, what is the capsule/coating derived from (e.g. **fish**, **crustacea**)? |
| Cereals | Is it a product of / does it contain **wheat**, **oats**, **rye**, **barley**, **spelt**, including hybridised strains?<br>Refer to Table 2 (Allergens associated with agricultural co-mingling). |
| Cheese | Does it contain rennet (refer to section on Rennet), vinegar (refer to section on Vinegar), gelatine (refer to section on Gelatine), lysozymes (refer to section on Lysozymes), starch (e.g. Edam & Gouda cheese) (refer to section on Starch)? |
| Cheese (grated) | Does it contain anti-caking agent? If yes, what is it and what is it derived from (e.g. **wheat** starch, **wheat** flour, maize etc.)? Refer to section on Cheese. |
| Cheese powder | Does it contain anti-caking agent? If yes, what is it and what is it derived from (e.g. **wheat** starch, **wheat** flour, maize etc.)? Refer to section on Cheese. |
| Clarifying agents (used in wine, wine vinegar, fruit and vegetable juices, animal/ vegetable stock/broth) | Clarifying agents can include casein (**milk**), **egg** white, isinglass (**fish**), gelatine (refer to section on Gelatine) or chitosan (sourced from **crustacea**). |
| Cocoa powder | Does it contain **soy** lecithin or **wheat** flour? |
| Coconut / desiccated coconut | Does it contain added **sulphites**? |
| Coconut milk / coconut milk powder | Does it contain **milk** components such as casein? Is the processing line shared with other foods (e.g. **milk**)? |
| Colour(s) | Is there a carrier? If yes, what is the carrier derived from? Does it contain maltodextrin (refer to section on Maltodextrin), starch (refer to section on Starch), Yeast/yeast extract (refer section on yeast), **soy**, cereals containing **gluten**?<br>Check for the addition of **sulphites**. |
| Colour (101) – riboflavin | What is it derived from (e.g. yeast)? Refer to section on Yeast/yeast extract. |
| Colour (153) – carbon black or brilliant black | Does it contain glucose? Refer to section on Glucose. |
| Colour (160a) – beta carotene | Is it microencapsulated? If so, what is the capsule/coating derived from (e.g. **fish** gelatine)? |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Colour (161) – xanthophylls | What is it derived from (e.g. animal, **egg**, **egg** yolk, **crustacea**, **fish**)? |
| Corn | Does this refer to maize or **wheat**? Some countries use the terms "corn" and "**wheat**" interchangeably. |
| Cornflour / corn starch | Is this derived from **wheat** or maize flour? |
| Cultures | Check for **milk**. |
| Curry paste / curry powder | What are the ingredients (including compound ingredients)? Do they contain allergens?<br>Check for possible allergens associated with agricultural co-mingling (not just added allergens). |
| Dates | Do they contain any anti-caking agents (e.g. **wheat** flour, **oat** flour etc.)? |
| Dehydrated / dried products | Do they contain any anti-caking agents (e.g. **wheat** flour, **oat** flour etc., vegetable oils)? Could these agents be exposed to **wheat** or other cereals containing **gluten**?<br>Do they contain oils (used as a processing aid)? Refer to section on Fat / Oil.<br>Refer to Table 2 (Allergens associated with agricultural co-mingling).<br>Check for **sulphites**. Are **sulphites** naturally occurring? Are **sulphites** added as processing aids? What levels are the **sulphites** in finished dehydrated vegetables (e.g. onions, potato, chives, etc.)? |
| Dextrin / dextrose / maltodextrin | Is this derived from **oats** or **wheat**?<br>Glucose syrups made from **wheat** starch may be exempt from mandatory declaration. Confirm if the dextrose etc. is exempt. Confirm that all exemption conditions are met. |
| Emulsifier | What is it derived from (e.g. **soy**, **egg**, **wheat**)? |
| Emulsifier – calcium stearate / stearic acid (570) | What is it derived from (e.g. **peanuts**)? |
| Emulsifier – sodium lactylates / calcium stearoyl lactylate (481) | What is it derived from (e.g. **peanuts**, **milk**)? |
| Enzymes | Do they contain carriers? Is the carrier from a **wheat** source?<br>What is the fermentation substrate used to grow the enzymes? |
| Ethanol | What is it derived from (e.g. **wheat**, whey (**milk**))?<br>If derived from **wheat** or **milk**, is it exempt from mandatory allergen declaration? Confirm that all exemption conditions are met. |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Fats / oils (including cold-pressed oils, animal fats and vegetable oils) | Does it contain antioxidants? Refer to section on Antioxidants.<br>Check for the addition of **soy** tocopherols. Refer to section on Tocopherols.<br>Animal fat/oil – what is it derived from (e.g. ghee (**milk**))?<br>Vegetable oil- what is the source of the oil (e.g. **soy**, **peanut**, **sesame**, canola, olive, sunflower etc.)? Has it been exposed to other oils manufactured/processed in the same facility (e.g. **tree nuts**, **peanut**, **sesame**)? If **soybean** oil is present, is it exempt from mandatory allergen declaration? Confirm that all exemption conditions are met.<br>Cold pressed oil, expeller pressed oil, or extruded oil – these oils are not highly refined and may still contain protein. Has the oil been exposed to other cold pressed oils etc., manufactured/processed in the same facility (e.g. **tree nuts**, **peanut**, sesame)? |
| Fatty acids (mono and di-glycerides) | What are they derived from (e.g. **soy**)? |
| Flavour enhancers (620, 621, 622, 623,624, 625, 627, 631, 635) | What are they derived from (e.g. meat, sardines (**fish**), **wheat**, **soy**, maize)?<br>If microbial synthesis occurs, what is the source of the nitrogen and carbohydrate (e.g. **wheat**, **soy**, maize etc.)? |
| Flavours | What are they derived from (e.g. **wheat**, maize, **soy**, **egg**, **peanut**)?<br>Do they contain or are a product of allergens (e.g. **milk**)?<br>Do they contain any bases, carriers, anti-caking agents? If yes, what are they derived from?<br>Does it contain maltodextrin (refer to section on Maltodextrin), casein (**milk**), oleoresins (refer to section on Oleoresins), emulsifiers (refer to section on Emulsifiers), oils (refer to section on Fat / Oil)?<br>Do they contain hydrolysed protein? Refer to section on Hydrolysed Proteins.<br>Do they contain yeasts or yeast extracts? Refer to section on Yeast/yeast extract.<br>Do they contain fatty acids (e.g. mono-, di- or triglycerides?) Refer to section on Fatty Acids.<br>Have they been microencapsulated with **fish** gelatine? |
| Fruit | Check waxes/coatings applied to fruits for allergens. |
| Gelatine | What is the gelatine derived from (e.g. isinglass (**fish**), beef, pork, chicken etc.)?<br>Check for the addition of **sulphites**. |
