

4.4 Irrigated Chickpeas – Best Practice Guide

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Key points

- Water required varies from 350 to 500 mm
- Chickpeas are particularly sensitive to waterlogging, particularly if irrigated when the soil has been allowed to crack open
- Planting into pre-irrigated fields can lead to poor crop establishment. Planting dry and watering up may be preferred to establish the crop.
- Field selection and fast watering practices are needed to minimise the risk of crop death through waterlogging.
- Scheduling irrigations when PAWC is at 40% depletion rather than using crop growth stage as the trigger minimises crop loss from waterlogging.
- Crops are most sensitive to waterlogging at full flower and late pod-fill.
- Attention to varietal choice, planting date, row spacing, and plant population are critical to achieving a profitable chickpea crop
- Implement an Integrated Disease Management program to manage serious disease risks – Phytophthora root rot, Ascochyta blight and Botrytis Grey Mould

Plant Water Use

A chickpea crop achieving maximum production will use between 350 and 500 mm of water depending on seasonal conditions.

The amount of water required to produce a chickpea is not a fixed value as temperature and relative humidity during the growing period, along with wind and soil moisture, all determine the rate of evaporation from the soil and transpiration from the plant (evapotranspiration or ET_c). The DAFF Queensland free on-line tool [CropWaterUse](#) can be used to examine the seasonal variability in crop water requirement for irrigated chickpea at your location.

Table 1 summarises the output from [CropWaterUse](#) used to estimate the irrigation needed to grow chickpeas at three locations Emerald (15 May planting date), Dalby and Narrabri (1 June planting date). The analysis assumes that the crop is fully-irrigated to target maximum yield. A 75% irrigation application efficiency and a 75mm irrigation trigger deficit are assumed. Results show a large variation in seasonal crop water demand, rainfall and irrigation demand between locations and season types.

Figure 4.4.1 shows the daily water use in chickpea which peaks during podding and seed development (R6 to R9).

The area of irrigated chickpea to plant is a function of chickpea price, available water and your planned irrigation strategy.

Irrigation Strategies

Full Irrigation

Table 4.4.2 summarises the impact of excessive and inadequate water on chickpea at different growth stages. Chickpeas are generally not fully irrigated because of the impact of even short term waterlogging on crop performance. This risk also interacts with soil type – the negative impact of waterlogging increases with increases in clay content. The losses are greatest on heavy black earths (with 70 to 80% clay) and least on medium grey clays (40 to 50% clay).

As the crop is more sensitive to waterlogging than winter cereals a different irrigation scheduling strategy is needed. This strategy also varies with the irrigation system used.

For furrow irrigation the key strategies are:

- Select fields with good layout and tail water drainage, enabling fast irrigation events (preferably less than 8 hours in duration)
- Use high volume beds or hills, with relatively good grades (avoid flat grades)

Table 4.4.1 Comparison of average water requirements for chickpeas planted on the 15 May at Emerald, and the 1 June at Dalby and Narrabri based on historical weather data (1957 to 2008)

Season Type	Narrabri			Dalby			Emerald		
	Dry	Ave	Wet	Dry	Ave	Wet	Dry	Ave	Wet
Crop ET _c (mm)	424	396	364	449	419	398	413	393	366
In-crop Rainfall (mm)	130	221	367	114	188	279	36	93	199
Irrigation Demand (ML/ha)	4.0	2.8	1.7	4.3	3.5	2.7	4.6	3.9	2.9
No. of Irrigations	4	3	2	4	3	3	4	4	3

- Pre-irrigation to fill the profile can lead to poor crop establishment due to soil smearing and crack formation along the planting line.
 - Watering up is used to successfully establish the crop in the optimum planting window. It does however run the risk of germinating a first flush of weeds along with the crop.
 - Do not allow the soil to dry out and form deep cracks. This cracking damages roots, providing an opportunity for soil borne diseases to infect during the irrigation event and causing additional stress on the crop.
 - On lower clay content soils, irrigate early, before soil cracking, and use more frequent irrigations.
- On higher clay content soils a quick watering prior to flowering (R1) to top up the profile, if needed, is recommended.
- Irrigation is not recommended once flowering has commenced.
 - Avoid saline or sodic soils as chickpeas are extremely sensitive to salinity and unable to access water and nutrients from saline layers in the soil. Saline and sodic layers in the top 90cm of soil will severely limit root development and water extraction.
 - Optimise furrow irrigation by watering every second furrow and doubling-up siphons where necessary
 - Do not irrigate if there is a likelihood of rain immediately following the irrigation event.

