

SECTION A

Introduction

A.1 Agronomy at a glance

- Measure stored soil moisture depth.
- Avoid saline or sodic soils.
- Assess the Phytophthora risk.
- Avoid waterlogged areas.
- Control broadleaf weeds.
- Ensure there are no damaging levels of herbicide residue.
- Avoid planting near old chickpea stubble.
- Research variety choice and specific variety management packages.
- Ensure seed quality and seed fungicide dressing is adequate.
- Ensure inoculation procedures are adequate.
- Sow in an up and back row formation.
- Ensure fertiliser requirements are met.
- Assess crop establishment conditions.
- Monitor crops at critical stages.
- Respond to crop management needs in timely way.
- Set up boom spray for fungicides.
- Consider desiccation as harvest aide.
- Prepare storage infrastructure for grain at 14-16% moisture.¹

A.2 Crop overview

Chickpeas were first grown in Australia as a commercial crop in Goondiwindi, Queensland, during the early 1970s.

There are two groups of chickpeas grown in Australia, Desi and Kabuli, mainly distinguished by seed size, shape and colour. They also have different growth requirements, markets and end-users.

Desi types have small angular seeds weighing about 120 mg, are wrinkled at the beak and range in colour from brown to light brown and fawn. They are normally dehulled and split to obtain dhal (Figure 1) and are favoured in the Asian sub-continent.

Kabuli have large, rounder seeds, weighing about 400 mg. They are white-cream in colour and are almost exclusively used whole. They are preferred through the Mediterranean region.

The plant is erect and freestanding, ranging in height from 40-60 cm in the northern region, although well-grown plants may reach 80 cm. They have a fibrous taproot system, a number of woody stems forming from the base, upper secondary branches,

¹ Pulse Australia, Checklist for Northern Growers http://www.pulseaus.com.au/storage/app/media/crops/2010_NPB-Chickpea-checklist-north.pdf

and fine, frond-like leaves. Each leaflet has a thick covering of glandular hairs that secrete a strong acid (malic), particularly during pod-set, and this provides some protection from insects. The plant can derive >70% of its nitrogen from symbiotic nitrogen fixation.

Yields are best in areas with reliable seasonal rainfall and mild spring conditions during seed filling. Chickpeas are well suited to well-drained, non-acidic soils of a medium to heavy texture.²



Figure 1: Desi chickpeas are split to obtain dhal.

More information

<http://www.gograins.com.au/>

<http://www.grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-91-March-April-2011/Go-Grains>

A.2.1 Nutritional Information

Chickpeas are a very good source of carbohydrates and proteins, which together constitute about 80% of the total dry seed weight. Starch, which is the principal carbohydrate component, varies in content from 41 to 50% and is lower in Desi varieties than in Kabuli varieties. Total seed carbohydrates vary from 52 to 71%. The crude protein content of chickpea varieties ranges from 16 to 24%. Crude fibre, an important constituent of chickpeas, is mostly located within the seed coat.

Based on amino acid composition, the proteins of chickpea seed were found, on average, to be of higher nutritive value than those of other grain legumes. Chickpeas meet adult human requirements for all essential amino acids except methionine and cysteine, and have a low level of tryptophan. Chickpeas have a high protein digestibility and are richer in phosphorus and calcium than other pulses.

A.2.2 Pulses

Chickpeas are pulses, which by definition are annual legume crops that fix nitrogen from the atmosphere and produce high-protein grain for human consumption.³

Chickpeas are an annual leguminous crop, and the grain is used for human and animal consumption. Pulses do not include green beans and peas; these are considered vegetable crops. Crops grown mainly for oil extraction (e.g. peanuts and soybean) are also excluded. Pulses are the major source of protein in vegetarian diets. They have a

² Pulse Australia. Chickpea, (*Cicer arietinum*). <http://www.pulseaus.com.au/growing-pulses/bmp/chickpea>

³ E Armstrong (2013) The role of pulses and their management in southern NSW. GRDC Update Papers 31 July 2013, <http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/07/The-role-of-pulses-and-their-management-in-southern-NSW>

protein percentage of 20–25%, compared with wheat, which has half this and rice, with only one-third.⁴

The crop is generally sown in winter and harvested in late spring or summer. New South Wales is the state with the highest production, particularly northern NSW, followed by Queensland. Chickpeas are also grown in Western Australia, South Australia and Victoria.