| Gellan gum | What is the carbohydrate source used to grow the gum (e.g. **wheat**, maize, molasses, cane sugar)? What is the protein source used to grow the gum (e.g. **soy**, **egg**)? |
| Glaze | Does it contain **egg** or **milk**? |
| Glucose / glucose syrup | What is it derived from (e.g. **wheat**, maize, rice, potato, **oats** etc.)?<br>Glucose syrups made from **wheat** starch may be exempt from mandatory declaration. Confirm that all exemption conditions are met. |
| Glycerine | Check for **peanut**. |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Herb extract(s) | Do they contain any bases, carriers, anti-caking agents (e.g. maltodextrin, flour, oleoresins, emulsifiers)? If yes, what are they derived from (e.g. **wheat**, maize, **soy**, **egg** etc.)? |
| Herb(s) | Do they contain any bases, carriers, anti-caking agents (e.g. maltodextrin, flour, oleoresins, emulsifiers)? If yes, what are they derived from (e.g. **wheat**, maize, **soy**, **egg**)?<br>Refer to Table 2 (Allergens associated with agricultural co-mingling). |
| Hydrolysed animal protein | What is it derived from? Is it a product of casein or whey (**milk**), **egg**, **fish**?<br>Note: Hydrolysed allergen proteins may be difficult to detect through analysis and may be allergenic even when not detected. |
| Hydrolysed vegetable protein | What is it derived from? Is it a product of **soy**, **wheat**, maize, **peanut**, sesame etc.?<br>Note: Hydrolysed allergen proteins may be difficult to detect through analysis and may be allergenic even when not detected. |
| Icing sugar | Is it 100% pure icing sugar? If not, what else is added (e.g. **wheat**)? |
| Isoflavones | Are they derived from **soy**? |
| Lecithin | What is it derived from? Is it a product of **soy**, **egg** etc.?<br>Note: In some countries, certain **soy** lecithin products may be exempt from allergen declaration. Check the Code carefully to determine the declaration requirements in Australia and New Zealand. |
| Lysosyme | What is it derived from? Is it a product of **egg**? If checking for the presence of **egg** protein, ensure appropriate test method is used (such as the lysozyme ELISA method). |
| Malt / malt extract | What is it derived from (e.g. cereals containing **gluten** such as **wheat**, **barley**)? |
| Maltodextrin | Check for **wheat** and added **sulphites**.<br>Glucose syrups made from **wheat** starch may be exempt from mandatory declaration. Confirm if the maltodextrin is exempt. Confirm that all exemption conditions are met. |
| Mayonnaise | What are the ingredients (including compound ingredients)?<br>Do they contain allergens (e.g. **egg**, **milk**, **soy**)? |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Meat (including manufactured – fish, meat, poultry, smallgoods) | Does it contain binders? If yes, do the binders contain **milk**, **egg**, cereals containing **gluten**?<br>Does this product contain fillers? If yes, do the fillers contain **soy**, cereals containing **gluten**?<br>Does it contain cure/brine premixes, or massage mixes? If yes, do they contain **milk**, **egg**?<br>Does it contain seasoning premixes? If yes, do they contain **wheat**, **egg**, **milk**, **soy**? Refer to sections on Herb(s), Spice(s) and their extracts.<br>Does it contain processing aids such as lactoperoxidase (**milk**)?<br>Does it contain **sulphites**? |
| Milk powder | Does it contain **soy** lecithin? |
| Minerals | Are they microencapsulated with **fish** gelatine? |
| Mustard | Does it contain **wheat**? Refer to Table 2 (Allergens associated with agricultural co-mingling). |
| Non-dairy creamers | **Milk** derivatives have been reported in some non-dairy creamers. |
| Oleoresins | Do they contain antioxidants/tocopherols or emulsifier? If yes, what are they derived from (e.g. **soy**, **egg**, **sesame**)? Refer to section on Tocopherols. |
| Omega 3, 6 | Are they derived from **fish**, linseed etc.? Check for the addition of **soy** lecithin. |
| Polyols (sugar alcohols) e.g. sorbitol (420) | What are they derived from (**wheat**, **milk**, **tree nuts**, maize etc.)?<br>Some polyols such as sorbitol can be a product of glucose syrup derived from **wheat** starch, which may be exempt from mandatory declaration. Confirm that all exemption conditions are met. |
| Processing aids | Are there any processing aids derived from allergen sources? |
| Rennet | What is it derived from (e.g. bovine or synthetic)? If synthetic, what is the source (e.g. maize, **wheat**, **soy**, molasses, sugar beet)? |
| Rice flour | Does it contain **wheat** or other allergens from other plant sources (**soy**, **lupin** etc.)? |
| Seasoning pre-mixes | Do they contain **wheat**, **egg**, **milk**, **soy**? Refer to sections on Herb(s), Spice(s) and their extracts. |
| Shortening powder | Does it contain **wheat**, maize, casein (**milk**) etc.? |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Soy Sauce | Does it contain **wheat** (in addition to **soy**)? |
| Spice extract(s) | Do they contain any bases, carriers, anti-caking agents (e.g. maltodextrin, flour, oleoresins, emulsifiers)? If yes, what are they derived from (e.g. **wheat**, maize, **soy**, **egg** etc.)? |
| Spice(s) | Do they contain any bases, carriers, anti-caking agents (e.g. maltodextrin, flour, oleoresins, emulsifiers)? If yes, what are they derived from (e.g. **wheat**, maize, **soy**, **egg**)?<br>Refer to Table 2 (Allergens associated with agricultural co-mingling). |
| Stabilisers | What are they derived from (e.g. **soy**, **egg**, cereals containing **gluten**)? |
| Starch (including native or chemically or physically modified) | What is the starch derived from (maize, tapioca, potato, **wheat**)?<br>Check for added **sulphites**. |
| Sterols (plant) | What is it derived from (**soy**)?<br>For **soybean** derivatives that are phytosterols, confirm if allergen labelling exemptions apply. |
| Suet | Check for cereals containing **gluten**. |
| Sugar | What is it derived from (e.g. cane sugar, sugar beet, **wheat**)? |
| Sulphites – sulphur dioxide, bisulphite, metabisulphite (220, 221, 222, 223, 224, 228) | What is the concentration of added **sulphites**? Check level of addition (mg/kg (ppm) or mg/100g)? |
| Sultanas | Check for **soy** oil.<br>Check for **wheat** starch used as an anti-caking agent. |
| Textured vegetable protein | Does it contain **wheat**, **soy**? |
| Thickener | What is the thickener derived from (maize, tapioca, potato, **wheat**) and what is the carrier material? |
| Tocopherols | What are the tocopherols derived from (**wheat**, **soy**)?<br>For **soybean** derivatives that are tocopherols, confirm if allergen labelling exemptions apply. |
| Triticale | Is this a **wheat** and **rye** hybrid? |
| Vegetable Oil | Refer to section on Fats / oils (including cold-pressed oils, animal fats and vegetable oils) |

