Onion information kit

Reprint – information current in 1997

REPRINT INFORMATION – PLEASE READ!

For updated information please call 13 25 23 or visit the website www.deedi.qld.gov.au

This publication has been reprinted as a digital book without any changes to the content published in 1997. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research:

- Chemical recommendations—check with an agronomist or Infopest www.infopest.qld.gov.au
- Financial information—costs and returns listed in this publication are out of date. Please contact an adviser or industry body to assist with identifying more current figures.
- Varieties—new varieties are likely to be available and some older varieties may no longer be recommended. Check with an agronomist, call the Business Information Centre on 13 25 23, visit our website www.deedi.qld.gov.au or contact the industry body.
- Contacts—many of the contact details may have changed and there could be several new contacts available. The industry organisation may be able to assist you to find the information or services you require.
- Organisation names—most government agencies referred to in this publication have had name changes. Contact the Business Information Centre on 13 25 23 or the industry organisation to find out the current name and contact details for these agencies.
- Additional information—many other sources of information are now available for each crop. Contact an agronomist, Business Information Centre on 13 25 23 or the industry organisation for other suggested reading.

Even with these limitations we believe this information kit provides important and valuable information for intending and existing growers.

This publication was last revised in 1997. The information is not current and the accuracy of the information cannot be guaranteed by the State of Queensland.

This information has been made available to assist users to identify issues involved in onion production. This information is not to be used or relied upon by users for any purpose which may expose the user or any other person to loss or damage. Users should conduct their own inquiries and rely on their own independent professional advice.

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in this publication.

Queensland Government

Growing THE CROP

This section is our recipe for growing and marketing a commercial crop of onions for the fresh market. To keep the section as brief as possible and easy to follow, little explanation is provided with recommendations. Where more information may help, reference is made to other sections of the kit. Symbols on the left of the page will help you make these links.

The onion plant

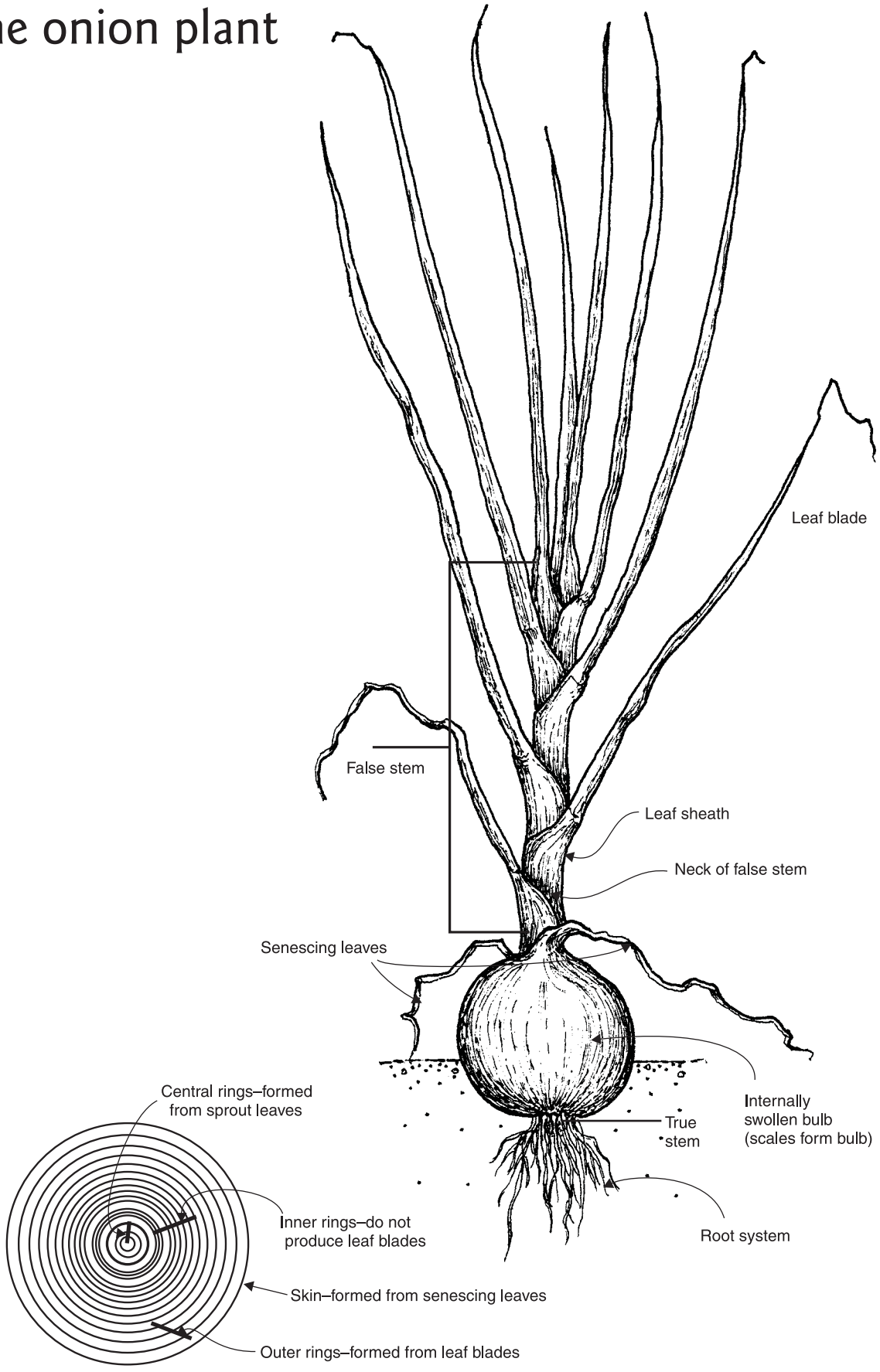


Figure 1. *Parts of the onion plant*

Getting the crop started

To give yourself the best chance of success with onions, start planning your choice of varieties and land preparation at least four months before planting. This involves 12 key steps.

Select your varieties

The choice of variety for a particular planting date is critical because bulb formation is sensitive to temperature and daylength (the number of hours of daylight).

If, for example, a mid-season variety such as Gladalan is planted out of season in February or March the crop bolts and produces mainly seed stems and some picklers (small onions).

Varieties such as South Australian White Globe or Cream Gold from southern states do not produce bulbs if planted during Queensland's normal onion season. They may produce a poor crop if planted in August or September, but the weather at harvest is unfavourable and competition from other areas high.

Queensland onions are mainly salad-type onions. To produce a satisfactory crop, each variety requires a specific planting time and, conversely, each planting time needs a specific variety. In the Lockyer and Callide Valleys, planting starts in February or March.

The planting period which results in the highest proportion of seed stems is late March to mid April. The exact period varies from year to year with temperature variations but falls roughly in this period. Lockyer onion growers usually avoid early April and plant towards the end of that month.

Table 1 lists the varieties commonly grown and their planting times in the Lockyer Valley, the major production area. Planting times in other areas may vary slightly.

