Optimising Yield & Shelf Life of Iceberg & Cos Lettuce

A Training Guide for the Australian Lettuce Industry

contents

Optimising Yield and Shelf Life of Iceberg and Cos Lettuce.
A Training Guide for the Australian Lettuce Industry.

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This publication covers research conducted by HAL project VG 03092 "Postharvest improvement in Iceberg and Cos lettuce to extend the shelf life for fresh cut salads"

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Introduction

This guide is a summary of the key outcomes from a three year study aimed at improving quality and shelf life of iceberg and cos lettuce. The project developed strategies to improve the shelf-life of minimally processed cos and iceberg lettuce and has heightened the understanding of environmental effects on yield and quality.

The research was conducted on commercial lettuce suppliers' properties at a number of sites in Toowoomba & Lockyer Valley (Queensland) and East Gippsland & Robinvale (Victoria) with postharvest trials executed at lettuce processing facilities in Wacol (Queensland) and Bairnsdale (Victoria).

The results also have significant value for suppliers of whole head lettuce for the fresh market, especially as that market moves towards wrapped whole iceberg and cos lettuce.

Training

This training guide is designed to compliment the training and to be used as a reference to the main aspects of that training. It is not a comprehensive report on the research project.

How to Use these Guidelines

The training and the guide have been designed around the idea of helping growers to make the most of the environment on which they are operating. In this sense, it is the underlying principles of variety selection, water and nutrient management and postharvest handling that are most important.

Try to use and adapt this information to maximise yield and quality for your individual region and farm.

Research which supports these guidelines

The following research was undertaken as part of the development of this guide. Some of the information comes from other research projects, published information and the personal experience of the authors.

In summary, the main areas of supporting research are:

Pre Harvest

1. Harvest maturity
This work highlighted the importance of harvesting at optimal maturity, with respect to achieving maximum yield and shelf-life.

2. Irrigation management
The lettuce yields and shelf-life associated with overhead irrigation (sprinklers on portable spray lines) and sub-surface trickle irrigation were compared in the Lockyer Valley, SE Queensland.

3. Planting density
The effect of planting density x nutrition on yield and shelf life was investigated to optimise yields of Cos lettuce.

Post Harvest

1. Postharvest temperature management
Up to 3 days additional shelf life over current practices was achieved through better postharvest temperature management.

2. Moisture in packaged products
Reducing the free moisture content in bags of processed lettuce was also the focus of several factory trials.

3. Product age before processing
The age of the product at the point of processing was also found to have a significant effect on the performance of lettuce in regards to the total days shelf life achieved.

4. Trimming outside leaves
The combination of a reduced number of outer leaves and processing as soon as possible after harvest significantly improved the shelf life of processed lettuce.

Variety evaluation and crop modelling

1. Variety Evaluation
For areas of both, summer and winter production, the variation in yield and quality over a season was established. The yield and shelf-life values were found to follow similar trends at all sites. A large selection of cos and iceberg lettuce varieties were assessed in all regions with an emphasis on lettuce aphid (Nasonovia ribis-nigri) resistance (Nr).

2. Yield and Shelf Life
Data collected in the Lockyer Valley, Toowoomba and East Gippsland was used to develop models for the yield and shelf life. The best shelf life was closely associated with the highest yield.

3. Crop Scheduling
The data collected for yield and growth period through a season has been combined to produce predictive scheduling tables for each region and type of lettuce. The models indicate the appropriate transplant date and the number of seedlings required for a consistent yield over the season.

Postharvest
handling of lettuce

- Lettuce is a living product. It is living and growing in the field and remains alive after harvest.
- A living product respires which means it takes in oxygen and gives off carbon dioxide. The process of respiration maintains the metabolism of the living lettuce.
- After harvest lettuce must survive on stored water and carbohydrate.
- Lettuce has a growth phase followed by a senescent (growing old) phase. Postharvest handling is about maintaining a healthy living product by delaying the onset of senescence.
- Postharvest damage and rots must be prevented as they make the product unsaleable.

Good postharvest handling for lettuce includes:

1. Harvesting at the correct time

Harvesting too late or too early will shorten the marketable life of lettuce (Figure 1). Harvesting early means less carbohydrate has been stored and harvesting late means that senescence (growing old) has already started in the field.