Kabuli chickpeas are creamy-white and much larger than Desi chickpeas. They are sold whole, so seed size and appearance are critically important. Yields are generally lower and more variable than Desi varieties, although premiums for larger chickpeas can offset the yield disadvantage. Advances through plant breeding are giving more consistent results from Kabuli varieties. Kabuli seed sizes of 7–8 mm can command price premiums of >\$100 per tonne (t) over Desi types, and sizes >8 mm considerably more.

The majority of Australian-produced chickpeas are exported, with India, Pakistan and Bangladesh taking nearly 80% of all exported chickpeas in the year ended October 2015. Chickpeas are suitable for both ruminant and non-ruminant feeds but are not commonly used for these purposes because of the higher prices obtained from human consumption markets.⁵

A.2.3 Production

Table 1: Chickpea production 2016 for Desi and Kabuli chickpeas.

Desi chickpeas										
Region	Western				Northern					Australia Total
State	WA	SA	VIC	S/NSW	Subtotal	QLD	N/NSW	Subtotal		
2016 Production (t)	2,500	3,000	3,300	41,000	47,300	555,000	365,000	920,000	987,800	
2016 Sown area (ha)	2,200	3,000	6,100	30,000	39,100	338,000	235,000	573,000	614,300	
Variation from Dec 2015 (t)	-1,260	0	-1,600	0	-1,600	0	0	0	-2,860	

Kabuli chickpeas										
Region	Western				Northern					Australia Total
State	WA	SA	VIC	S/NSW	Subtotal	QLD	N/NSW	Subtotal		
2015 Production (t)	700	8,000	2,000	3,100	13,100		29,400	29,400	43,200	
2015 Sown area (ha)	500	13,900	6,800	2,800	23,500		23,000	23,000	47,000	
Variation from Dec 2015 (t)	0	0	-500	0	-500		0	0	-500	

(Source: Pulse Australia)

A.2.4 Quality attributes and end use

Australia is the world's number one chickpea exporter with 90% of Australian chickpeas exported and supplying more than a third of Desi chickpea traded internationally. Australian chickpeas are exported to more than 40 countries. The industry is committed to supplying chickpea with quality attributes tailored to these markets.

Important quality traits targeted by chickpea breeders include:

- large and uniform seed size
- lighter coloured seed coat
- splitting quality of Desi chickpea

⁴ DAFF (2012) Chickpea—overview. Department of Agriculture Fisheries and Forestry Queensland, <http://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/chickpeas/overview>

⁵ P Chudleigh (2012) An economic analysis of GRDC investment in the National Chickpea Breeding Program. GRDC Impact Assessment Report Series, December 2012, <https://www.grdc.com.au/Research-and-Development/-/media/2FE8D5C5C0FE42B8BC7985647002FD70.pdf>

- hydration and cooking characteristics of Desi and Kabuli chickpeas ⁶

Chickpeas are prepared and eaten in a variety of ways (Figure 2). Chickpeas are a staple food in the Middle East and the Indian subcontinent. The consumption of pulses in the western world is increasing as diets are becoming more diverse and people are recognising pulses' nutritional value. However, this is still a very small percentage of global consumption. Only 1% of Australian chickpeas is consumed locally, with the remaining percentage exported.



Figure 2: Chickpeas are exported for human consumption.

Chickpeas are a winter crop and, because they are leguminous, are valuable as an alternative crop in a cereal-based farming system. They are also an excellent break crop from diseases, weeds and pests. ⁷

A.2.5 Role within northern region farming systems

Long-term tillage and rotation trials have been conducted by the Department of Agriculture, Fisheries and Forestry Queensland (DAF) and the New South Wales Department of Primary Industries (NSW DPI). These trials have shown that, through the adoption of best management practice (BMP) and breaking cereal monocultures by allocating 15–20% of winter cropping area to chickpeas, leading growers in Queensland and NSW have seen an average increase of 1 t/ha in yield and 1% in grain protein content in their following wheat crops.