## Table 1: Unexpected allergens associated with foods and ingredients

| Food | Details |
|---|---|
| Vinegar | What is the vinegar derived from (e.g. **wheat**, **barley**, maize, malt, **milk**)?<br>If balsamic vinegar, does it contain caramel? Refer to section on Caramel.<br>For vinegars derived from alcohol distilled from whey (**milk**) or **wheat** – confirm if allergen labelling exemptions apply. |
| Vitamin E | Check for **soy**. Refer to section on Tocopherols. |
| Vitamins / vitamin premix | Are they microencapsulated with **fish** gelatine?<br>If spraydried, confirm the medium (e.g. maltodextrin). Check for lactose (**milk**)) carriers. |
| Whitener | Does it contain **wheat**, casein (**milk**)? |
| Wine / wine vinegar | For wines and wine vinegars, are clarifying/fining agents used during the processing of wine (e.g. casein (**milk**), **egg** white, isinglass (**fish**), gelatine (beef, **fish**, chicken, pork) or chitosan (sourced from **crustacea**))?<br>If isinglass is used as a clarifying agent, confirm if allergen labelling exemptions apply.<br>Check for **sulphites**. |
| Worscestershire sauce | Check for the addition of anchovies (**fish**), **soy**. |
| Xanthan gum | What is the carbohydrate source used to grow the gum (e.g. **wheat**, maize, molasses, cane sugar)?<br>What is the protein source used to grow the gum (e.g. **soy**, **egg**)? |
| Yeast / yeast extract | What is the substrate the yeast is grown on (e.g. **wheat**, malt, **barley**, **soy** etc.)?<br>Where **barley** and or **wheat** are used as a substrate - are they malted?<br>Are there any carriers? Refer to section on Flavours. |

# 3. AGRICULTURAL CO-MINGLING

Agricultural co-mingling is the result of different crops being grown in close proximity with each other, sharing the same fields due to crop rotation, and/or sharing the same equipment/facilities for harvesting, transport and storage, despite the application of allergen controls as part of Good Agricultural Practices (GAPs). This means that the presence of variable amounts of one crop may be found in another crop. This is of particular concern in relation to the presence of allergens, such as cereals containing gluten, peanuts, soy, and lupin. Although it is possible to apply processes to clean crops and reduce the concentration of co-mingled grains, seeds, or pulses, these do not generally remove all traces of them and thus allergen identification and declaration is an important consideration.

## 3.1 Crops and commodities

Table 2 is a guide to assist FBOs with identifying allergen co-mingling that may be present in crops or commodities including those that have undergone primary and/or minimal processing (such as sorting, milling, drying, or freezing). FBOs who source such commodities should have a vendor assurance program in place which ensures that the answer to such questions as outlined in the table are known, recorded, and included in the allergen risk review of the commodity ingredient. If the FBO is a supplier of commodity ingredients, they should be able to provide a considered allergen specification to their customer, who is encouraged to also refer to this table when reviewing their ingredient information.

Further information on agricultural cropping practices and controls are discussed in Table 3 on page 23 and Table 4 on page 25.