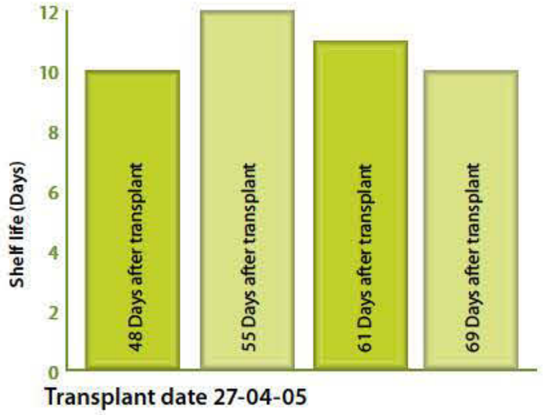


Figure 1. Harvesting too late or too early reduces the shelf life of lettuce.

2. Cooling/Temperature management

The maximum marketable life of lettuce is achieved if the product is vacuum cooled within half an hour of harvest (Figure 2). Forced air cooling is a slow method of cooling and it is not the recommended method for cooling lettuce. The cool chain MUST be maintained from the farm gate to the consumer for best results.

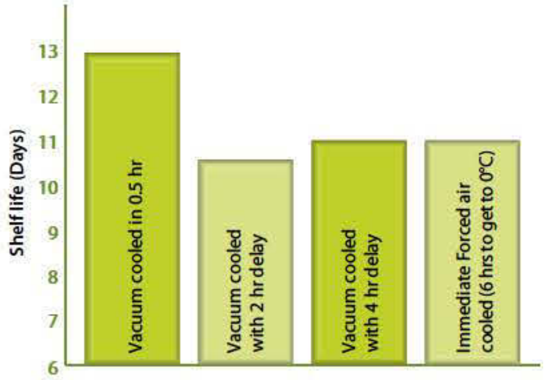
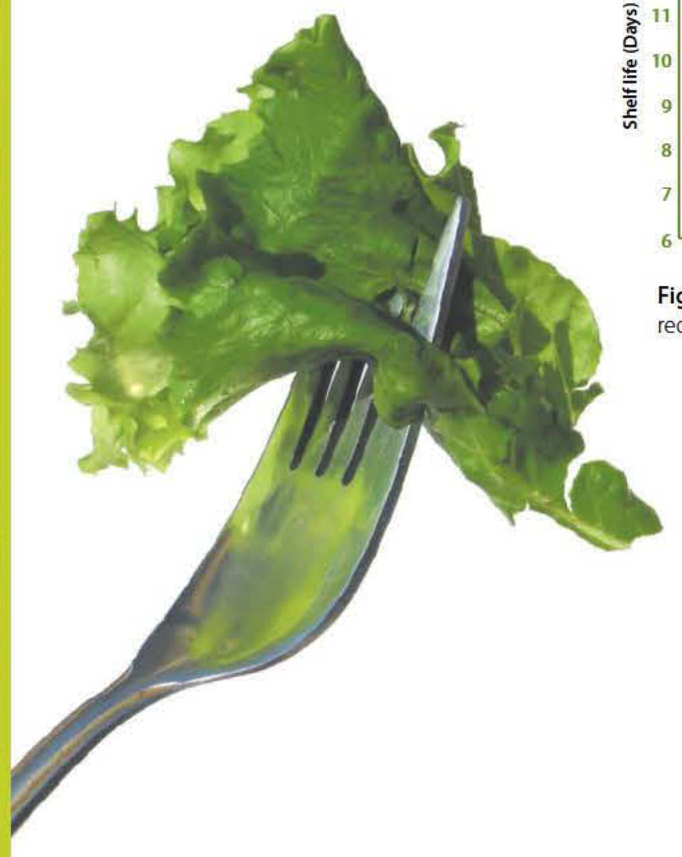


Figure 2. Delaying cooling after harvest reduces the shelf life of lettuce.



3. Store lettuce as close to 0°C as possible

Low temperature storage reduces the respiration rate of the product and this slows the rate of deterioration, metabolism and slows the rate of the development of rots (Figure 3).

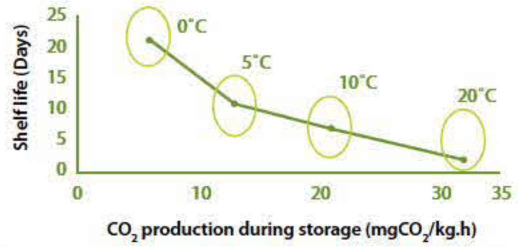


Figure 3. Storing processed lettuce at 0°C gives the longest shelf life. The principle applies to whole head lettuce as well.

4. Avoid damage during harvest and handling

Damage after harvest promotes browning and rots. Removing the outer leaves of lettuce after harvest can extend the marketable life (Figure 4).

5. Storing lettuce after harvest reduces the marketable life

Storage of lettuce at 0°C delays the onset of senescence but it does not prevent it. After harvest lettuce lives off stored carbohydrate and as this reserve is depleted the marketable life is reduced (Figure 3).