Standard varieties

The Early Lockyer (white and brown) and Gladalan varieties (white and brown) are salad-type onions. They are harvested at a relatively immature stage, tend to be soft, and have a short shelf life. The Golden Brown is a much firmer onion. It is harvested at the same stage and has better keeping qualities than the other recommended varieties. Golden Brown is preferred for the export and Western Australian trade. It should not be confused with the southern Cream Gold as they are different varieties. The Golden Brown is a local selection derived from Early Lockyer Brown. Gladiator is also exported. White onions are too soft for the export market.

Early strains of Gladalan White and Brown have been developed at Gatton Research Station for March/April planting. The Gladalan variety is more tolerant of downy mildew than other mid-season varieties.

Spring onions

Spring onions grown in Queensland are usually strains of Early Lockyer White onions picked when immature.

Pickling onions

Pickling onions are white or brown onions planted close together. The bulbs stay small and are harvested when mature. The most commonly planted varieties are strains of Early Lockyer White or Golden Brown.

Red onions

There is a small market for red onions, the main variety being Red Rojo. Red onions are planted in early May to June. Contact the seed

companies for further information on red onions.

Table 1. *Onion varieties grown in the Lockyer Valley*

Variety	Seed source	Plant	Harvest	Notes
Early Lockyer White	Local	Late February and March	Early July to late August	Some variation in performance of local selections.
Early Lockyer Brown	Local	Late February and March	Early July to late August	Gatton Research Station selection Barton Brown released in 1994.
Early Lockyer White	Commercial	Mid March to early April	Late July to early September	Out-yields local selections in these later plantings.
Golden Brown	Local and commercial	March to early May	Late August to October	Selection from early Lockyer Brown. Milder flavour than Early Lockyer White. Has been exported.
Lockyer Gold	Commercial	Late March to May	September to October	Golden Brown selection.
Lockrose White	Commercial	Late April to early May	Late September to October.	Good appearance but does not store well
Snowball	Commercial	Late April to late May	Late September to early November	White hybrid. Good appearance but does not store well.
Diamond White	Commercial	Early May to June	Late October to November	White hybrid. Good late season onion, resists greening.
Omega	Commercial	Early May to June	Late October to November	Brown hybrid. Sweet onion with mild flavour, good size and reasonable storage.
Red Rojo	Commercial	Early May to June	November to mid December	Bright red skin, develops internal red rings.
Wallon White	Local and commercial	Late April to late May	Late October to November	Gatton Research Station early selection within Gladalan White.
Wallon Brown	Local and commercial	Late April to late May	Late October to November	Gatton Research Station early selection within Gladalan Brown.
Centurion	Commercial	Late May to June	November to mid December	Brown hybrid. Uniform good quality firm bulbs that retain skins well in storage.
Gladiator	Commercial	Late May to June	November to mid December	Brown hybrid. Similar to Centurion in appearance and storage. Has been exported.
Gladalan Brown	Commercial	Late May to June	November to mid December	Salad-type onion that does not store well but has some tolerance of downy mildew.
Gladalan White	Commercial	Late May to June	November to mid December	Similar qualities to those of Gladalan Brown.

Order seed

Seed for early plantings is grown by Lockyer Valley seed growers. Seed for subsequent plantings is available from several seed companies through commercial outlets. Some varieties for later plantings are also available from Lockyer Valley seed growers. Check seed supplies six to eight weeks before planting as sometimes there are problems with seed production. Ordering seed early gives you the best chance of getting the varieties you want when you want them.

Seed suppliers
Section 6 page 4

Calculating the number of plants per hectare

For single row plantings

To calculate how many plants you will need per planted hectare (excluding headlands), first calculate the metres of row per hectare.

Step 1 $\frac{10\,000\ (m^2/ha)}{\text{distance between rows (m)}}$ = metres of row per hectare (m/ha)

Then calculate the number of plants per hectare.

Step 2 $\frac{\text{metres of row per hectare (m/ha)}}{\text{distance between plants (m)}}$ = plants per hectare

For example: How many plants do you need per hectare for a crop with rows 30 cm apart and plants 75 mm apart?

Step 1 $\frac{10\,000\ m^2/ha}{0.3\ m}$ = 33 330 metres of row per hectare

Step 2 $\frac{33\,330\ m/ha}{0.075\ m}$ = 444 400 plants per hectare

For paired rows

To calculate how many plants you will need per planted hectare (excluding headlands), first calculate the average row spacing.

Step 1

$\frac{\text{distance from centre to centre of beds (m)}}{\text{number of rows on the bed}}$ = average row spacing

Then calculate the number of plants per hectare.

Step 2

$\frac{10\,000\ (m^2/ha)}{\text{distance between rows (m)}}$ = metres of row per hectare

Then calculate the number of plants per hectare.

Step 3

$\frac{\text{metres of row per hectare (m/ha)}}{\text{distance between plants (m)}}$ = plant positions per hectare

For example: How many plants will you need at 1800 mm (1.8 m) bed centres with four pairs of rows per bed (eight rows) and 100 mm (0.1 m) between plants?

Step 1 $\frac{1800\ \text{mm}}{8}$ = 225 mm average row spacing

Step 2 $\frac{10\,000\ \text{m}^2/\text{ha}}{0.225\ \text{m}}$ = 44 440 metres of row per hectare

Step 3 $\frac{44\,440\ \text{m/ha}}{0.1\ \text{m}}$ = 444 400 plants per hectare

Develop an irrigation plan and choose equipment

Irrigation management
Section 4 page 22

Consult an irrigation equipment supplier or designer in your area and get them to develop an irrigation plan. Onions require overhead sprinklers for best plant establishment. These can then be used to water the plants throughout the season. Use single knocker, impact sprinklers on short risers to allow spray machinery to pass overhead.

Trickle irrigation is an alternative way to water the plants once they are established. Trickle watering has some advantages over sprinkler watering. It can use less water, reduce leaf diseases and can be used to apply soluble fertilisers directly into the plant root zone. Use a trickle tube with outlets no more than 20 cm apart. Trickle irrigation requires more management and reguar maintenance during the growing period.

Water quality

Onions have a high tolerance of salinity after seedling establishment. Test your irrigation water. Conductivity should preferably be less than 1200 microSiemens per centimetre (mS/cm) but levels of up to 1800 mS/cm can be tolerated after seedling establishment.

Prepare the land

Wind damage

Wind damage is not a problem with onions, so wind protection is not necessary.

Soil erosion

Land conservation advice
Section 6 page 7

Uncontrolled runoff water removes valuable topsoil while the land is being prepared. Where slopes used are greater than 5%, plan the

farm layout to prevent erosion and allow efficient irrigation and use of equipment. Avoid using slopes greater than 10%.

Laser levelling improves water management and avoids low spots, which increase disease risk. Land conservation extension officers from the Department of Natural Resources provide free on-site advice on farm layout.

Test the soil

Test your soil before planting to determine pH and a fertiliser strategy. Onions grow best in a pH range of 5.5 to 7.5. They do not tolerate acid soils and grow poorly in very alkaline soils (pH greater than 8.0). Remember that a pH of 5 is 10 times more acid than a pH of 6.