Figure 4.3.1 Average daily water use pattern for chickpea and critical growth stages

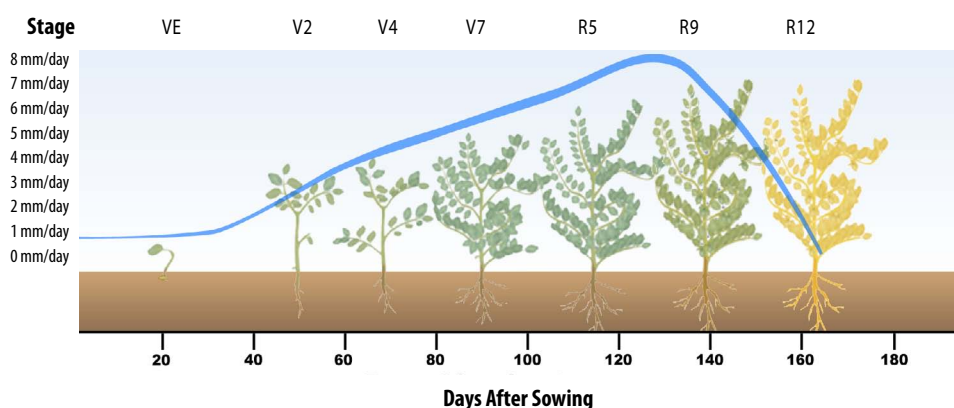


Chart for a 1 June planted crop at Dalby – daily water use values for hotter districts like Emerald would be 10 to 20% higher.

For sprinkler irrigation the risk of water logging is less significant as the amount and time of water application is better controlled. However, the risk of foliar fungal diseases such as ascochyta blight and botrytis grey mould is increased. It is important to apply recommended fungicides before irrigating with overhead sprinklers. LEPA systems may provide similar flexibility in timing and amount of water application without increased disease risk.

Daily water use varies throughout the season depending on weather conditions and stage of growth (see Figure 4.4.1). The crops ability to take up water increases as the canopy develops, peaking during the seed fill period (R8 and R9) – this coincides with warmer spring temperatures.

Irrigations can be scheduled based on soil moisture monitoring using one of the commercial soil moisture monitoring tools available. This equipment can tell you the rate of crop water use and the depth of water extraction.

This can be used to make irrigation scheduling decisions (bearing in mind the importance of minimising waterlogging with this crop and foliar disease implications).

Irrigation can also be scheduled based on estimation of crop ET_c from weather data. [Watersched2](#), a free online irrigation scheduling tool developed by DAFF Queensland is now available. This tool automatically downloads daily weather data from different locations in Queensland and New South Wales and, using farm-specific inputs, conducts a daily soil water balance and economic analysis to determine when and how much to irrigate.

Figure 4.4.2 is an example of the end of season report generated by [Watersched2](#) for an irrigated chickpea crop at Dalby in the 2009 season. This report summarises the water, crop and economic data for the crop. It provides the WUE indices for predicted and actual yield achieved. The graph at the bottom of the report shows the daily soil water depletion.

During the season this report provides the information needed to decide on the most appropriate irrigation scheduling strategy in response to crop water requirements, likely economic returns and whole farm water availability.

Limited Water Strategies

If there is a high probability of reduced water allocation and insufficient rainfall, then the yield target may need to be revised down, and supplementary irrigation strategies adopted. Supplementary irrigated crops are 'water limited' – there is not enough water available to fully irrigate the area to be sown. Growers faced with this situation have two main choices:

1. maximise production per hectare by growing an area that can be fully irrigated from the water available
2. grow the largest possible area possible where irrigation is only applied during the most critical growth stages.

Growers wanting to maximise productivity per ML of water will need to strike a balance between these options based on their local conditions and climatic forecasts. Growing a smaller, fully irrigated area of crop may limit the potential upside but avoids the extra costs associated with growing a larger area. On the other hand, yield may be poor if a larger area is planted and seasonal conditions are not favourable.