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| Vegetables & Legumes - fresh & frozen (e.g. capsicum, beans, peas, edamame) | What other crops are being (or can be) grown nearby? This includes **lupin**, **soy** and cereals containing gluten including **wheat**, wild **wheat**, **barley**.<br><br>What other crops are used for crop rotation by the grower?<br><br>What seasons are the crops harvested in? This provides information about other plants nearby and shared equipment.<br><br>Are the crops early or late season crops? Early or late season crops may be close to other plants of different maturity e.g. immature/mature wild **wheat**.<br><br>What crop measures are in place to effectively remove physical remains of other crops?<br><br>What crops are purchased from contract farms or wholesalers?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from maintenance machinery and harvesting equipment?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>What effective measures are in place to remove allergen cross contact from the prepared (washed, diced, de-husked, peeled, podded etc.) vegetables?<br><br>Does the primary and secondary vegetable processor have allergen controls within their facility?<br><br>Example of known cross contact: -<br>• Green beans grown in fields where wild **wheat** grass (and therefore potentially **wheat** grain) also germinates. |
| Vegetables - dehydrated / processed (e.g. capsicum, onion flakes, chili flakes) | In addition to the questions above for Vegetables & Legumes.<br><br>What is the form of the processed vegetable (e.g. flakes, powder, pieces)? Is the cross contact similar in appearance to the vegetable (i.e. difficult to clean and separate)?<br><br>What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)?<br><br>Does the primary and secondary vegetable processor have allergen controls within their facility?<br><br>What effective separation processes are used by the primary and secondary processors (e.g. sorting facilities for dried vegetables can be shared with **wheat**, **soy** products or dried vegetables with an allergen cross contact etc.)?<br><br>Examples of known cross contact: -<br>• Tomato flakes with **wheat** cross contact.<br>• Capsicum powder with **wheat** cross contact. |

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| Dehydrated garlic | What is the geographical origin of the garlic? Refer to Case study – Crop rotation practices can impact upon ingredient allergen status.<br><br>What other crops are used for crop rotation by the grower? Does the farming source crop rotate with **peanut**?<br><br>What other crops are being (or can be) grown nearby?<br><br>What crop measures are in place to effectively remove physical remains of other crops?<br><br>How is the garlic (fresh or dehydrated) traded/sourced (e.g. through general markets with lesser known controls; contracted farms; controlled Backward Integration programs)?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Does the primary and secondary garlic processor have allergen controls within their facility?<br><br>Does the primary and secondary processor process batches of garlic with **peanut** cross contact and garlic without **peanut** cross contact in the same facility? |
| Pulses - mature seeds, dried (e.g. split peas, blue peas, beans, chickpeas, lupin) | Are there any **wheat**, **barley**, **oats**, **spelt**, **lupin** or **soy** crops grown in the same geographical region?<br><br>What other crops are used for crop rotation by the grower?<br><br>What other crops are being (or can be) grown nearby?<br><br>What seasons are the crops harvested in? This provides information about other plants nearby and shared storage.<br><br>What crop measures are in place to effectively remove physical remains of other crops?<br><br>Are storage silo's and harvest equipment shared across farms and all seasons?<br><br>How are the vegetables crops traded/sourced (e.g. through general markets with lesser known controls; contracted farms; controlled Backward Integration programs)?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from maintenance machinery, harvesting equipment?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Is the allergen similar in size and colour as the pulse (i.e. difficult to clean and separate)? What is the form of the processed pulse (e.g. whole, split, grits)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)? Is the cross contact similar in appearance to the pulse (i.e. difficult to clean and separate)?<br><br>cont... |

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| cont..<br>Pulses - mature seeds, dried (e.g. split peas, blue peas, beans, chickpeas, lupin) | Examples of known cross contact: -<br>• Dried beans with **soybean** cross contact.<br>• Dried beans with **wheat** cross contact.<br>Does the primary and secondary processor have allergen controls within their facility?<br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br>What effective separation processes are used by the primary and secondary processors?<br>Example of known cross contact: -<br>• Sorting facilities for dried split peas can be shared with pearl **barley**, **wheat**, **soy** etc. |
| Milled pulses (e.g. pea powder, soy grits, lupin flakes chickpea flour (besan flour), soy flour, lupin flour) | In addition to the questions above for Pulses.<br>Does the pulse processor have allergen controls within their facility?<br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br>What effective separation processes are used by the pulse processor (e.g. pea flour milling facilities can be shared with **soy** etc.)?<br>Is the cross contact similar in appearance to the pulse (i.e. difficult to clean and separate)? What is the form of the processed pulse (e.g. splits, grits, flakes, meal, flour)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, grit, pearl, kernel, flake, coarse ground)?<br>Example of known cross contact: -<br>• Chickpea flour with **wheat**, **barley**, **oats**. |

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| Cereal grains (e.g. barley, buckwheat, maize, millet, oats, popcorn, rice, rye, sorghum, spelt, triticale, wheat, wild rice) | Are there any **wheat**, **barley**, **oats**, **spelt**, **lupin** or **soy** crops grown in the same geographical region?<br><br>What other crops are used for crop rotation by the grower (e.g. **lupin** and **oats** can be used in crop rotation)?<br><br>What other crops are being (or can be) grown nearby? This includes **lupin**, **soy** and cereals containing gluten including **wheat**, wild **wheat**, **barley**, **spelt** and **oats**.<br><br>What seasons are the crops harvested in? This provides information about other plants nearby and shared storage.<br><br>What crop measures are in place to effectively remove physical remains of other crops?<br><br>Are storage silo's and harvest equipment shared across farms and all seasons?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from maintenance machinery, harvesting equipment?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Is the allergen similar in size and colour as the cereal grain (i.e. difficult to clean and separate)? What is the form of the cereal (e.g. whole, split, grits, husked)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)? Is the cross contact similar in appearance to the cereal (i.e. difficult to clean and separate)?<br><br>Examples of known cross contact: -<br>• **Oats** with **lupin** cross contact.<br>• **Wheat** with **soy** cross contact.<br>• Buckwheat kernel with **wheat** cross contact.<br><br>Does the primary and secondary processor have allergen controls within their facility?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>What effective separation processes are used by the primary and secondary processors?<br><br>Example of known cross contact: -<br>• Sorting facilities for dried corn (such as popcorn) can be shared with **wheat**, **soy** etc. |