Crop rotations

To prevent the build-up of pests and disease, onions are grown in rotation with a wide range of fresh and processing vegetables as well as lucerne, grain legumes and oilseeds. Crops recommended in direct rotation with onions are potatoes, beetroot, beans and soybeans. Do not plant onions after cereal crops such as maize, sorghum, wheat and barley because they are alternative hosts of pink root disease.

It was common practice to grow several crops of onions on the same ground, mainly because of better weed control. This practice has stopped with improved chemical weed control.

A guide to seedbed preparation

Onions need a finely worked seedbed 2 to 3 cm deep over a firm base. The land preparation necessary depends on soil type and the preceding crop. In tight soils an initial ripping or ploughing may be necessary, followed by several discings, and a final rotary hoeing and harrowing down. Less working is required on more friable soils, particularly following vegetable crops. Table 2 shows the ideal land preparation schedule for a March-planted crop.

Table 2. *A land preparation schedule for a March-planted crop*

Timing	Action
November	Cultivate soil following harvest of the previous crop.
mid December/January	Cultivate to control weeds.
Late January	Sample soil for nutrient analysis
early February	Apply and incorporate fertilisers according to soil nutrient analysis results. Final working of soil and bed forming.
late February	Control weeds on beds with a contact herbicide.

Here are details on some steps in Table 2.

- **Initial cultivation (November).** If your land is under grass or a previous crop, first plough it with a disc or mouldboard plough. If the land has been previously cultivated, deep ripping is also recommended.

- **Soil nutrient analysis (late January).** Buy a soil sampling kit from your local farm supply outlet. Follow the sampling instructions and send the sample away for analysis. Results should be back in about two weeks and will be interpreted by the laboratory analysing your sample.
- **Final land preparation (January to early February).** The soil must be worked up to a fine tilth to allow bed forming in early February. This is be done by cultivating with a rotary hoe or power harrows.

Nutrition
Section 4 page 19

Apply fertiliser

The onion crop has a high requirement for nutrients. Discuss the results of your soil analysis with your farm supply agent and work out how much fertiliser is needed. Broadcast these fertilisers over the cultivated land and incorporate with a rotary hoe or power harrows to a depth of 20 cm. If no soil test was done, or results are not available, a basal application of 250 to 300 kg/ha of a complete fertiliser containing major and trace elements is recommended. If in doubt, consult your local reseller. Fertiliser can still be applied up to the third true leaf stage.

Trace elements

In the Lockyer Valley onion growth has improved after applications of zinc and manganese on heavy soils with a pH 8 to 9. There has also been some response to sulphur, particularly when applied as sulphate of ammonia on these high pH soils.

Zinc. Apply to the soil at least three weeks before planting, at 30 kg/ ha of zinc sulphate monohydrate.

Manganese. Apply to the soil as manganese sulphate at 20 to 30 kg/ ha.

Soil nutrient levels must be right at this stage because it is difficult to correct deficiencies of phosphorus, calcium, manganese and zinc after planting.

Form the beds

Grow onions on beds to improve drainage and avoid planting delays. Beds are formed with a bed-shaper during final land preparation. They are of variable widths and heights according to wheel spacing, planting machinery and soil types. Prepare beds well before planting to allow for settling. Do not plant closer than 150 mm from the edge of the bed.

Seed treatment
Problem solver handy guide

Seed treatment

Seedling diseases are not usually a problem.

Seed grading

Commercial seed is graded by size to suit the older, belt type planters such as the Stanhay. Pelleting of seed is an option to improve planting efficiency.

Plant the seed

Onion seed is sown with precision belt planters (for example Stanhay) or with air planters (for example Nodet). To obtain paired rows, a special foot can be used to split or divide the seed as it drops from the planting tube.

Seed

Mature onion seed is black and angular. Each kilogram of seed usually contains 280 000 to 320 000 seeds, but this number can vary. Within varieties there is a considerable variation in seed size depending on the source. Seed grading would be an advantage, particularly when using precision or air planters.

A field germination of 80% is satisfactory for onions. The germination capacity of onion seed can deteriorate rapidly during storage and should be tested before use.

Plant densities

A uniform plant stand is required to produce bulbs of similar shape and size. In the Lockyer Valley, a density of 40 plants/m^2 (400 000 plants per hectare) is recommended. For example at 30 cm row spacing this equals one plant per 75 mm of row. Depending on germination percentage and seed size, about 2 kg/ha of seed is needed to achieve this density.

Row width

Row width depends on the planter used. The most common planting system is high density paired rows planted 75 mm apart with 25 to 30 cm between each pair. There are usually three or four pairs of rows pr bed (Figure 2). Single rows are normally 25 to 30 cm apart. High density single rows are planted 15 to 20 cm apart.

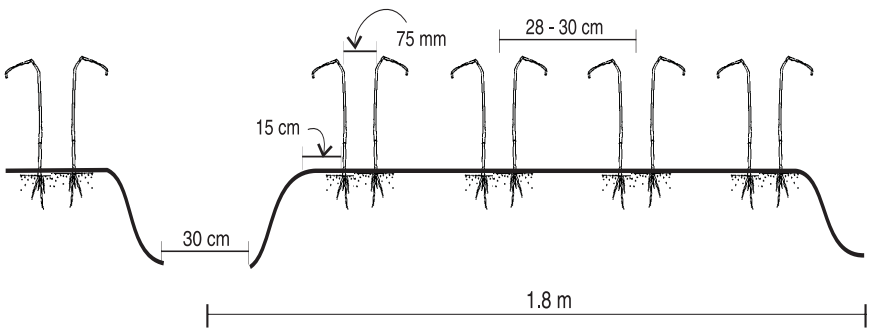


Figure 2. *High density paired rows on beds*

Plant spacing

Whichever row width system is used, plants in each row should be 75 to 100 mm apart to produce uniform bulbs.

Planting depth

Chemicals in the *Problem solver handy guide*

Plant seed 12 to 15 mm deep, but no deeper than 20 mm. Seed planted too deep will germinate poorly and the crop will be patchy.

Apply white rot treatment

Management of white rot Section 4 page 29

Fungicides are the best method of controlling onion white rot. Spray to control white rot.

Spray a 15 to 20 cm wide band over the row after planting. Use a fan nozzle to apply as high a rate of water as possible. Some growers set up a boom spray behind the planter to ensure good coverage over the row. This is the most effective and efficient method of application. Irrigate after planting so that the fungicide leaches through the soil to the seed.

Control weeds

Pre-emergent herbicide

A pre-emergent herbicide can be applied by boom spray immediately after planting and irrigated into the soil. The spray equipment can be attached behind the planter so that seeding and spraying is a single operation. Table 3 lists pre-emergent herbicides that can be used to control weeds in onions.

Table 3. *Pre-emergent herbicides to control weeds in onions*

Chemical	Product	Rate /ha
chlorthal-dimethyl	Dacthal	6 – 15 kg
chlorthal-dimethyl + propachlor	Prothal	14 – 18 kg
propachlor	Ramrod	12 L

Control early weeds

Irrigation management Section 4 page 22

Where weeds have emerged but onions will not emerge for at least three days, spray paraquat or diquat, or a mixture of both chemicals, either in place of pre-emergent herbicides or in addition to them.