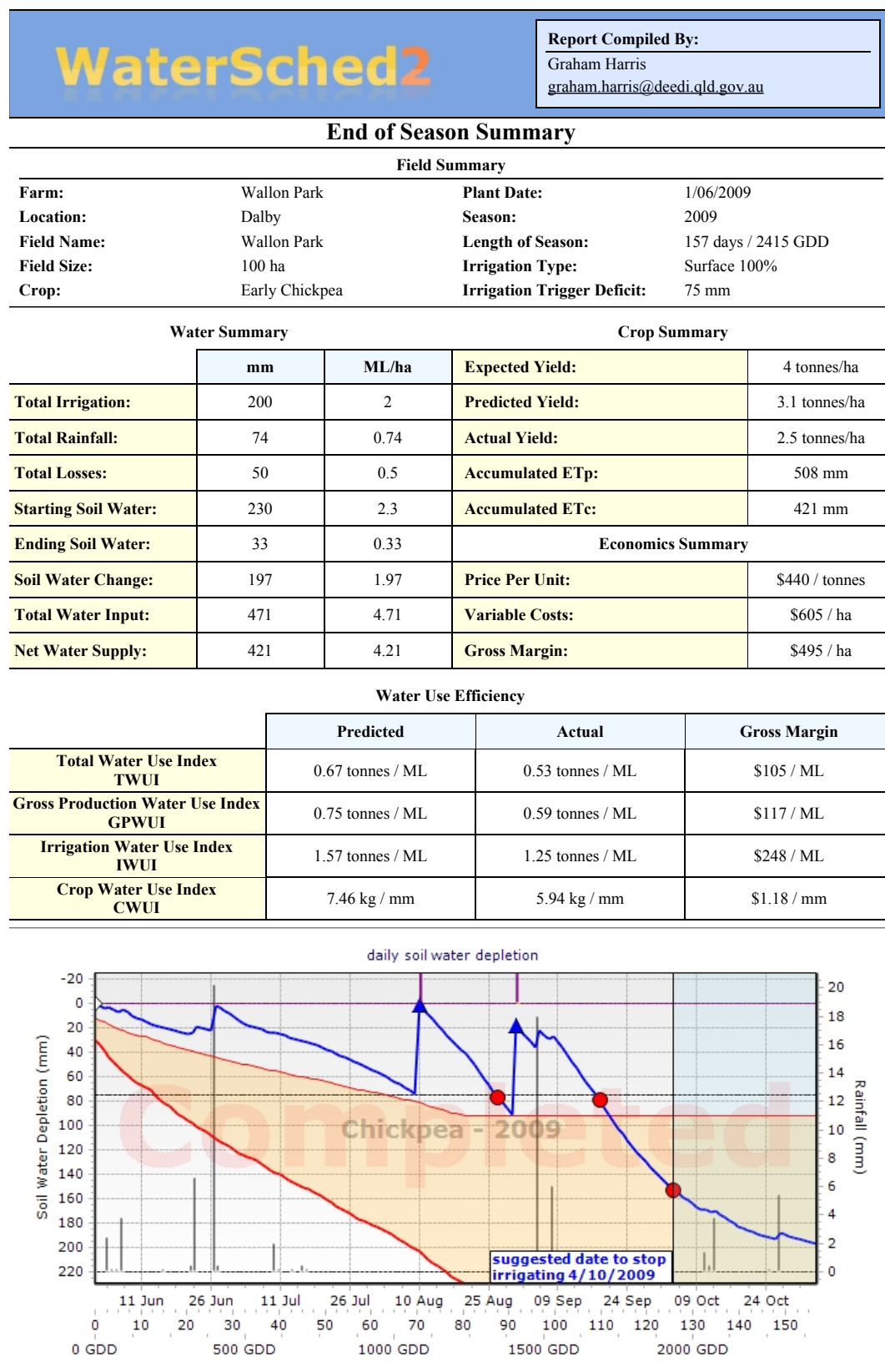
With chickpeas, the first option is preferred given its susceptibility to waterlogging under moisture stress. Ideally chickpeas should be irrigated when the deficit is 30 to 40% of PAWC in the root zone (before significant soil cracking is observed).

If the second option is to be implemented it is best to pre-irrigate a larger area and grow the crop as raingrown.

Table 4.4.2 Critical water management considerations by growth stage for chickpea

Stage	Stage Length (Days) ¹	Description	Water Management Consideration
VG	7 to 15	Germination	Adequate soil moisture essential to establish desired plant population. Soil smearing and subsequent crack formation reduce establishment if planted with disc-openers in too wet a seedbed. Do not allow the soil to dry below 50% of plant available water content (PAWC). Beyond this the soil will crack open, damaging the root system and leading to plant death if irrigated at this time. Better to apply irrigation with depletion at around 40% PAWC to prevent soil cracking. Do not irrigate before rainfall events and use best management irrigation practices. Apply fungicides before irrigating with sprinkler irrigation.
VE	40 to 80	Emergence – seedling emerges	
V1		First Node – 1st multifoliate leaf at first node fully unfolded	
V2		Second Node – 1st multifoliate leaf at second node fully unfolded	
V3		Third node – 1st multifoliate leaf at third node fully unfolded	
V(n)		nth node – 1st multifoliate leaf at nth node fully unfolded	
R1	20 to 30	Start flowering – one flower bud at any node on the main stem	Continue to irrigate at around 40% depletion of PAWC rather than using plant growth stage as an irrigation trigger. Do not irrigate when the crop is fully flowering and soil cracks are present as crop death will result.
R2		Calyx opening – bud grows but is still sterile, sepals begin to form	
R3		Anthesis – pollination occurs before bud opens	
R4		Wings extend – flower petals extend to form flower	
R5		Flower Collapses	
R6	10 to 15	Pod initiation – one pod found in any nod on the main stem	Continue to irrigate at around 40% depletion of PAWC rather than using plant growth stage as an irrigation trigger. Do not irrigate in late pod fill – chickpeas are especially sensitive to waterlogging at this time.
R7		Full pod – one fully expanded pod present	
R8	10 to 15	Beginning seed – one fully expanded pod in which seed cotyledon growth is visible	Irrigate when soil water depletion is around 30 to 40% of PAWC – this is more important than basing irrigation on crop growth stage.
R9		Full seed – one pod on the main stem filled by seeds when fresh	
R10	20 to 30	Beginning maturity – one pod on the main stem turns to a light golden yellow colour	Irrigation should not be required beyond this stage.
R11		50% of pods golden yellow	
R12		90% of pods golden yellow	

