Lupins for Food & Health

Dr Mark Sweetingham (Lupin Program Manager)
Ancient crop
- Peru, Ecuador
alkaloids removed by soaking
Traditional food
- Mediterranean region

alkaloids removed by soaking & boiling in brine
20th Century - plant breeding

Varieties for modern agriculture

• ‘sweet’ seeds (alkaloids < 0.02%)
  (wild, bitter lupins = 2 - 4% alkaloids)
• suitable for mechanical sowing and harvest
• disease resistant

- in Europe (since 1930s)
- in Australia (since 1960s)
Lupin species

• **Australian Sweet** (L. angustifolius)

• **European White** (L. albus)

• **Sweet Yellow** (L. luteus)

• **Pearl** (L. mutabilis)
Western Australia

• world’s largest lupin breeding program
• developing GM-free varieties
Western Australia

- Grows 85% of world’s lupin grain production
- Innovative farmers with clean production systems
- Quality Assured grain receival, storage and transport
The lupin grain

a unique combination of
- high protein
- high dietary fibre
- low oil
- no starch

Low Glycaemic Index (G.I.)
The 21st Century - obesity epidemic

The metabolic syndrome
- over-weight
- high blood pressure
- high plasma cholesterol & lipid
- Type II diabetes

Low G.I. Foods combat the disorder
**Lupin**
(Australian Sweet Lupin)

**Hull (25%):**
- cellulose - 50%
- pectin - 30%
- protein - 6%
- oil - 1%
- water - 10%

**Kernel (75%):**
- protein - 40%
- pectin - 28%
- oil - 7%
- oligosacch. - 6%
- cellulose - 2%
- water - 10%
Lupin
(Australian sweet lupin)

- higher lysine than cereals
- major natural source of arginine
  - precursor for NO & GABA

Amino acids
Lupin
(Australian sweet lupin)

- high in oleic acid
- high in natural lethicin

Good quality oil
Lupin
(Australian sweet lupin)

- carotenoids
  - beta carotene (2mg/kg)
  - lutein (15mg/kg)
  - zeaxanthine (5mg/kg)
- tocopherols

Rich in natural anti-oxidants
**Lupin**
(Australian sweet lupin)

- Low protease & amylase inhibitors (T.I = 0.12 mg/g)
- Low in phytates (0.58%)
  - greater Ca and Zn absorption
- Low in tannins and saponins
- No detectable lectins

Low in anti-nutritional factors
Fermented products - soy equivalents

• tofu
• miso
• shoyu
• tempeh
# Miso - Sensory Evaluation

Shinshu Research Institute, Japan

<table>
<thead>
<tr>
<th>Product</th>
<th>Color</th>
<th>Taste</th>
<th>Aroma</th>
<th>Texture</th>
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<tbody>
<tr>
<td>Lupin miso</td>
<td>12</td>
<td>10</td>
<td>7</td>
<td>6</td>
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<tr>
<td>Soybean miso</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
Lupin kernel flour

- Simple grinding process

Weston Milling, Australia
LUP’INGREDIENTS, France
Fa. L.I. Frank, Netherlands
Soja Austria, Austria
AVELUP, Chile
Lupin kernel flour

FUNCTIONAL PROPERTIES

• Dough Functionality
  - water retention & fat binding
  - egg & butter replacement

• Pale yellow colouring

• Stability & shelf-life

HEALTH IMPLICATIONS

- high protein
- high fibre
- low GI
Kernel flour products

- bread
- biscuits
- muffins
- waffles
- pasta
- noodles
- confectionery
Human dietary study


![Graph showing incremental plasma glucose concentration over time for standard white bread and ASLF bread breakfasts.](image-url)
Lupin processing

- KERNELS
  - MILLING
  - EXTRUSION
    - BREAD
    - BAKED GOODS
    - PASTA, NOODLES

- FLOUR
  - PROTEIN F
  - PROTEIN E
  - FIBRE
    - BREAKFAST CEREALS
    - SNACK FOODS

- EGG WHITE REPLACEMENT
  - MILK, YOGHURT, ICE CREAM
  - SMALLGOODS, MEAT EXTENDERS

- WET PROCESSING
Lupin protein F

Functionality
• excellent foaming properties
• low *Salmonella* risk

Products
• egg white replacement
• glazes, frozen deserts
Lupin protein E

Functionality
• emulsifying
• water & fat binding
• white colour

Products
• dairy substitutes
• meat extenders, analogues
• surimi

Protein isolate E (90% CP)
Lupin milk & yoghurt
- thermally stable
- whiter colour & better tasting than soy-milk

Patent pending
Lupin proteins - Health implications

Appetite regulation
• protein a highly satiating macronutrient

Cholesterol lowering
• \( \gamma \)-conglutin up-regulates LDL receptors

Cardiovascular protection
• reduced arthrosclerosis (soft plaque)

Reduced hypertension
• arginine - NO pathway ?

Gluten free
Lupin kernel fibre

FUNCTIONALITY
• colourless, odourless
• water binding
• fat replacer
  - no loss in taste

PRODUCTS
• bread
• biscuits, muffins
• breakfast cereals, snack bars
• sausages, burgers
• health drinks
Lupin kernel fibre
Dietary research findings

• high satiety factor
  - suppresses appetite
• lowers cholesterol
  - reduced fat intake
  - additional mechanisms
• bowel health
  - reduces transit time
  - lowers colon pH
  - pre-biotic
Food safety

Alkaloids - (less than 200mg/kg)
Phomopsin - (less than: 5ug/kg)

Approvals
• Australian Food Standards Code A12 (FSANZ)
• UK, European Union
• Japanese Ministry of Health, Labour & Welfare (for Shoyu in 2001)

In preparation
• GRAS (United States)
Allergy

• A small proportion of the population are allergic to lupin protein
• Similar to the peanut allergen
• Can cause a severe anaphylactic response
Summary

- Lupin products are new to the food ingredient industry, being most advanced in Europe.
- Lupin products are being valued for their:
  - non-GM status
  - functional properties
  - nutritional, and potential health benefits
- Lupin products can substitute for, and in some applications are superior to soy products.
- Supply-chain partnerships are strengthening in Australia with linkages back to lupin breeders to improve grain quality.