Irrigate

Apply an overhead irrigation of 12 to 25 mm immediately after planting. This irrigation mst be sufficient to leach th white rot fungicide through the soil to the seed and to incorporate the pre-emergent herbicide into the soil.

Looking after the crop: planting to third true leaf

The onion plant grows slowly and competes poorly against weeds. It is highly sensitive to moisture stress. The plant has a limited root system, so correct fertiliser placement and irrigation management are important. This growth stage usually takes up to 37 days. Figure 3 shows these stages. There are three important things to do.

more info

A guide of things to do: *Crop production handy guide*

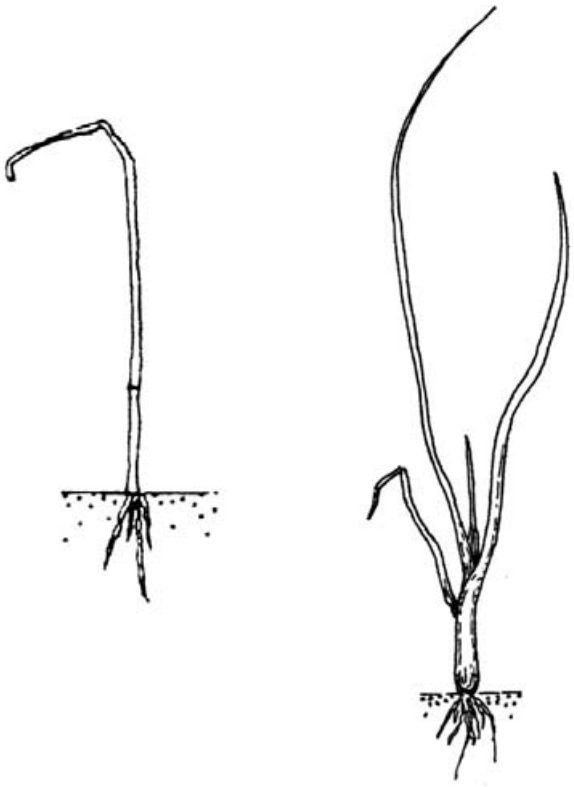


Figure 3. *Hook leaf (left) and third true leaf stage of onions*

Planting to third true leaf

Irrigate to maintain soil moisture

Keep the soil moist until the crop is fully emerged. Low volume solid set irrigation is ideal for onion production due to the plant's demand for frequent light irrigations in the early growth stages.

Quantity

About 3 to 4 ML/ha of water should be available. An irrigation of 12 to 25 mm is recommended immediately after planting, white rot treatment and the application of pre-emergent herbicide. Seedlings usually emerge within eight to 10 days.

The frequency and timing of irrigation after seedling emergence depend on the weather, but the plant must not be allowed to suffer from lack of soil moisture. Frequent light irrigations, about 15 mm, every five to seven days, may be necessary to promote emergence of seedlings, even growth and prevent soil crusting. Do not allow the soil to dry out and crust until onions are fully emerged. Over watering can result in damping-off of the delicate young seedlings.

Water quality

Onions have a high tolerance of salinity after seedling establishment. Water conductivity should preferably be less than 1200 mS/cm but levels of up to 1800 mS/cm can be tolerated after seedling establishment.

Manage pests and diseases

more info
Pest and disease problems: Section 5 *Problem solver*

Serious pests and diseases are likely at some stage of your crop. Learn as much as possible about these pests and diseases and their recommended management.

Diseases such as downy mildew require regular spraying, up to every ten days, for the life of the crop. Spray applications will be more frequent in wet weather and less frequent in dry conditions.

Insect pests may not need regular spraying. Plants can tolerate small numbers of these pests without significantly affecting yield or quality. In these cases, the cost of spraying is much greater than the benefit gained by controlling the insects. Make sure that insect levels are high enough to warrant spraying. This check will save you money and reduce the risk of spray burn and chemical residues in the environment. Recording insect pest numbers is called pest monitoring. This involves inspecting the crop once every week and recording pest numbers. When these numbers reach levels which cause economic damage, use a pesticide.

Planting to third true leaf

Monitoring for pests and diseases

You have two options for monitoring for pests and diseases.

- The best option is to engage the services of a competent consultant to do the monitoring for you.
- The next best option is to do the monitoring yourself. If you do this, first seek professional assistance and some training from a consultant before you start.

Names of horticultural consultants
Section 6 page 6

Application of chemicals

Most chemicals are applied as sprays. An engine powered sprayer, such as a hydraulic sprayer, air blast sprayer or controlled droplet applicator, is recommended.

Do not apply herbicides with your main pest and disease sprayer. This avoids the risk of herbicide residues in the sprayer causing crop damage.

Where to get this book
Section 6 page 12

A good understanding of the principles of spray application is desirable. This helps you improve your spray efficiency and minimise spray drift. Read DPI's *Pesticide application manual* for an understanding of spray applications.

Care with chemicals

Only use chemicals registered for onions. Read the label carefully and use the product only as directed. Always wear the recommended protective clothing as detailed on the product label.

Insect pests

Check your crop regularly during the first few weeks for cutworm and armyworm damage. Look for missing sections of row. If plants are damaged, spray late in the afternoon with a chemical from the *Problem solver handy guide*. Spray after the day's watering has been completed and the plants have dried. This treatment should also reduce damage by armyworms.

Onion thrips are the most important insect pest of onions. These insects attack the leaves, leaving white flecks where they have been feeding. Heavy populations can adversely affect the crop. If thrips can be easily found in the leaf axil, control by spraying with a chemical from the *Problem solver handy guide*.

Diseases

Diseases: causes and solutions Section 5 *Problem solver*

Disease management is the most difficult aspect of growing onions. Serious diseases are likely at some stage in the life of the crop. How well you manage these diseases will determine your success in onion production.

Planting to third true leaf

The main diseases of onions are downy mildew, white rot, fusarium wilt and pink root. Other diseases such as neck rot and purple blotch can be a problem in some years. Rust has only been identified in onions that were not commercially grown.

Control grass weeds

Apply a herbicide to control grasses. Table 4 lists chemicals registered to control grass weeds in onions.

