

Maintaining the Pulse in Agricultural Resilience

– Sydney Institute of Agriculture

Presented by

Associate Professor Brent N. Kaiser

Director - Legumes for Sustainable Agriculture

Faculty of Science

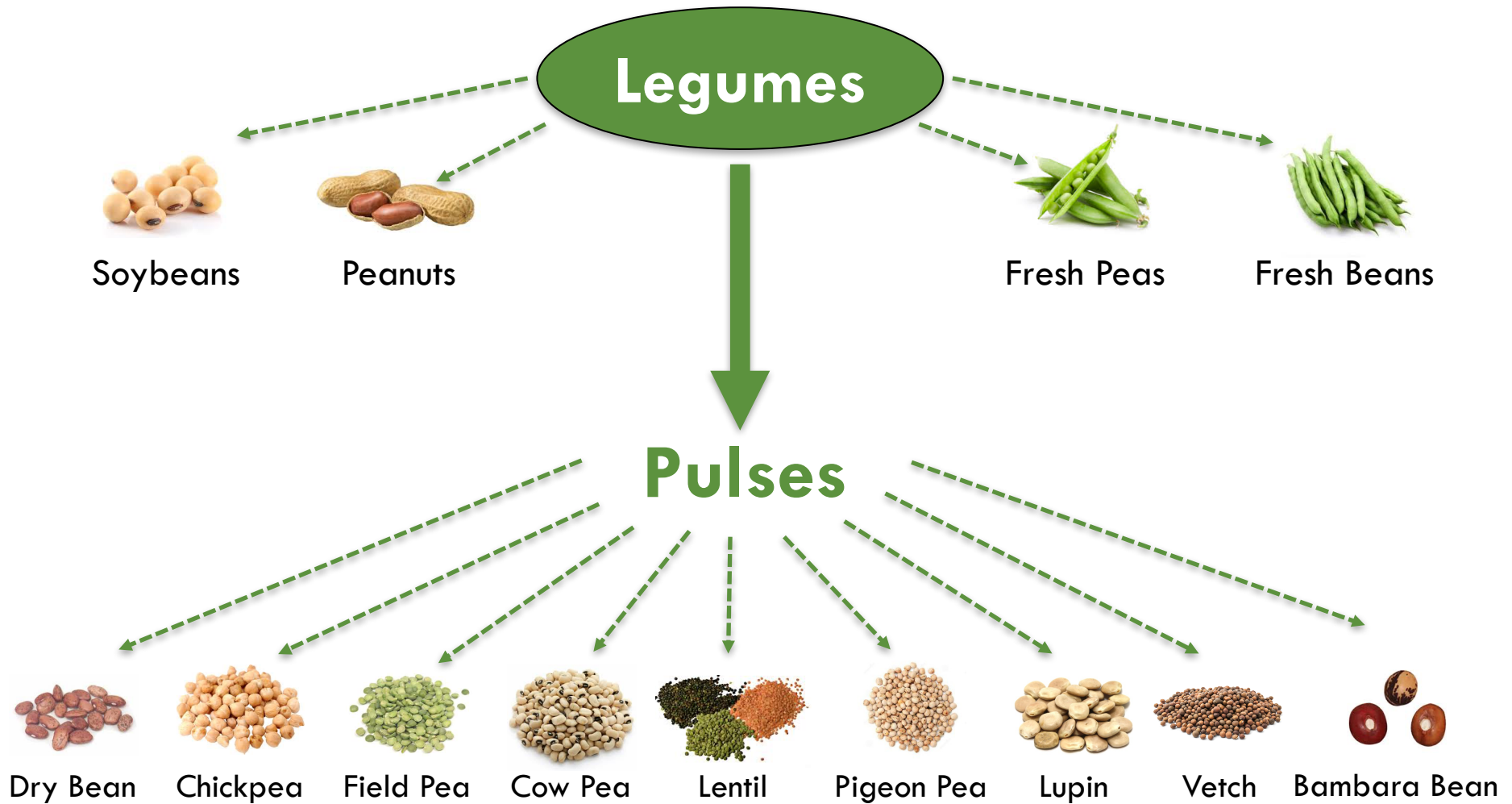
School of Life and Environmental Science



THE UNIVERSITY OF
SYDNEY



What is a Pulse?



Pulses are good for you!