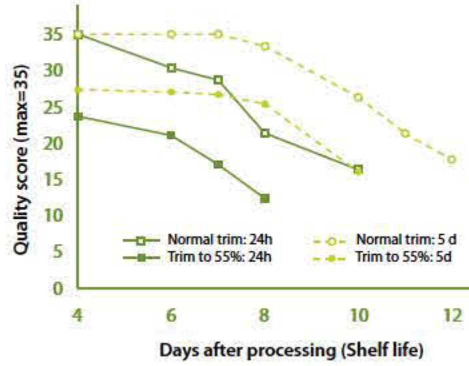


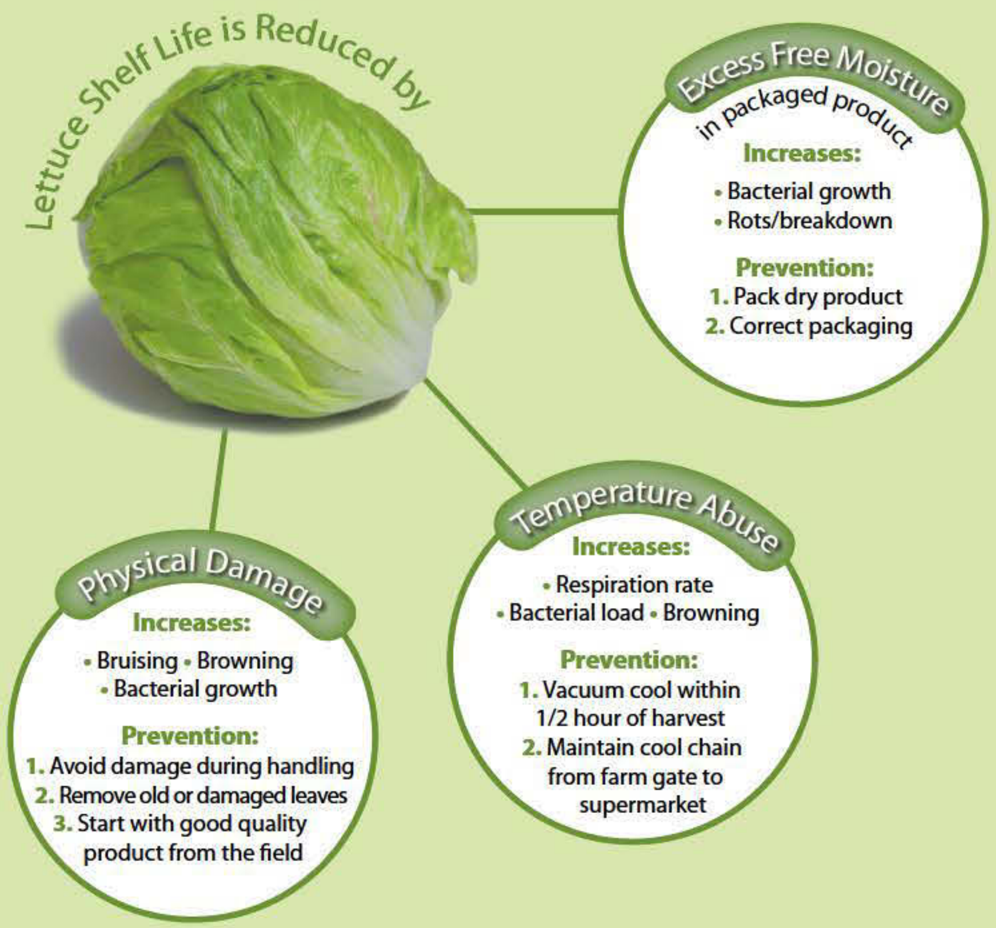
Figure 4. Storing processed lettuce before harvest reduces the marketable life and removing the outer leaves extends the marketable life of lettuce.

6. Breaks in the cool chain can undo all the good work done on farm

A reliable cool chain is a key step that shouldn't be over looked.



Factors Affecting the Marketable Life of Lettuce



Harvest time

Managing the harvest maturity of lettuce

Outcome:

Head weight and total yield can be increased with no loss in quality by harvesting lettuce at the correct maturity stage.

Introduction

In order to meet processing specifications, growers must focus on both the yield and processing-quality of a crop at the point of harvest.

Choosing the best time to harvest involves a balance between yield and quality.

- Harvest may have to be earlier or later if scheduling has failed to provide appropriate processing volumes throughout the season.
- During warm, dry weather, there is also a greater risk of bolting or the development of tipburn as the crop nears maturity.
- These factors can mean that lettuce is often harvested before the optimum head weight has been achieved as a risk management strategy.
- In order to capitalise on the potential for an increased head weight it is important to be aware of the climatic and varietal interactions.