Table 4. *Herbicides to control emerged grasses in onions*

Chemical	Product	Rae per	
		ha	10 L (spotspray)
fluazifop-P	Fusilade	0.5 – 1.5 L	12.5 – 100 mL
quizalofop-P-ethyl	Targa	125 mL – 1 L	
sethoxydim	Sertin 186 EC	1 L + 1 – 2 L crop oil	
	Sertin Plus	1.6 L	

Looking after the crop: third true leaf to bulbing

Bulbing is the stage when the bulb is twice the diameter of the stem. This stage takes about 55 days. Figure 4 shows these stages. There are four important things to do.

more info

A guide of things to do: *Crop production handy guide*

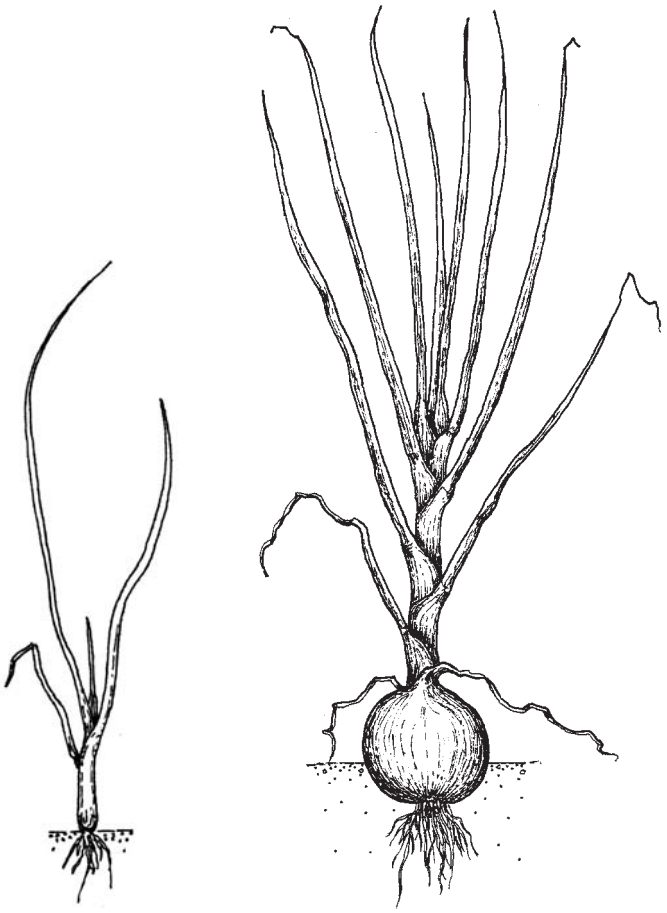


Figure 4. *Third true leaf stage (left) and bulbing (seventh or eighth leaf)*

Third true leaf to bulbing

Control weeds

Cultivation

Onions are normally grown on land prepared to reduce weed population to a minimum. With the advent of effective pre-emergent and post-emergent herbicides, mechanical cultivation of the emerged onion crop is seldom necessary. A quick hand chipping may be necessary to eradicate the odd hard-to-kill weed. Special small onion chipping hoes are used.

Small 'onion' tractors fitted with mid-mounted blade or knife-type cultivators were used but are seldom seen in today's onion fields.

Herbicides

Post-emergence

Post-emergent herbicides used to control broad leafed weeds are listed in Table 5. Ioxynil can be applied only after the onions have grown out of the hook leaf stage and reached the third to fourth true leaf stage. Fusilade, Sertin and Targa control grasses only. Rates for these products are shown in Table 4 on page 15.

Table 5. *Post-emergent herbicides to control emerged weeds*

Chemical	Product	Rate / ha
ioxynil	Totril	2.1 – 2.8 L
	Unyunox	2 – 3 L
linuron	Afalon	300 – 550 g
	Afalon Flowable	330 – 600 mL
	Linuron DF	300 – 550 g
	Linurex Flowable	330 – 600 mL

Manage pests and diseases

Forecasting for downy mildew
Section 4 page 31

Insect pests

Monitor for and control onion thrips. Control by spraying with a chemical from the *Problem solver handy guide*.

Diseases

Diseases that may develop at this stage are downy mildew, white rot. and fusarium wilt. Other diseases such as neck rot and purple blotch can be a problem in some years.

In mid June spray to control white rot with a chemical from the *Problem solver handy guide*. The spray should be directed in a band at the base of the plant and repeated every four weeks.

Downy mildew and purple blotch can be controlled by a fungicide spray from the *Problem solver handy guide*.

Third true leaf to bulbing

Downy mildew can quickly become resistant to chemicals that once controlled it. To delay this resistance as long as possible, use the following strategy.

1. Ensure that spray equipment is calibrated and in good working condition.
2. Use a protectant fungicide, for example mancozeb, propineb etc., at seven to 10 day intervals.
3. If weather is favourable for downy mildew, that is long dew periods or showers, replace the protectant fungicide with a combined systemic/protectant, for example Acrobat MZ, for the next two applications. To get systemic action add an oil adjuvant, for example Synertrol or Codacide.
4. Return to a regular program of protectant sprays.
5. When systemic fungicides from different groups are available, alternate these in step 3.

Chemicals registered to control diseases in onions are listed in the *Problem solver handy guide*.

Monitor plant nutrients and fertilise

The onion crop has a high nitrogen and potassium requirement and a moderate phosphorus requirement. A crop that yields 30 t/ha removes about 80 kg of nitrogen, 18 kg of phosphorus and 100 kg of potassium from the soil.

Plant nutrient monitoring

On alkaline soils with a pH above 7, start monitoring just as the plants reach the third leaf stage. Contact your local rural supply outlet or consultant to get a sample to be taken. Your results will be interpreted by the laboratory analysing your sample. The desired leaf nutrient levels for onions are shown in Table 6. The aim is to apply fertilisers to get nutrient levels within these ranges at the time of bulbing.

Table 6. *Desired leaf nutrient levels (based on dry weight) of the youngest mature leaf at mid growth (about sixth true leaf stage)*

Nutrient	Normal level
Nitrogen (N)	2.5 – 4.0%
Phosphorus (P)	0.25 – 0.4%
Potassium (K)	2.5 – 5.0%
Calcium (Ca)	1.5 – 3.0%
Magnesium (Mg)	0.3 – 0.5%
Sulphur (S)	0.5 – 1.0%
Sodium (Na)	0.0 – 0.4%
Chloride (Cl)	0.0 – 1.5%
Copper (Cu)	6 – 20 ppm
Zinc (Zn)	25 – 100 ppm
Manganese (Mn)	30 – 300 ppm
Iron (Fe)	60 – 300 ppm
Boron (Bo)	25 – 50 ppm

Source: R. G. Weir and G. C. Cresswell, NSW Agriculture.

Nutrition
Section 4 page 19

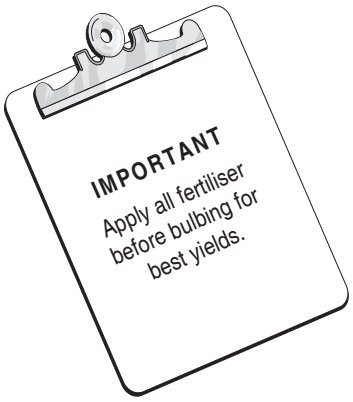
Third true leaf to bulbing

Fertiliser recommendations

All fertiliser should be applied before bulbing. Additional nitrogen may be beneficial if the crop has been setback due to heavy rain resulting in leaching or disease. Fertiliser applications should be based on a soil test or leaf analysis. The following suggestions are included as a guide if no test is available.

On alluvial soils, nitrogen is supplied mainly as urea or sulphate of ammonia but nitram is also used. Apply the first dressing at the third leaf stage. Each application should not exceed 50 kg of nitrogen per hectare (5 g/m^2). The total amount of nitrogen applied varies from 30 to 130 kg/ha depending on previous cropping and fertiliser practices. Apply one to three equal applications just before irrigation. Spin onto the growing crop at two to three week intervals for three applications and a little longer if two applications are made.