Queensland chickpea production grew seven-fold between 1995 and 2005, and is continuing to increase. Agronomic guidelines for BMP are widely available through the websites and publications of the [DAF](#), [NSW DPI](#) and [Pulse Australia](#). Growers also have access to the network of chickpea agronomists accredited by Pulse Australia or have the opportunity to undertake the training themselves.

Chickpeas are recognised as a reliable, profitable winter crop with a vital role in farming systems and have great potential throughout the whole of the northern grains region. New chickpea varieties are released through Pulse Breeding Australia (PBA), a joint venture between Grains Research and Development Corporation (GRDC) and state departments of agriculture. ⁸

⁶ Pulse Australia (2010) A snapshot of Australian pulses. Poster reprint from CICILS/IPTIC Convention, http://www.pulseaus.com.au/storage/app/media/crops/2010_Australian-pulses.pdf

⁷ DAFF (2012) Chickpea—overview. Department of Agriculture Fisheries and Forestry Queensland, <http://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/chickpeas/overview>

⁸ DAFF (2012) Chickpea—overview. Department of Agriculture Fisheries and Forestry Queensland, <http://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/chickpeas/overview>

A.2.6 GRDC's chickpea-breeding investment

A highly coordinated chickpea-breeding program commenced in Australia in 2005, but improvement via selection began in the 1970s. NSW DPI and DAFF have also collaborated on breeding chickpeas since 1983. Several improved varieties had been released in the period before the current investment commenced.

The principal outputs of GRDC chickpea-breeding investments have been improved varieties (Figure 3). Important traits from these improved varieties have been disease and pest resistance and traits that influence yield. Higher yields and increased disease resistance can translate into higher profits from the chickpea crop, in turn potentially increasing the attractiveness of chickpeas in a cereal rotation and benefiting the next cereal crop.



Figure 3: The GRDC-funded chickpea-breeding program has resulted in improved varieties with better disease and pest resistance.

GRDC's investment in three projects (DAN00065, DAN00094, DAN00151) is expected to produce a number of benefits. The total investment of \$43 million has been estimated to produce total gross benefits of \$123 million, providing a net present value of \$80 million, a benefit-cost ratio of just under 3 to 1 (over 30 years, using a 5% discount rate), and an internal rate of return of >15%.⁹

Pulse Breeding Australian (PBA) is a world class Australian breeding program for chickpeas, field peas, faba beans, lentils and lupins. PBA has operated since 2006 and its vision is to see pulses expand to >15% of the cropping area so as to underpin the productivity, profitability and sustainability of Australian grain farming systems.

PBA is developing a pipeline of improved varieties for Australian growers that achieve higher yields, have resistance to major diseases and stresses, and have grain qualities that enhance market competitiveness.

PBA is an unincorporated joint venture between:

[Department of Primary Industries, Victoria \(DPI Vic\)](#)

[South Australian Research and Development Institute \(SARDI\)](#)

[Department of Agriculture, Fisheries and Forestry, Queensland \(DAF Qld\)](#)

⁹ P Chudleigh (2012) An economic analysis of GRDC investment in the National Chickpea Breeding Program. GRDC Impact Assessment Report Series, December 2012, <https://www.grdc.com.au/Research-and-Development/-/media/2FE8D5C5C0FE42B8BC7985647002FD70.pdf>

More information

[An Economic Analysis of GRDC Investment in the National Chickpea Breeding Program](#)

[Chickpea genome decoded, The Crawford Fund](#)

www.grdc.com.au/Research-and-Development/Major-Initiatives/PBA

[New South Wales Department of Primary Industries \(NSW DPI\)](#)
[Department of Agriculture and Food Western Australia \(DAFWA\)](#)
[University of Adelaide](#)
[University of Sydney](#)
[Pulse Australia](#)
[Grains Research and Development Corporation \(GRDC\)](#)

A.3 Keywords

Chickpeas, Desi, Kabuli, pulse, nitrogen fixation, rotation, breeding, northern farming systems.