Growth Rate of Spring Lettuce

Results for Iceberg Lettuce

To increase yield variety selection is important

The results show that Patagonia had the greatest yield increase with the smallest increase in core length compared to the varieties Cartagenas and Titanic at the time shown in Figure 1 in Gatton.

- Patagonia and Titanic are winter vanguard types and they are most suited to a July/Aug harvest date which is the example reported here.
- Cartagenas in comparison is a summer Salinas/Vanguard type and is more suited to a May/Jun harvest. Cartagenus is also bolting resistant which could have helped reduce the rate of core growth.

The processing specification for core length is less than 75 mm. If the core length is greater than 75 mm then the shipment can be rejected for processing. Increases in core length can be associated with bolting and the emphasis has been on breeding bolting resistant varieties to reduce the problem. In this example shown in Figure 2, delaying harvest did not mean that samples had core lengths greater than 75mm.

The shelf life data showed no significant differences in the quality of the different varieties or harvest dates.

Results for Cos Lettuce

The results showed that Cos lettuce (cv. Cyclone) also benefited from an extended growing period, as the yield was seen to progressively increase with each harvest (Figure 3).

The core length also increased with later harvest dates. The harvest at 69 days after transplanting being 90 mm and well above the processing specification. The average core length of 65mm, found in the previous harvest (61 days after transplanting (DAT)) is acceptable.

- It was the third harvest (61 DAT) which has generated the maximum yield possible within specified quality for fresh-cut lettuce.

The shelf-life evaluation confirmed that the third harvest (61 DAT) produced the best balance of yield and quality.

Conclusions

- This change in production practice is best suited to cooler periods in the season when growing conditions are optimal to avoid the issue of bolting. The results showed that yield increases as high as 60% could be obtained for Iceberg lettuce (cv.Titanic transplanted 26-04-05) and a 35% increase in Cos lettuce (cv. Cyclone transplanted 27-4-05).
- These findings are specific to the conditions experienced during these trials and research encompassing a range of regions, seasonal timing and varieties is required to verify a broader application.

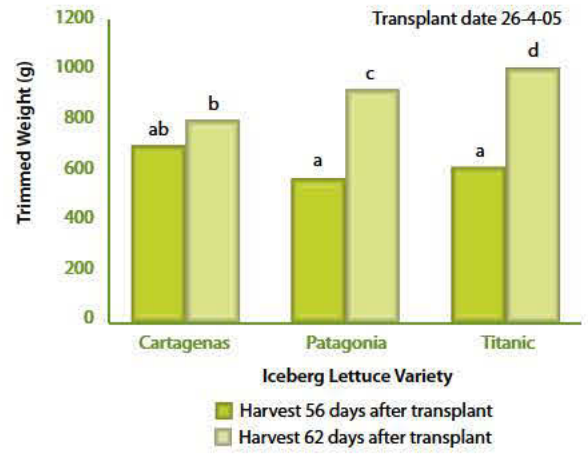


Figure 1. The effect of delaying the harvest date of lettuce by one week on the trimmed head weight of three varieties of Iceberg lettuce planted on the 26-4-05.

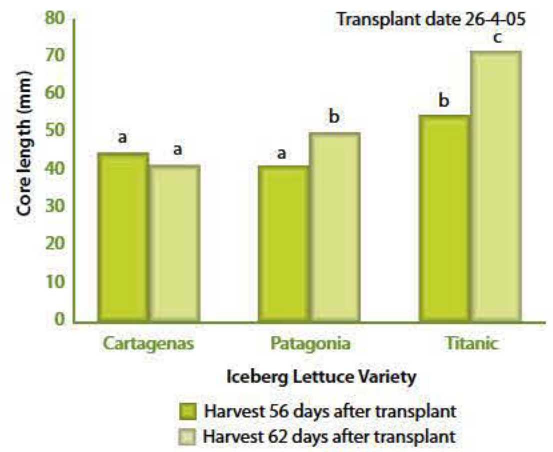


Figure 2. The effect of delaying the harvest date of lettuce by one week on the core length of three varieties of Iceberg lettuce planted on the 26-4-05.