On less fertile soils, nitrogen, phosphorus, potassium (N:P:K) fertiliser mixtures such as 13:2:13 or 15:4:11 may be applied at this stage at 250 to 700 kg/ha (25 to 70 g/m^2), preferably spun onto the emerged crop before irrigation. Nitrogen side dressings are often required.



Fertilising through the irrigation water (fertigation)

Fertigation has advantages over the manual application of solid fertilisers. It uses less labour, fertilisers can be applied closer to the plant roots with a trickle system and it is convenient—fertilisers can be applied more regularly.

With fertigation, fertiliser is dissolved in water in a drum or tank and sucked or injected through the watering system. Fertilisers used must be highly soluble to avoid pump damage and pipe blockages. Some suitable fertilisers are listed in Table 7.

Fertigation rates should be based on leaf analysis. You can fertigate every time you water but once a week is sufficient and most practical. All fertiliser should be applied by bulbing. Before you start fertigating, get a water testing laboratory to fully analyse your irrigation water. Make sure an iron test is included if using trickle irrigation. Seek professional advice from an experienced irrigation designer when planning the system.

Table 7. *Soluble fertilisers for fertigation*

Fertiliser	Main nutrients supplied
Urea	Nitrogen (N)
Calcium nitrate	Nitrogen (N), Calcium (Ca)
Potassium nitrate	Potassium (K), Nitrogen (N)
Potassium chloride	Potassium (K)
MAP (technical grade)	Phosphorus (P), Nitrogen (N)
MKP (mono potassium phosphate)	Phosphorus (P), Potassium (K)

Third true leaf to bulbing

Trace elements

In the Lockyer Valley plant growth has improved after applications of zinc and manganese on heavy soils with a high pH (8 to 9). There has also been some response to sulphur on these high pH soils, particularly when applied as sulphate of ammonia.

Zinc. Apply two to three foliar sprays of zinc sulphate heptahydrate at 1 kg zinc sulphate heptahydrate plus 1 kg urea in 470 L of water per hectare. Apply foliar sprays early in the life of the onion crop.

Manganese. Apply two sprays of manganese sulphate at 1 kg of manganese sulphate per hectare. Ensure the concentration never exceeds 2% manganese sulphate, that is use no more than 2 kg/100 L of water.

Irrigate

Tensiometer use in irrigation
Section 4 page 24

The frequency and timing of irrigation depends on the weather, but the plant must not be allowed to dry out. A growth check through lack of moisture during early bulb development will result in a high percentage of small onions or picklers, as well as split bulbs or doubles.

Irrigation scheduling

Onions are shallow rooted plants, highly susceptible to water stress. Watering rates and timing should be based on a soil moisture monitoring system.

Tensiometers are water scheduling devices that are positioned in the crop after planting and left there until the end of the season. They are generall installed and read by the grower. Install one pair of tensiometers in each variety or block of plants. Follow the manufacturer's instructions. Position tensiometers in the beds as shown in Figure 5. The shallow tensiometer indicates when to irrigate, the deep one indicates how much to apply.

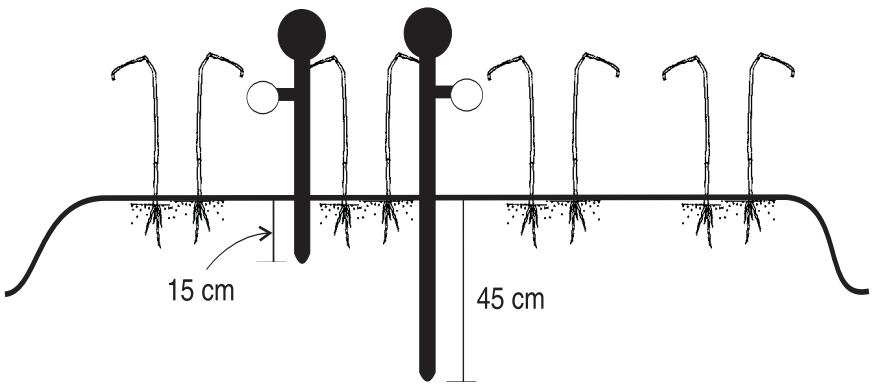


Figure 4. *Where to position a tensiometer in an onion bed*

Once tensiometers are installed, read the gauge to determine when to water. Remember, read tensiometers between sunrise and 8 a.m. because at that time there is little movement of water in the soil or plants and they are almost in equilibrium. Errors caused by heating of the gauge or water column are also avoided.

When using tensiometers, Table 8 provides a rough guide of the frequency and amount of water needed. The table makes no allowance for rainfall or very dry weather. Only the tensiometers can make this allowance. The readings in Table 8 relate to the shallow tensiometer set 15 cm deep. In sandy soils use the lower tensiometer reading and apply the smaller quantity of water.

If the deep tensiometer reading continues to rise after irrigation, apply a little more water next irrigation. If the reading falls to less than 10 centibars within two days, apply a little less water next irrigation. If the deep tensiometer reading remains the same, the root zone has been saturated.

Table 8. *A guide to irrigating onions from the third true leaf to bulbing*

Season	Tensiometer reading	Amount per application	Apply every
Winter	40 centibars	15 – 20 mm	5 – 7 days
Spring and summer	30 centibars	15 – 20 mm	5 – 7 days

Looking after the crop: bulbing to maturity

Bulbing is the stage when the bulb is twice the diameter of the stem. Onions are mature when the bulbs are firm and 80% of the leaves have fallen over. This stage takes about 70 days. Figure 6 shows these stages. There are four important things to do.