High in
dietary fibre

High in iron
and calcium

The Protein Power of Pulses

Vitamins
(Folate)

Source of
antioxidants

Low
glycaemic
index

Pulses are good for Agriculture

- Rotational crops
 - Break disease cycles
 - Disrupt weed populations
 - Provide soil nutrition



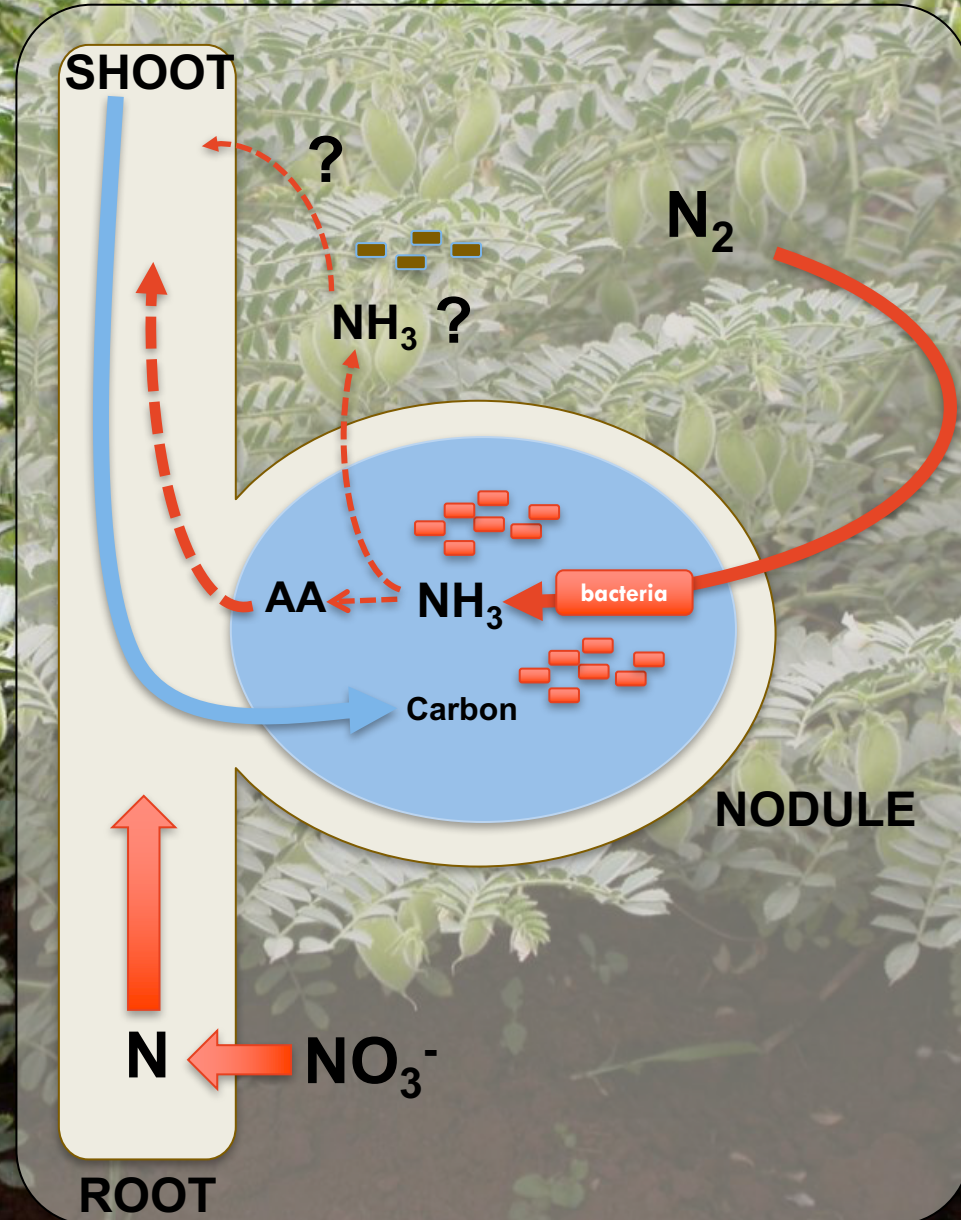
Pulses Fix Nitrogen (N_2) – Nitrogen self-sufficiency

- N to grow and set seed
- Soil N for other crops
 - Wheat, Canola, Maize
 - Soil microbes

The diagram illustrates the nitrogen fixation process in a pulse plant. It shows a cross-section of the root system with a root nodule. Inside the nodule, bacteria are shown fixing atmospheric nitrogen (N_2) into ammonia (NH_3). The ammonia is then converted to ammonium ions (NH_4^+), which are transported to the shoot. The shoot also receives nitrogen from the soil as nitrate (NO_3^-). The diagram also shows the movement of carbon from the shoot to the nodule, which is used by the bacteria for energy. The nodule is labeled 'NODULE' and the root is labeled 'ROOT'. The shoot is labeled 'SHOOT'. The process is labeled 'NITROGEN FIXATION'.