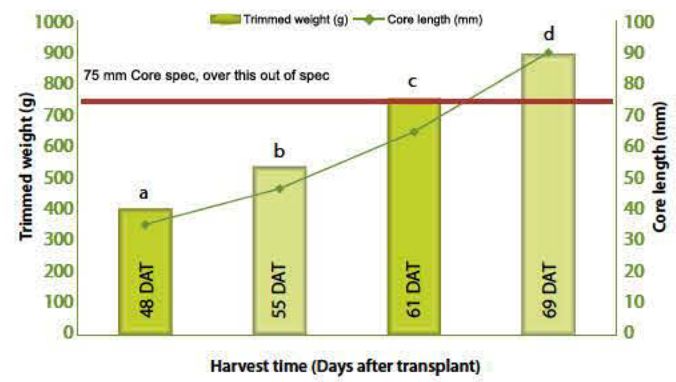


Figure 3. The effect of delaying the harvest date of Cos lettuce (cv Cyclone) transplanted on the 27-4-05 on the trimmed head weight and the comparative core length.

Reference

Zink, F.W. & Yamaguchi, M. (1962) 'Studies on the Growth Rate and Nutrient Absorption of Lettuce'. Hilgardia 32(11): 471 – 500.

Crop nutrition

Outcomes:

- It is essential that nutrients are applied at the appropriate ratio with other nutrients rather than simply applying elements independently if optimal yield and quality are to be achieved.
- Adverse outcomes can be experienced when nitrogen is over supplied.
- Phosphorous is a key element particularly for new soils.
- Slowing the crop growth rate is more important than supplying calcium for the prevention of tipburn.

Nitrogen

- Excessive nitrogen application can reduce both yield (Figure 1) and quality (shelf-life) (Figure 2).
- In this trial, Nitrogen applied between 50 and 100 kg/Ha gave the best yield and quality combination.

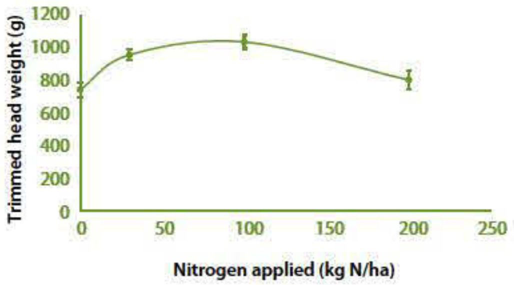


Figure 1. Effects on nitrogen on trimmed head weight of Iceberg lettuce

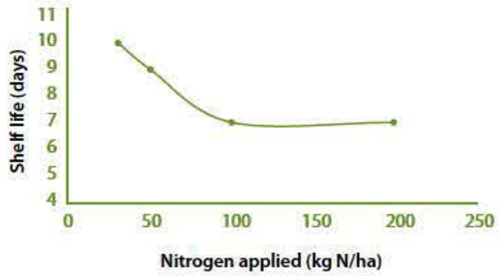


Figure 2. Effects of Nitrogen fertilizer on shelf life of Iceberg lettuce

N:P:K application

- It is essential that nutrients are applied at the appropriate ratio with other nutrients rather than simply applying elements independently if optimal yield and quality are to be achieved (Figure 3).
- For Iceberg lettuce increasing the ratio of N:P:K from 50:60:80 to 75:90:120 kg/ha retained the original balance of nutrients and significantly increased the total yield (Figure 3).

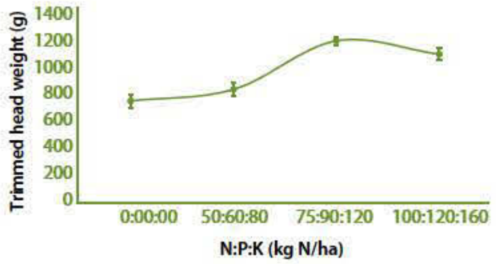


Figure 3. Effects of changing fertiliser quantities with nutrient ratios constant on the trimmed head weight of Iceberg lettuce

- For Cos lettuce increasing the ratio of N:P:K from 26:28:24 to 46:51:43 kg/ha retained the original balance of nutrients and significantly increased the total yield (Figure 4).

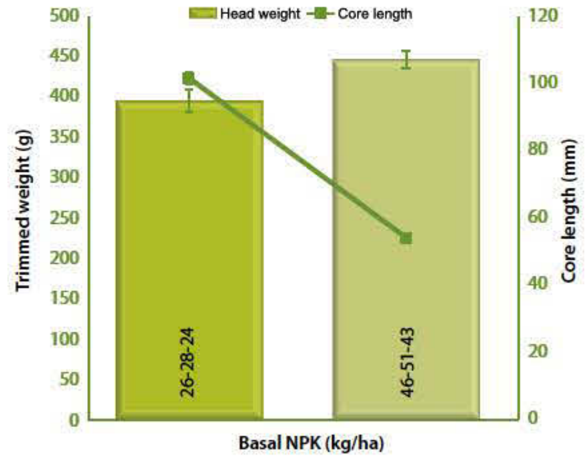


Figure 4.