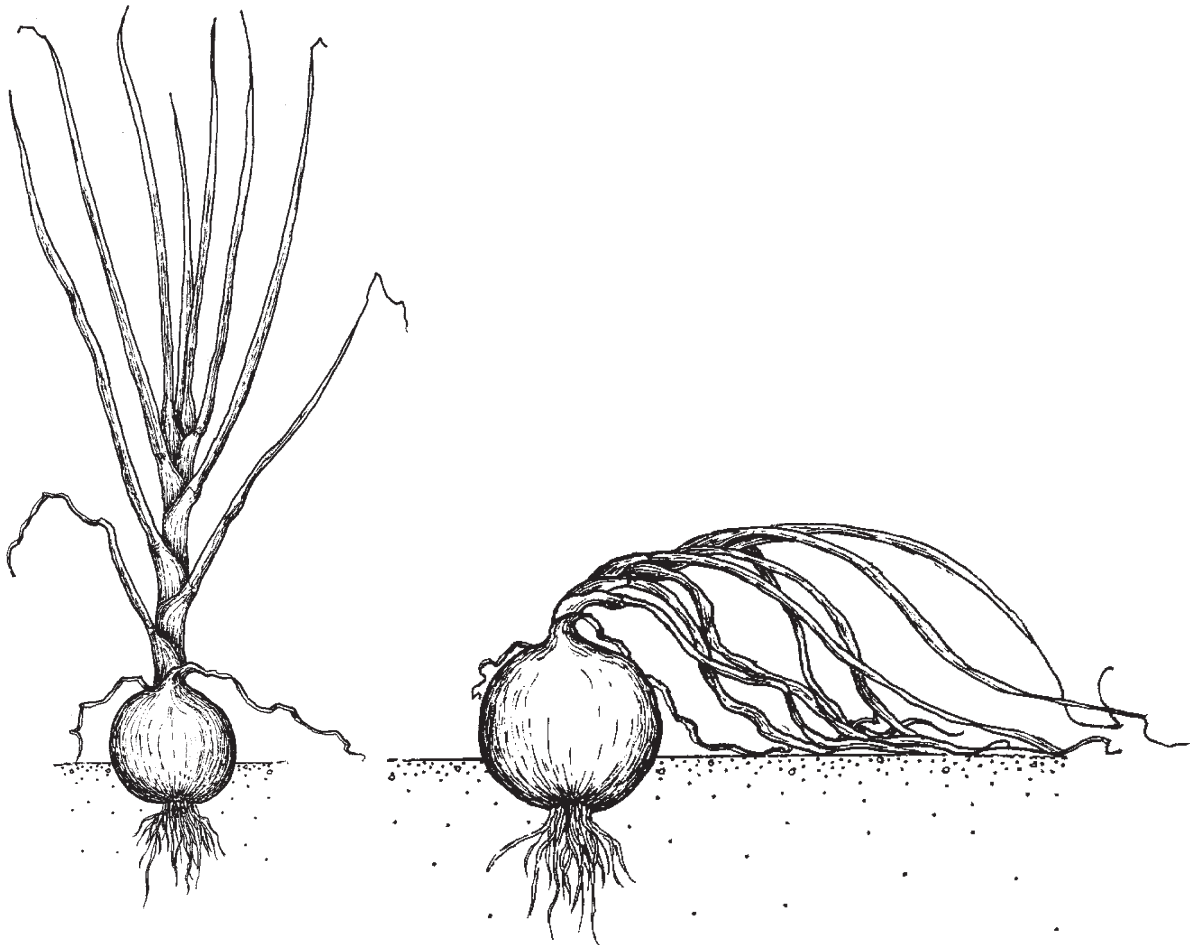


Figure 6. *Bulbing (seventh or eighth leaf—left) and mature leaf*

Bulbing to maturity

Control weeds

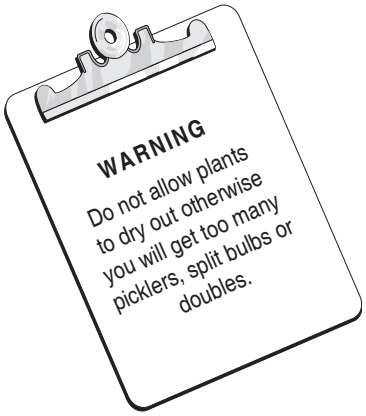
All weeds should be controlled by this stage. If necessary, pull out large weeds by hand.

Manage pests and diseases

Pest and disease symptoms Section 5 *Problem solver*

Watch for symptoms of pests and diseases and manage them. Control pests and diseases with a chemical from the *Problem solver handy guide*.

Irrigate



The frequency and timing of irrigation depends on the weather, but the plant must not be allowed to dry out. A growth check through lack of moisture during the early bulb development stage, will result in a high percentage of small onions or picklers, as well as split bulbs or doubles.

As the plant matures, heavier less frequent irrigation is needed. The total crop water requirement for this stage, including normal rainfall, is 300 to 400 mm of irrigation.

Irrigation scheduling

When using tensiometers, Table 9 provides a rough guide of the frequency and amount of water needed. The table makes no allowance for rainfall or very dry weather. Only the tensiometers can make this allowance. The readings in Table 9 relate to the shallow tensiometer set 15 cm deep. Use the higher tensiometer reading and irrigation quantities on finer textured clay soils.

If the deep tensiometer reading continues to rise after irrigation, apply a little more water next irrigation. If the reading falls to less than 10 centibars within two days, apply a little less water next irrigation. If the deep tensiometer reading remains the same, the root zone has been saturated.

Table 9. *A guide to watering onions from bulbing to maturity*

Season	Tensiometer reading	Amount per application	Apply every
Winter	50 centibars	20 – 35 mm	5 – 7 days
Spring and summer	40 centibars	20 – 35 mm	5 – 7 days

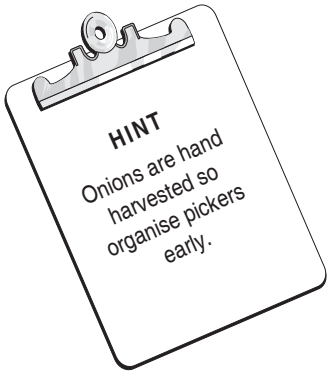
Fertilise

All fertiliser should have been applied by this stage.

Harvesting and marketing

Onions must be harvested, handled and marketed with great care. The price you receive for your crop will depend on how well you manage seven important operations.

Harvesting



The average yield of onions in the Lockyer Valley is 30 t/ha over the full season. For the main crop grown under good conditions, top producers can expect 40 t/ha. Yields of 50 t/ha have been achieved.

Onions are ready to harvest when the necks shrivel and 80% of the tops bend over. Most onions in Queensland, particularly the early and mid-season plantings, are harvested at an immature stage. They are harvested with tops still green, whereas onions in southern states are left in the field until the tops dry off.

How to pick and handle onions

Almost all onions in Queensland are hand harvested, so you need to organise a labour force. Sometimes late onions are mechanically harvested if the market price is too low to employ hand labour. Onions are pulled by hand, by cutting them off with sharp sheep-dagging shears. The roots are trimmed off and the tops removed, leaving about 13 mm of neck above the bulb. If onions do not pull freely from the ground attach a cutter bar to the tractor tool bar and run the cutter bar under the crop, to make pulling easier.

The onions are cut into picking drums (20 to 25 L capacity) and then tipped into 500 kg bulk bins placed strategically in the field.

If drying facilities are not available, the newly harvested onions may be spread on bags in the field to partially cure them before going into

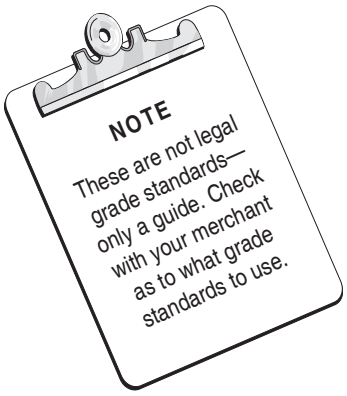
the bulk bins. This practice is no longer common as contract drying facilities are available in major onion producing areas. In fine weather, especially if there are prevailing westerly winds, the filled bins can be left in the field for several days to enable preliminary drying. Use a fork-lift to move the filled bins onto trailers or trucks for transport to drying and grading facilities.

Drying and curing

The use of artificial dryers has greatly improved the appearance and keeping quality of Queensland-grown onions, which by selection and stage of picking are a soft, salad-type onion. Commercial drying and grading sheds operate in the Lockyer Valley.