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| Milled / processed cereal grain products (e.g. bran, flour, germ, meal, flakes) | In addition to the questions above for Cereal grains.<br><br>Does the grain processor have allergen controls within their facility?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>What effective separation processes are used by the grain processor (e.g. milling facilities for **oats** can be shared with **wheat**, **barley** etc.)?<br><br>Is the allergen similar in size and colour as the cereal grain (i.e. difficult to clean and separate)? What is the form of the processed cereal (e.g. whole, split, grits, meal, flour)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)? Is the cross contact similar in appearance to the cereal (i.e. difficult to clean and separate)?<br><br>Examples of known cross contact: -<br><br>• Buckwheat flour with **wheat** cross contact.<br>• Maize flour with **wheat** and **soy** cross contact. |
| Nuts - tree nuts and ground nuts | What is the geographical origin of the **tree nut** or **peanut**? Have other countries, that are included in the supply chain, been considered?<br><br>What seasons are the crops harvested in? This provides information about other plants nearby and shared storage.<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from maintenance machinery, harvesting equipment?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Are other **tree nuts** and/or **peanut** processed in the same facility?<br><br>Does the primary and secondary processor have allergen controls within their facility?<br><br>Is the cross contact similar in size and colour as the nut (i.e. difficult to clean and separate)? What is the form of the processed nut (e.g. whole, split, shelled, pieces, meal, flour, paste)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, paste, or particulate - whole, split, pieces, meal)? Is the cross contact similar in appearance to the nut (i.e. difficult to clean and separate)?<br><br>Examples of known cross contact: -<br><br>• **Cashews** with **peanut** cross contact.<br>• **Tree nuts** with other **tree nut** cross contact. |

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| Oil seeds (e.g. chia seed, hemp seed, linseed, mustard seed, poppy seed, quinoa seed, sesame seed, sunflower seed) | Are any **wheat**, **sesame** or **soy** crops grown in the same geographical region?<br><br>What other crops are being (or can be) grown nearby?<br><br>How are the seeds traded/sourced (e.g. through general markets with lesser known controls; contracted farms; controlled Backward Integration programs)?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Is the allergen similar in size and colour as the oil seed (i.e. difficult to clean and separate)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)?<br><br>Does the primary and secondary processor have allergen controls within their facility?<br><br>Examples of known cross contact: -<br><br>• Chia seed with **soy** cross contact.<br>• Hemp seed with **wheat** grain cross contact.<br>• Hemp protein with **wheat** cross contact.<br>• Mustard seed with **wheat** grain cross contact. |
| Spices (e.g. celery seed, coriander, cumin, dill, fennel, fenugreek, turmeric, etc.) | Are any **wheat**, **sesame** or **soy** crops grown in the same geographical region?<br><br>What other crops are being (or can be) grown nearby?<br><br>How are the spices/seeds traded/sourced (e.g. through general markets with lesser known controls; contracted farms; controlled Backward Integration programs)?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Is the allergen similar in size and colour as the spice/seed (i.e. difficult to clean and separate)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)?<br><br>Does the primary and secondary processor have allergen controls within their facility?<br><br>Examples of known cross contact: -<br><br>• Fennel seeds with **sesame** seed and **wheat** cross contact.<br>• Dill seeds with **sesame** seed cross contact.<br>• Cumin seeds with **wheat** and **peanut** cross contact.<br>• Coriander seeds with **wheat** and **sesame** seed cross contact.<br>• Fenugreek seeds with **sesame** seed cross contact.<br>• Celery seeds with **wheat** cross contact.<br>• Ground cumin with **wheat** and **peanut** cross contact. |

## Table 2: Allergens associated with agricultural co-mingling

| Food | Details |
|---|---|
| Herbs (e.g. oregano, marjoram, rosemary, thyme, parsley, etc.) | Are any **wheat** crops grown in the same geographical region?<br><br>What other crops are being (or can be) grown nearby? This includes cereals containing gluten including **wheat**, wild **wheat**, **barley**.<br><br>What seasons are the crops harvested in? This provides information about other plants nearby and shared storage.<br><br>What crop measures are in place to effectively remove physical remains of other crops?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from maintenance machinery, harvesting equipment?<br><br>What effective measures are in place to prevent or minimise potential allergen cross contact from shared storage equipment and facilities and/or transportation?<br><br>Are storage silo's and harvest equipment shared across farms and all seasons?<br><br>What measures are in place to minimise potential allergen cross contact from storage facilities (e.g. silos)?<br><br>Is the allergen similar, in size and colour, to the herb (i.e. difficult to clean and separate)? What is the form of the cross contact (e.g. readily dispersible - powder/dust, or particulate - split, whole, seed, leaf, pod, grit, hull, pearl, kernel, coarse ground)? What is the form of the herb?<br><br>How are the herbs traded/sourced (e.g. through general markets with lesser known controls; contracted farms; controlled Backward Integration programs)?<br><br>Does the primary and secondary herb processor have allergen controls within their facility?<br><br>Examples of known cross contact: -<br>• Oregano with **wheat** cross contact.<br>• Marjoram with **wheat** cross contact. |

## 3.2 Agriculture practices and allergen controls

During cultivation, primary processing, storage and transportation of commodity crops, there are several factors that can contribute to agricultural allergen co-mingling. However, measures can be put in place that can reduce the degree of this occurring. Table 3 describes where controls can be implemented and situations where there may not historically have been any controls identified.