Phosphorous

- Phosphorous is a key element particularly for new soils.
- Phosphorous management is important for sustaining the maximum, long-term performance of the crop.
- Phosphorous supply can be an issue on soils new to horticultural production, where relatively high rates may need to be applied (Figure 5).

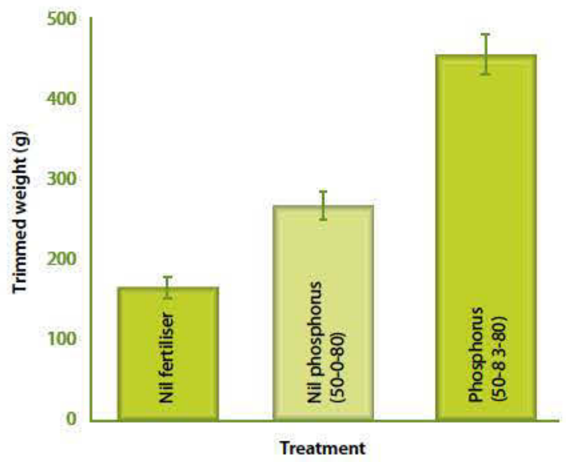


Figure 5. The Effect of Applied Phosphorus on the Yield of Iceberg Lettuce, Toowoomba, 2005

Calcium

- Slowing the crop growth rate is more important than supplying calcium for the prevention of tipburn.
- Calcium foliar sprays are not effective in tip burn alleviation and cultural practices that aim to prevent excessive growth rates are a better strategy for reducing this disorder.
- Although weekly calcium sprays provided a small, experimental reduction in tipburn severity, the treatments had no impact on the commercial outcome (Figure 6).

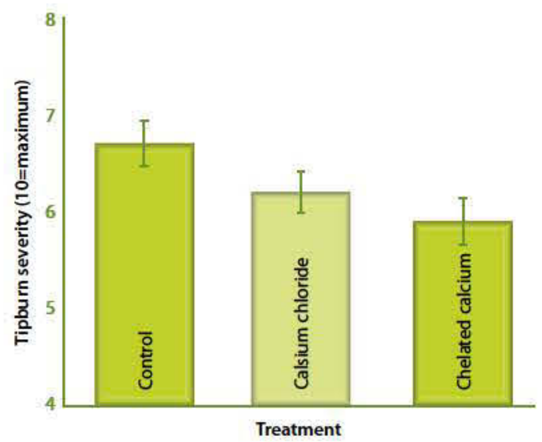


Figure 6. The Effect of Calcium, Applied as a Foliar Spray, on Tipburn Incidence in Cos Lettuce, Gatton, 2005

Irrigation

Water management for lettuce

Outcome:

Trickle irrigation can be used successfully to grow lettuce with higher water use efficiency than using sprinkler irrigation. Lettuce plants should be maintained free of water stress right up to harvest for maximum yields.

Introduction

Most of the lettuce grown in Australia is irrigated by hand shift, or solid set sprinklers. This method is popular because it applies water over the whole bed area, which is an advantage in a multi-row per bed crop like lettuce.

Sprinkler irrigation does however have some limitations. They include:

- low water use efficiency;
- variable coverage due to sprinkler design;
- susceptibility to wind which can affect uniformity of watering;
- it wets the foliage making plants more susceptible to disease.

For these reasons, the alternative of trickle irrigation can be an attractive option for growers. Trickle irrigation has two major advantages over sprinklers. It places water directly into the crop root zone, increasing water use efficiency; and provide a means of utilising water resources that are too high in salts for application via overhead irrigation.

At the same time however, the challenge with trickle is to get enough lateral movement of water across the bed for all plants to get adequate water.

Water Application and Uptake - Gatton

The uptake of water, irrigation applied, and yields of Iceberg and Cos lettuce crops was measured using soil capacitance probes (EnviroScan, Sentek Australia) over two seasons in 2004 and 2005. The data was collected from crops grown in Gatton (SE Qld) East Gippsland, (Vic).

The common result was that while the plants grown on either irrigation system actually took up a similar amount of water in the plant row (Table 1). This means that trickle-grown plants were not under any more water stress than sprinkler-grown plants.

Trickle irrigation used water much more efficiently than sprinkler because less water was being applied (Figures 1 and 2). In addition, trickle applies water only in the plant row, and the total amount of water applied per ha would have been much lower for trickle than sprinkler.

In all cases however, the water use efficiency (amount of water used for a given crop yield) was much higher for trickle irrigation than for sprinkler.

This means that where the amount of water available is a limiting factor, trickle does a better job than sprinkler.