A photograph of a pulse plant root system, showing several orange, bumpy nodules attached to the roots. The nodules are labeled 'Nodules' with white arrows pointing to them. The background is a dark, moist soil.

-
- Nodules**

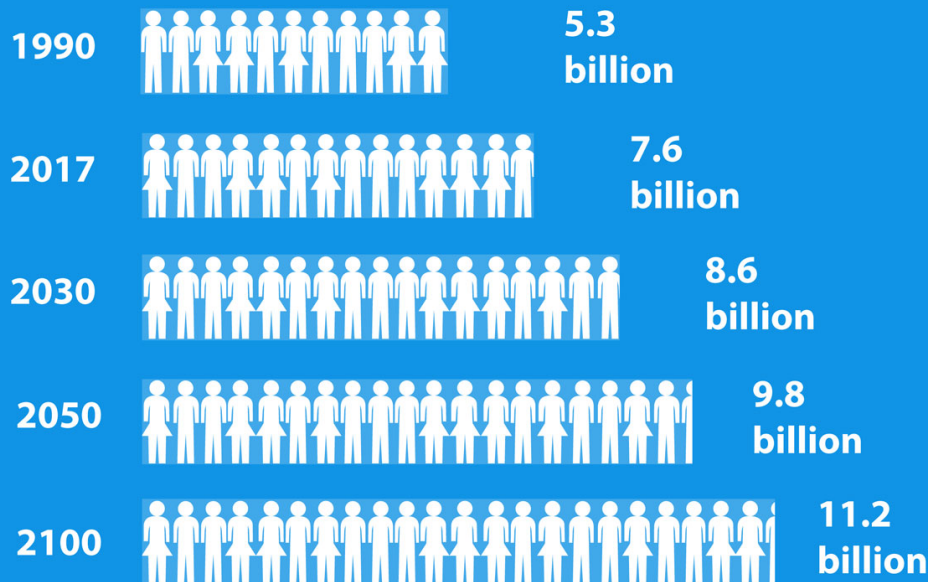


Population Growth – Ensuring Food Security

- World population is increasing
- How to feed ~9 billion people by 2030?

World Population

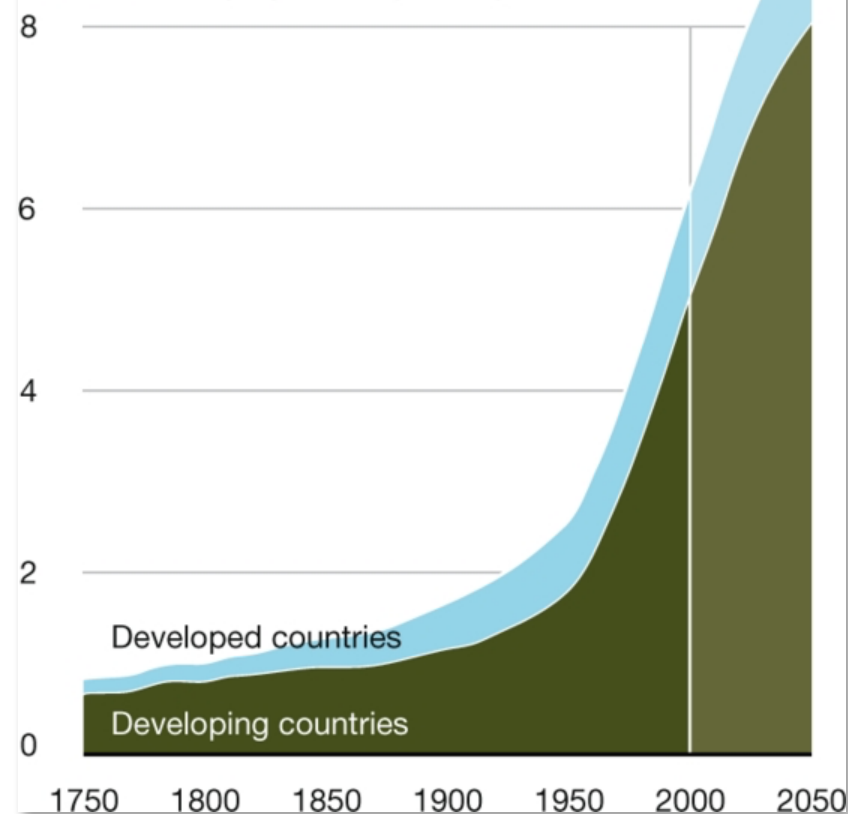
Projected world population until 2100



Source: United Nations Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2017 Revision*
Produced by: United Nations Department of Public Information



Global population, estimates and projections (billions)