Further information is available in the new publication by Codex Alimentarius *Code of Practice on food allergen management for businesses* (CXC 80-2020). This document provides allergen management guidance including measures to prevent cross contact during primary production, manufacturing, and retail and food service. Section III focusses on practices that reduce the likelihood of agricultural co-mingling during primary production.

## Table 3: Situations contributing to allergen agricultural co-mingling

| Situation | Details |
|---|---|
| Accumulation / markets / trading | Crop aggregators liaise with farmers to sell crops on their behalf. Accumulations of crops from various farms can be stored together and presented at markets. Knowledge of farming practices in relation to allergens may not be available. |
| Adjacent crop fields | The growing environment (e.g. neighboring fields and farms) should be considered when reviewing the potential for allergen cross contact. The adventitious presence of an allergen may be from drift or crop migration. Growers should understand the history of the growing area. |
| Crop rotation | This is the practice of cultivating different crops in a specific growing area during alternate seasons. Rotational crops are selected to restore nutrients in soil, help manage weed and pest activity. Allergen co-mingling may occur due to the exposure to physical remains of previous crops, without sufficient removal, prior to replanting. Growers should understand the history of the growing area (e.g. in some regions garlic is crop rotated with peanut crops). |
| Farming equipment | Maintenance of farming equipment helps to minimise potential for allergen cross contact. Adequate cleaning of, for example, planting, harvesting, weeding equipment, should be sufficient to prevent carry-over of plant debris from previous crops into the next crop.<br><br>Farming equipment may be used across several commodities/growers as shared equipment or leased as joint farming equipment. Farms with various crops may use the same sowing and harvesting equipment without a sufficient cleaning step between that prevents allergen co-mingling. Smaller farming communities may share farming equipment without knowledge of what the equipment was previously used for or without a sufficient cleaning step that prevents allergen co-mingling.<br><br>Training programs should be in place with adequate awareness of identified risks and allergen management practices. |
| Cleaning crops | Cleaning crops after harvest can help reduce the presence of allergens. Sifting equipment, size sorters, and colour sorters, may help clean and separate allergens. Growers should know the size and colour of the allergen to assess the effectiveness of mechanical sorting and cleaning.<br><br>Note: Determination and separation of some commodities from allergen commodities may not be possible due to the similarity of colour and size. There are also multiple tolerances for extraneous matter of seeds and grains within various commodity standards for unprocessed commodities around the world that permit higher tolerances of foreign seed and grain. Refer to section on Permissible foreign grain. This may allow for higher levels of allergen presence particularly in lower graded commodities[1]. |
| Particulates | Most agricultural crops are in particulate form (leaf, seed, grain, pulse, pod, nut). Particulates can remain in whole or split form during harvesting and storage. Often particulates of allergen crops have a similar colour or size to non-allergen crops making it difficult to identify, separate or clean. |

## Table 3: Situations contributing to allergen agricultural co-mingling

| Situation | Details |
|---|---|
| Permissible foreign grain | Food commodity standards vary from country to country. Established standards allow for permissible foreign objects in unprocessed seeds and grains at different levels. The same commodity group may have different tolerances between countries or jurisdictions. Extraneous matter which includes foreign seeds and grains can be permitted from 1-3% by Codex or upward of 5-8% in the USA or Canada depending on the graded product. This may allow for a higher level of allergen presence particularly in lower graded commodities[1]. |
| Primary processing \ primary processors | Primary processors perform the initial processing step on crops and commodities (e.g. air drying, shelling, hand sorting). Knowledge of the primary processing environment should be considered for the potential for allergen cross contact. Allergen cross contact can occur when processing steps are located close to other commodities which are allergens or are part of uncontrolled conditions.<br><br>Primary processors who dry crops or commodities should have measures in place that prevent inadvertent contact with allergens (e.g. physical barriers).<br><br>Storage containers or packaging should be clean. Bag reuse should be avoided when it previously stored an allergen. Storage of the filled containers should be in line with allergen management practices where allergens are clearly labelled to reduce the likelihood of cross contact due to unintentional mixing.<br><br>Training programs should be in place to address allergen controls such as the implementation of physical separation barriers, clearly labeled areas and the management of tools (e.g. containers, hanging materials). |
| Storage | Storage facilities with multiple commodities should ensure physical segregation of commodities with known allergen risk. Storage facilities and vessels used for multiple commodities should be appropriately cleaned and inspected. Storage containers should be suitably designed to facilitate adequate cleaning and inspection.<br><br>Allergen cross contact should be minimised by managing the flow of raw materials, the storage, and the processing steps within the facility.<br><br>Storage bags should be clean and bag reuse should be avoided when it previously stored an allergen. Storage of the filled bags should be in line with allergen management practices where allergens are stored on lower shelves to reduce the likelihood of cross contact due to spillage.<br><br>Training programs should be in place to address allergen controls such as the separation and movement of allergens around storage areas, cleaning of storage containers, the requirement of single use jute bags between commodities, and addressing allergen spillages. |

## Table 3: Situations contributing to allergen agricultural co-mingling

| Situation | Details |
|---|---|
| Transportation | There are a variety of transportation vehicles depending on the commodity and size of the operation. Controls and processes need to be appropriate for the transportation mode (e.g. bulk tanker, rail transport, shipping container, trucks, carts, trolleys). Often these vehicles are shared, hired, and used across multiple users. Depending on the cleaning practices, cross contact is likely unless the vessel is dedicated to the one type of crop.<br><br>Transport vehicles/containers should be appropriately emptied of the previous commodity, cleaned, and inspected before use to ensure there is no residue or carry-over from the previous commodity. Liners (e.g. cardboard sheeting of containers) used should be single use only.<br><br>Transport vehicles/containers should be suitably designed to facilitate adequate cleaning and inspection.<br><br>Loose crops and commodities should be transported separately or alternatively adequately separated by capping and wrapping with pallet covers to prevent spillage. Stacking of bagged commodities should be in line with allergen management practices where allergens are stored in a manner to reduce the likelihood of cross contact due to spillage.<br><br>Spillages of allergens should be cleaned up as soon as possible to minimise subsequent allergen cross contact.<br><br>Training programs should be in place to address allergen controls such as the separation of allergens, the cleaning between commodities transported and addressing allergen spillages. |

Table 4 describes practices that can be implemented to control and reduce the extent of allergen agricultural co-mingling within crops and commodities.