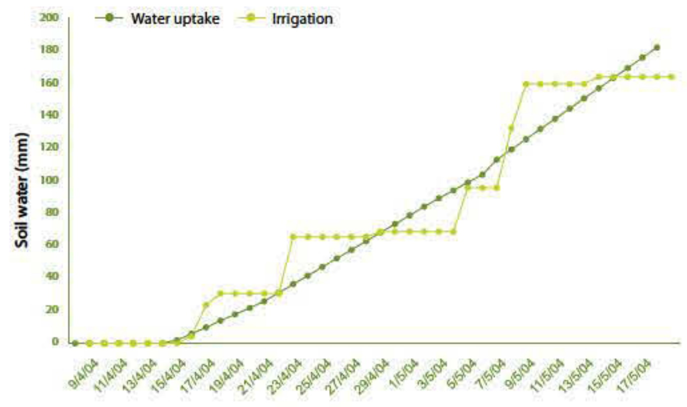


Figure 1. Crop water use and irrigation applied for sprinkler-Irrigated iceberg lettucce crop in Gatton, Autumn 2004.

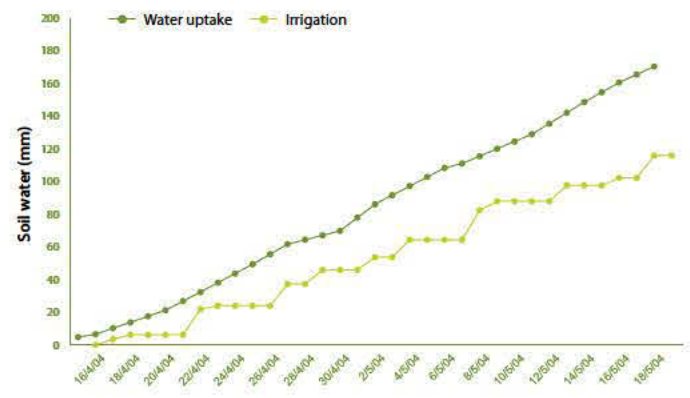


Figure 2. Crop water use and irrigation applied for a trickle-Irrigated iceberg lettucce crop in Gatton, Autumn 2004.

Managing soil Moisture

Lettuce crops are rapidly growing, vegetative crops and any factor which limits growth will result in reduced yields. Many studies have shown that water stress can limit lettuce growth at any stage of crop development (Fonseca 2006).

This means that managing soil moisture is critical for maximising yield and quality of lettuce crops. The best water management strategy for lettuce is to start with a full soil profile, then maintain the soil moisture between field capacity to just before the onset of stress.

Figure 3 shows an example of where soil moisture has been allowed to decline to a point where the plants were under moisture stress leading into the critical late crop development stage. In this crop, soil moisture at the 10cm, 20cm and 30cm depths has been depleted, and the plants were extracting water from 50cm to try and compensate for the dry topsoil.

This forces the plants to expend more energy to extract water at the expense of growth. Also, in this situation, plants are likely to be slightly wilted, increasing susceptibility to tip burn, and reducing leaf expansion, which also reduces growth and final yield.

Some form of soil moisture monitoring and interpretation of the data are really essential for this objective to be achieved.

Figure 4 shows an example of how soil moisture data can be used to identify the onset of plant stress. As plant water stress occurs, the rate of water uptake by the plant begins to slow. This shows up as a flattening of the slope of the line showing the soil moisture level. This is indicated on the figure by the colour change from light green to dark green.

The crop should be irrigated just before the onset of stress with just enough water to refill the soil profile back to field capacity. This point is sometimes refereed to as the ***refill point***. Then the soil should be allowed to dry back to the refill point before irrigigating again.

Irrigation Type	Water applied to the plant row (mm)	Water taken up in the plant row (mm)	YIELD (g/head)
Sprinkler			
Cos	160	136	690 ± 50
Iceberg	164	167	580 ± 40
Trickle			
Cos	102	142	540 ± 50
Iceberg	116	168	640 ± 40

Table 1. Yield and water use efficiency of iceberg and cos lettuce crops in Gatton, 2004 grown with sprinkler or trickle irrigation

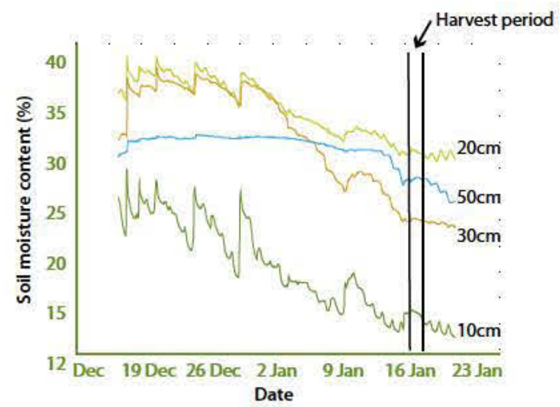


Figure 3. Soil moisture levels in a lettuce crop which has been subjected to moisture stress during late crop development.