Source: Grid Arendal

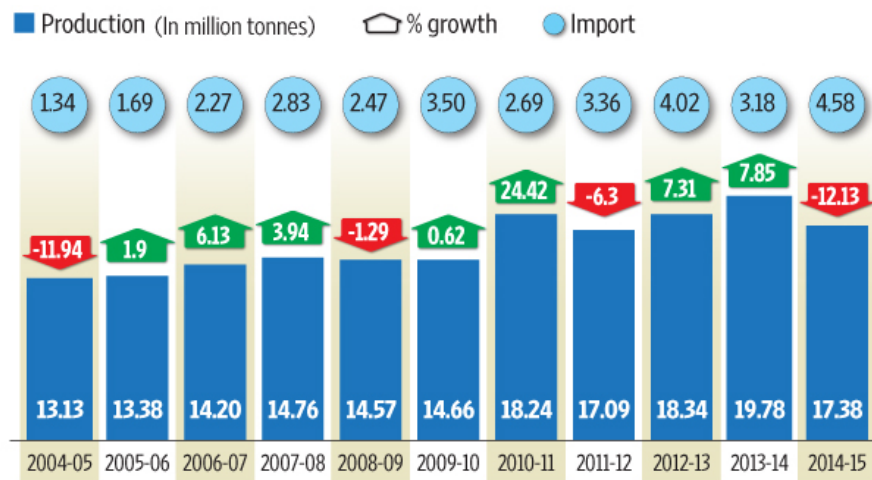
Australian Pulses are in Demand!



India: Pulse Demand - 2030

- Will require ~40 million tonnes (MT)
 - 2015 Indian production ~15 MT
- India will require ~1.5 MT of extra pulses per annum!

VOLATILITY IN PRODUCTION



Source: Ministry of agriculture

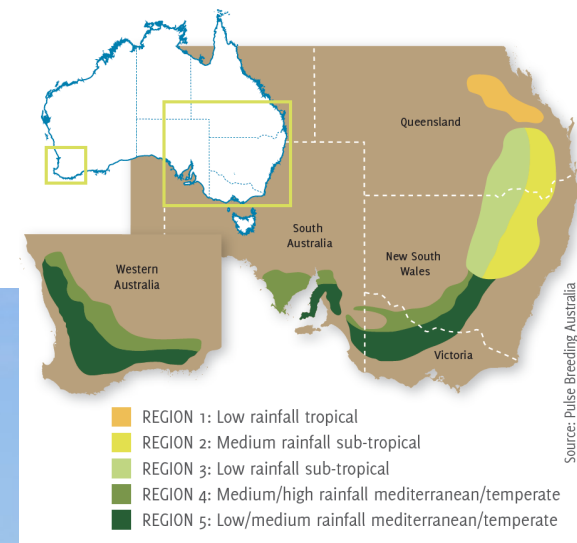


Australian Pulse Production

2017 Forecast: ~ 3 Million MT combined harvest

Chickpea	Lentil	Faba bean	Field Pea	Lupin
1.5 MT	370 KT	300 KT	280 KT	500 KT

AREAS OF PULSE PRODUCTION



Chickpea Harvest

Australian pulse production is not secure

- Pulse production (yield and quality) subject to unpredictable and challenging environments
 - Drought, heat, flood, frost, degraded soils



Challenges facing Australian pulse production

- Climate variability
 - Drought
 - Heat
 - Flooding
 - Salinity
- Disease
- Reliability
 - Profitability



Drought



Floods



Heat



Saline soils



Ascochyta Blight

Genetic resilience – key to sustainability

- Genetic improvement will mitigate the impact of climate change and disease – pathway to enhanced quality and yield
- 1) **Basic Research** to identify resilient traits (genes and proteins)
- 2) **Translatable Research** to introduce traits
- 3) **Plant Breeding** to deliver the physical outcomes to growers
- 4) **Societal** support that enables genetic improvement
 - Valuing agriculture and its role to meet global food demands
 - Prioritization of research funding to ensure long-term outcomes occur



- ARC Industrial Transformation Research Hub
 - Basic and Transformational Research for Legume Resilience



LSA Research Aims

- Develop pulses for increased **resilience to abiotic stress**
- **Optimise plant resource partitioning** to enhance yield under stress.
- **Enhance N₂-fixation** of pulses for annual and rotational crop production

Drought

Salinity

Heat

Flooding

Carbon

Nitrogen

Nodules

N₂-fix

N-soil

Symbiosis

Summary

- Pulses are important to Australia's agricultural sector and its **long-term sustainability**
- **Legumes for Sustainable Agriculture** has been developed to deliver pulse research and development to Australia
- **Legumes for Sustainable Agriculture** and the **Sydney Institute of Agriculture** will spearhead new investment and research activity focused on pulse improvement and their role in meeting global food challenges

Thankyou



Chickpea