Air is heated, usually using diesel fuel, and fan forced through bins stacked three to four high in specially designed rooms. The air flow should range from 0.17 to 0.27 m^3/second/m^3 of onions, with relative humidity between 65 and 75% and a temperature rise of 6 to 10°C. Air temperatures should not exceed 38°C; best skin colour is obtained at 24 to 27°C. Drying time varies from 24 to 48 hours, depending on the type and quantity of onions and the temperatures and air flows applied. The aim is not to cure the onions totally but to dry the outer skins, the adhering dirt and the cut tops and tails.

Grading and packing



Grade standards are no longer in force. Table 10 sets out the grading regulations that were applied as a guide to the grading buyers have previously expected.

Table 10. *A guide to grading onions*

Grade or Class	Specifications
No. 1 Grade (Class 1)	Sound, clean onions, well-cured, of similar varietal characteristics, practically free from peeled onions, abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths and mechanical injury. Not less than 75% in each package must be 40 mm or greater but not more than 70 mm diameter. The rest of the onions must be not less than 35 mm nor greater than 85 mm in diameter.
No. 1 Large Grade (Class 1 Large)	Sound, clean onions, well-cured, of similar varietal characteristics, practically free from peeled onions, abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths and mechanical injury. Not less than 90% in each package must be 75 mm or greater. The rest of the onions must be not less than 60 mm in diameter.
Picklers	Sound, clean onions, of similar varietal characteristics, practically free from abnormal doubles, pipers, bottle necks, scallions, sprouts, root growths and mechanical injury. Not more than 40 mm and not less than 20 mm in diameter.
No. 2 Grade (Class 2)	Sound, clean onions, of similar varietal characteristics, practically free from pipers, bottle necks, scallions, sprouts and root growths and not less than 40 mm in diameter.

The dried onions are tipped by bin tipper into the grader bins, passed over the grader and bagged off according to the set grade sizes. Dur-

ing the grading process most of the dried, dirty outer skin is removed, resulting in a more attractive packed product. Many graders are now fitted with automatic bag weighing devices to obtain a uniform bag fill.

Abnormal bulbs

Table 11 describes the common abnormalities mentioned in the grading regulations.

more info
Pictures of abnormal bulbs Section 5 *Problem solver*

Table 11. *Descriptions of common abnormalities of onions*

Abnormality	Description
Peeled onions (shelling)	The skin has come off.
Abnormal doubles	Obvious split bulbs.
Pipers	The bulb has produced a seed stem before harvest.
Scallions, bottle necks, bull necks	Thickened stems, no bulb.
Sprouts	Old onions have started to sprout new growth, or immature onions have continued to grow.
Root growths	Roots have not been trimmed from the bulb
Mechanical injury	Damage to bulbs during harvesting, or postharvest handling, or both.

Packaging

First grade onions re normally sold in 20 kg bags while second grade onions are normally sold in 10 kg bags.

Labelling

Onions for sale must have the grower's initials, name and address marked on the outside of the bag. The letters should be at least 6 mm high if printed. Many growers buy bags with their name and address embossed on the side of the bag. Labels as shown in Figure 7 are acceptable.

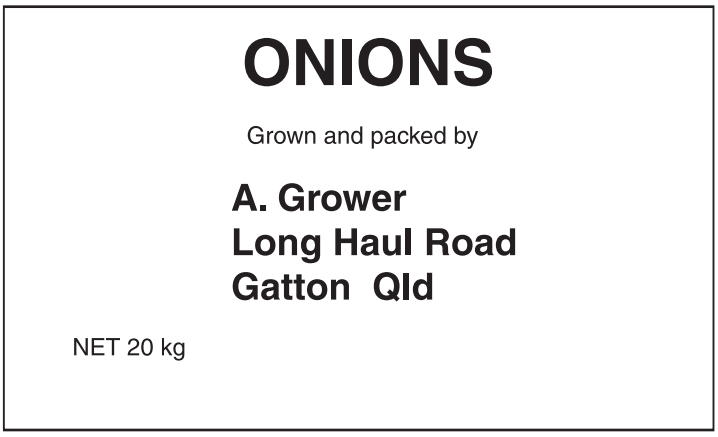


Figure 7. *Acceptable label for an onion bag*

Storage

Onions are not stored in the growing areas for longer than a few weeks after bagging. Queensland onions are perishable so the less time in storage the better.

Transport

Transport is mainly by road in semi-trailers. The use of pallets has speeded up turn around time and resulted in much less transport damage to onions. Each pallet carries 60 x 20 kg bags.

Marketing

Market information
Section 6 page 6

Most onions in Queensland are sold on farm to local merchants by private treaty. Merchants sell the product through market outlets, mainly in Sydney and Brisbane and to a lesser extent Melbourne, Adelaide and Perth. There is a limited market for export onions. Whatever market outlet you choose, keep in close contact with your marketer and ask for feedback on the quality of your onions in the marketplace.

Market prices

See the publications *Prices and throughput for the Brisbane market* available from Market Information Services, or *Fruit and vegetable prices and receivals* from the Flemington Markets' Reporting Service.

Levies

All onions marketed by Queensland growers are subject to levies under the Queensland Fruit Marketing Organisation Act. These are collected for QFVG (Queensland Fruit and Vegetable Growers) to fund promotion, grower services and research. Levies are collected from sales in Queensland, New South Wales and Victoria.

Pictures of postharvest problems Section 5 *Problem solver*

Postharvest diseases and disorders

Black mould and Botrytis. These diseases are not normally a problem in Queensland as onions are not stored for long.

Green sprouts. These can be a problem if onions are harvested at an immature stage.

Interstate quarantine requirements

Quarantine restrictions can change at short notice, always check before consigning produce. Contact your local DPI office for more information on inspections, property trapping and monitoring, and property freedom.

Queensland, New South Wales and Northern Territory

No restrictions.

Victoria

Cured onions, no restrictions.

Spring onions must be inspected by a DPI inspector as free of western flower thrips; be fumigated; or come from a property trapped and monitored for the pest.

South Australia

Cured onions must be free of soil. They must also be from a property inspected by a DPI inspector and accredited annually as free of garlic rust.

Spring onions must be free of soil. The property must be accredited fortnightly by a DPI inspector for freedom from garlic rust while spring onions are being consigned.

Western Australia

Cured onions must be free of soil and be accompanied by a DPI certificate of freedom from the diseases onion rust, white rot and American onion smut.

Spring onions must also be certified by an inspector as free from melon thrips, or from a property more than 100 km from a known outbreak of melon thrips; or be fumigated. They must also be certified by a DPI inspector as free from European red mite or from a property accredited annually as free from European red mite, or be fumigated. This mite is only known to occur on the Granite Belt.

Tasmania

Cured onions must have a DPI certificate of freedom from the diseases onion rust, white rot and American onion smut.

Spring onions must be free of soil; certified by a DPI inspector as grown and packed in a place known to be free of western flower thrips and packed in a way that prevents infestation of western flower thrips; or be fumigated and packed in a way that prevents infestation of western flower thrips.