## Table 4: Practices used to mitigate allergen co-mingling

| Practice | Details |
|---|---|
| Contracted farms | These are farms where agreements have been made controlling the choices of crop rotations that may contribute to allergen concerns and include suitable cleaning practices of farming equipment. Provides a deeper knowledge and understanding of the farming practices by the procurer. |
| Backward Integration practices | Backward or vertical integration is the relationship between the farmer or farming community and the FBOs. The farming community is supported by the FBO sharing knowledge and providing guidance about selection of seeds, fertilization, pest control advice, crop rotation, soil, and water management. This arrangement can help provide training and education for allergen cross contact controls. Backward Integration provides a deeper knowledge, greater control, traceability and understanding of the farming practices for the FBO. |

# 4. FOOD FRAUD

The unknown presence of allergens that have been deliberately added to foods and ingredients for the purpose of substitution, adulteration, and economic gain, is an increasing global concern. Food fraud is illegal, and the unknown addition of allergens can affect the safety of consumers with food allergy.

Food adulteration has occurred for hundreds of years and the reasons vary. Examples include: -

- to increase profit by using inexpensive bulking agents
- to be competitive within a global market
- to meet certain quality specifications
- market driven cost cutting
- natural disasters impacting upon supply and demand

Complex supply chains and in many cases a lack of traceability, can mean that it is difficult to address food fraud through appropriate food safety and food defense strategies. It is important for FBOs to take measures to be protected against adulteration and food fraud. FBOs need to ensure they have conducted appropriate risk reviews of their supply chain (including ingredients and suppliers), identified vulnerabilities, and implemented appropriate preventive measures.

With respect to food allergens, some foods such as wheat flour or by-products, or waste such as peanut and almond shells have been used in food products to enhance their appearance or act as a filler or diluents. Table 5 provides some examples of allergens which have been associated with food adulteration.

## Table 5: Examples of allergens associated with food adulteration

| Adulterant | Details |
|---|---|
| Tree nut or peanut shells added to spices | Adulteration of ground spices is an ongoing concern due to the complicated nature of the global spice supply chain and relative ease of hiding an adulterant within the ground material.<br><br>Hundreds of recalls across Canada and the USA occurred in 2014 when **almond** and **peanut** proteins were detected in cumin. Ground **peanuts** and **almond** shell waste product are similar in appearance to ground cumin. Further investigation and analysis confirmed peanut protein present in cumin. However, the presence of almond in cumin could not be confirmed due to the discovery that mahleb (a spice made from cherry seeds) was fully cross-reactive with some commercial almond ELISA test kits, showing that identifying allergen adulterants in spices can be complex[2].<br><br>Other spices thought to be adulterated with **almond** and **peanut** resulting in recalls have been cinnamon, paprika and cayenne pepper. |
| Starches and cereals added to spices | Spice products such as turmeric, ginger, and paprika have been known to be diluted with starch-based products like cassava, **wheat**, or **barley** powder to maintain a consistent colour and meet certain quality standards. Detection of starch addition is difficult without analysis, and some countries may permit the addition of starch to some spices making the discovery of food adulteration even more complicated[3]. |
| Tree nut and soy added to oils | Oils such as olive oil, and other vegetable oils can be diluted with a lower cost alternative using **hazelnut**, **soybean**, **walnut**, **peanut** oils. |
| Fish substituted for other fish | Valuable species of **fish** can often be substituted with a lower value fish and falsely labelled. This is cause for concern from an allergen perspective as an individual may be allergic to one type of **fish** species and not another. |
| Corn syrup added to honey | Honey has been known to be adulterated with corn syrup. Corn syrup is often a product of maize, however, it can also be a product of **wheat**. |

## Crop rotation practices can impact upon ingredient allergen status

### The dawn of a new challenge for the food industry

In 2014, the presence of low levels of peanut in garlic powder was detected through testing of garlic sold within the USA. Further testing, at that time, showed peanut concentrations in garlic powder ranging from 10 parts per million (ppm) to over 200 ppm[4]. Testing in the EU in 2016 also found positive results. It seemed consistent that the garlic, which showed positive presence of peanut, was in powdered or flake form, was souced from China. Today, most of the world's garlic is grown in China, some in India, and the remainder throughout the world including the United States and the EU[5].

### The investigation begins

The food industry, traders, importers, spice agents and analysts acted quickly to establish how peanut could be present in dried garlic. It was found that the most likely reason was due to the regular practice for growers in China to cultivate peanuts and garlic in tandem, or to crop rotate garlic with peanut. Crop rotation is a standard agricultural practice, important for sustainable farming and nourishing soils. In these fields, both peanuts and garlic are grown below ground and therefore some residual peanut plants may be harvested along with garlic. There is also the likelihood of sharing the same equipment for harvesting, and facilities for sun drying, transport and storage. The complexity of the supply chain is shown by the significant amount of garlic cultivation in China. There are over two million farms and more than 1000 dehydrators supporting the garlic supply chain.