Figure 4.4.2 WaterSched2 End of Season Field Summary report for an irrigated chickpea crop at Dalby in the 2009 season



Agronomy

To achieve high irrigated yields it is necessary to follow good agronomic practices. High yielding crops use water more efficiently than lower yielding crops.

Variety Choice

Choice of variety is based on yield potential and adaptation for specific locations, disease resistance, maturity, plant height and lodging potential, and suitability for target market.

For irrigated chickpeas choose varieties with the highest possible Phytophthora root rot resistance. This is critical on soils with the highest clay contents.

Choose a variety with the highest possible Ascochyta blight resistance. This is very important where sprinkler irrigation is applied.

There is also some variation in the level of salt tolerance amongst chickpea varieties. They should not be planted where the soil chloride is in excess of 800 mg/kg within the top 60 cm of the root zone. If salt is a risk choose varieties with the highest salt tolerance.

Planting Date

If the average daily temperature falls below 15°C chickpea flowers will abort.

Choice of sowing date is a trade-off between sowing early with high yield potential in years with a warmer spring versus lower yield potentials with delayed sowing to ensure flowering occurs in temperatures closer to 15°C in cooler springs.

If sown too early the crop will grow vegetatively and use soil water, reducing water productivity. Choose the most appropriate sowing window for your variety and location.

Row spacing

Row spacings of 18 cm to 100 cm are used. The choice is largely determined by available planting equipment, the existing field layout and tillage practices (whether zero-tilled or cultivated).

Where the yield potential is less than 1.5 t/ha, row spacings out to 100 cm have little impact on yield potential. However, where the yield potential is above 1.5 t/ha the wider row spacings give a yield reduction of 10 to 15% and increase the risk of lodging.

Plant population

Yields are generally stable within the range of 20 to 40 plants per square metre.

A target of 25 to 30 plants per square metre should be used. Where wide row spacings are used (100 cm) a population of 20 plants per square metre should be used – in this situation a higher plant population result in thin main stems and increased lodging risk.

The higher populations should be used where planting late in the planting window.

Disease Management

Disease management is critical in chickpea. In irrigated situations Phytophthora root rot can be particularly devastating. Paddock and varietal selection are critical to managing this disease. Only use varieties with the highest possible resistance, and select paddocks which are well drained, can be watered quickly and ideally have not grown chickpeas for at least two years.

Ascochyta blight and Botrytis grey mould are also very significant diseases in chickpeas. Use seed treated with fungicides for these diseases. For Ascochyta, spray with a registered fungicide before the first post-emergent rain event (or sprinkler irrigation) and again before the second post-emergent rain event (or sprinkler irrigation).

Botrytis grey mould (BGM) is particularly severe during wet spring conditions, when a combination of canopy closure, frequent rainfall (or sprinkler irrigation events) and overcast conditions results in prolonged periods of plant wetness. In conditions favouring the disease a preventative spray of a registered fungicide immediately prior to canopy closure, followed by a second application two weeks later will assist in minimising BGM development.

For more detail on disease management refer to the Northern Pulse Bulletins in the further reading section.

Further Reading

- Cumming, G. 2011 Certified Chickpea Agronomy Course 2011, Pulse Australia
- Moore et al 2011 [Chickpea: Ascochyta Blight Management](#), Northern Pulse Bulletin, Pulse Australia
- Moore et al 2011 [Chickpea: Phytophthora Root Rot Management](#), Northern Pulse Bulletin, Pulse Australia
- Ryley et al 2011 [Chickpea: Integrated Disease Management](#), Northern Pulse Bulletin, Pulse Australia
- Ryley et al 2011 [Chickpea: Botrytis Grey Mould Management](#), Northern Pulse Bulletin, Pulse Australia
- Slatter, J. and Lucy, M. 2002 [Fine-tuning irrigation management of chickpeas](#), Australian Cottongrower, 23(3): 42-43