### Industry guidance

When purchasing dehydrated garlic, or ingredients that contain dehydrated garlic, ask the supplier to provide information about peanut cross contact. The supplier can refer to the guidance in the section on dehydrated garlic in Table 2 of this Guide to form part of their investigation.

Three points to consider if peanut is present in the garlic due to cross contact:

- Sourcing garlic from geographical origins which do not crop rotate with peanut could eliminate the risk of peanut cross contact.
- Whether the raw material supplier's peanut allergen controls eliminate, reduce or quantify the risk of peanut cross contact.
- Conducting a risk assessment to determine the concentration of peanut cross contact present in the food for sale. The *Food Industry Guide to the Voluntary Incidental Trace Allergen Labelling (VITAL®) Program* (which is freely available on the Allergen Bureau website) provides guidance on cross contact allergen risk assessment.

# Supply chains can be complex and need to be fully understood

**Responding to a new allergen cross contact discovery**

During December 2019 and January 2020, pesto products manufactured in Italy were recalled across Europe and the UK due to the presence of undeclared peanut. Investigations indicated that the source of the peanut was from cashew ingredients in the form of meal, flour and pieces and it was thought these ingredients originated from Vietnam. In Australia, recalls were instigated for imported pesto products, followed by other products after proactive analysis for peanut in cashew ingredients was carried out. The food industry acted quickly and collaboratively with consumer groups, analytical laboratories, retailers, and regulators, to gain a better understanding of the nature of the issue.

**The investigation begins**

Many of the recalled foods were produced in different countries, so it was quickly agreed that the source of the peanut was not where the finished goods were manufactured. Analysis did not provide much insight as it did not show a consistent presence of peanut in the foods. Initially, there was a strong indication that the exposure to peanut occurred due to the bags used to transport the cashews from India and the Ivory Coast to Vietnam where the majority of the cashews are processed. This was uncertain, however, and so it was necessary for industry to track back, share knowledge, work together and understand the supply chain to identify the point of exposure.

**Supply chains can be complex**

Cashews are grown in many geographical regions worldwide, including Vietnam, India, West Africa, and South America[6]. Most of the whole cashews (the nut within its shell) are then transported to Vietnam for processing.

In cashew processing, the first step is to remove the shell, which is a critical step because the shell is toxic. The shell separation process involves roasting and steaming at high temperatures, and once the shell is removed there is further roasting to remove any residual oils (which may also contain toxins) and peel from the nut. It was concluded that if the unprocessed cashew nuts were exposed to peanut residue from shared bags used during transportation, it is very unlikely that peanut residue would remain after the shell, oil and peel separation steps, and any peanut residue present would be much lower than the levels detected in the recalled foods.

The roasted cashews are then graded. The bigger whole nuts are separated from the smaller whole nuts and from the pieces and all are bagged. At this stage, the original shipping bags cannot be reused so as to avoid contamination of the shell toxins.

Whole cashews are considered a premium product and once bagged, are distributed across the world demanding a higher price. During this investigation, analysis in Australia did not detect any peanut residue on whole cashews so the focus was directed to the smaller nuts and pieces.

The smaller whole cashews and pieces can undergo further processing. Some are bagged and distributed to suppliers, but most go on to various processors in the supply chain for additional roasting/nibbing/chopping. The complexity of the supply chain is shown at this point where in Vietnam alone, there are approximately one thousand (large, medium, and small) cashew processing sites. The potential that some of these sites are also processing other tree nuts and peanuts is high. It is likely that some supplier approval systems have not encompassed the complexity of this step.

**Investigation is continuing**

It is most likely that the source of the peanut contamination occurred during the secondary processing steps. This aligns with detecting peanut residues in the more finely ground cashew materials and may also explain why analysis did not show peanut consistently present in the foods. Investigation is continuing, however, this case study shows that for commodity ingredients, any secondary processing steps can inherently increase the allergen cross contact risk if allergen management practices are not well understood or implemented. As part of the raw material approval process, the supply chain needs to be fully understood to be confident of the allergen status of ingredients.

# 6. ENDNOTES


[1] Alvarez, PA. Boye, JI. (2012). Food production and processing considerations of allergenic food ingredients: a review. *J Allergy (Cairo)*;746125. doi:10.1155/2012/746125.

[2] Walker M.J., et al., (2018). Almond or mahaleb? Orthogonal allergen analysis during a live incident investigation by ELISA, molecular biology and protein mass spectrometry, *J. AOAC Int.*, 101, 1, 162-169, Available at https://doi.org/10.5740/jaoacint.17-0405 [Accessed 08 Dec. 2020].

[3] Oliveira, M., Cruz-Tirado, J. and Barbin, D., 2019. Nontargeted Analytical Methods as a Powerful Tool for the Authentication of Spices and Herbs: A Review. *Comprehensive Reviews in Food Science and Food Safety*, 18(3), pp.670-689.

[4] Taylor, S. (2017). *Allergen Residues in Spices: Discovery, Detection and Risk Assessment*, Melbourne, 2nd Food Allergen Management Symposium,
Available at: http://allergenbureau.net/wp-content/uploads/2017/07/Steve-Taylor-2_FAMS2017.pdf
[Accessed 27 Oct. 2020].

[5] © FAO (2020) *Production of Garlic: top 10 producers*. Available at: www.fao.org/faostat
[Accessed 27 Oct. 2020].

[6] © FAO 2020 *Production of Cashew nuts, with shell: top 10 producers*.
Available at: www.fao.org/faostat [Accessed 27 Oct. 2020].


Allergen Bureau

Australia 0437 918 959 International + 61 437 918 959

Email info@allergenbureau.net website www.allergenbureau.net