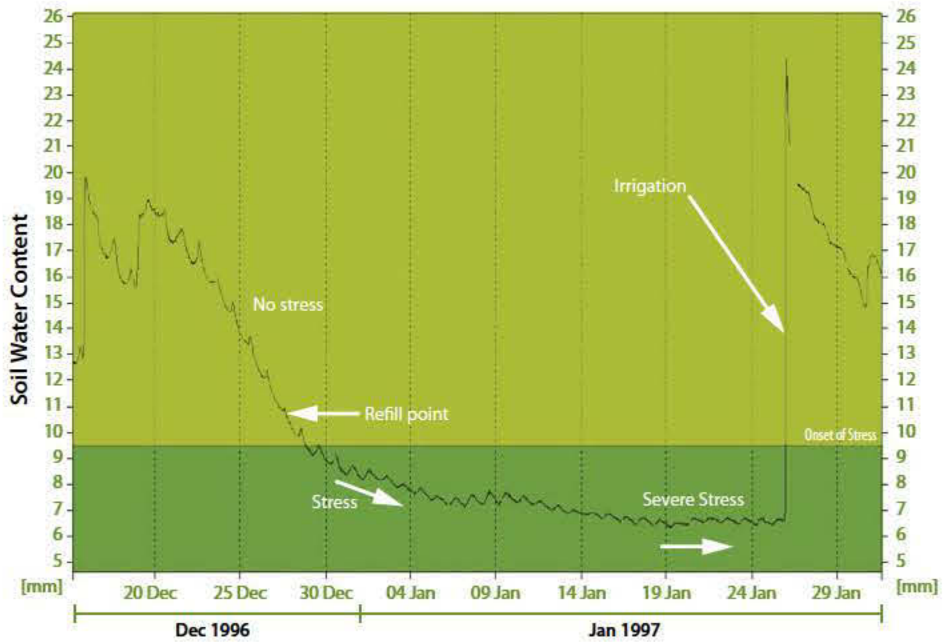


Figure 4. Interpretation of soil moisture data

Reference

Fonseca, Jorge M. (2006) Postharvest Quality and Microbial Population of Head Lettuce as Affected by Moisture at Harvest. Journal of Food Science 71 (2), M45-M49.

Managing plant density

Introduction

Standard planting densities of around 66,000 plants per hectare do not necessarily result in the highest yields per hectare, especially in small framed lettuce varieties such as 3/4 Cos types.

In this section, an example of how planting densities and fertilizers rates can be optimised is shown. This example is for processed lettuce production. For those producers supplying bagged or market lettuce the numbers will vary but the same principles apply.

Outcome:

To determine the optimum planting density and fertilizer input to maximise yields per ha.

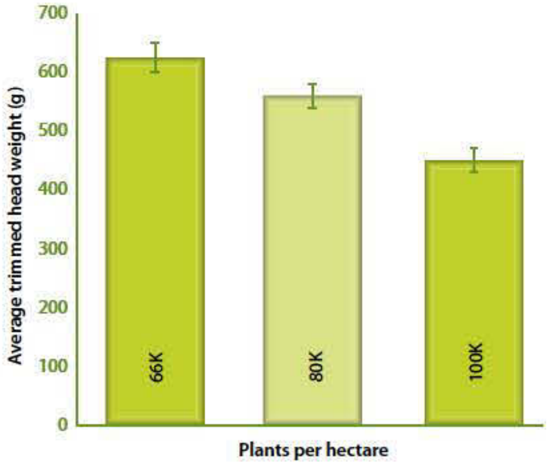


Figure 1. The Effect of Planting Density on the Average Head Weight of Cos Lettuce (Cyclone) Gatton, 2004

Results

Increasing planting densities from 66,000 to 100,000 plants per ha reduced individual head weights (Figure 1).

The highest yield was obtained at 80,000 plants per hectare due to the larger number of heads harvested however at the highest density of 100,000 plants per hectare, yields dropped again (Figure 2).

When the second factor of plant nutrition was considered, it was found that by increasing the rate of fertilizer from 26:28:24 kg/ha NPK to 46:51:43 kg/ha NPK, a yield of 45 t/ha could be achieved. This compares to the highest yield at the lower fertilizer rate of around 42 t/ha.

Increasing density to 100,000 plants per hectare, even at the higher fertilizer rate, was still only able to achieve a yield of 45 t/ha.

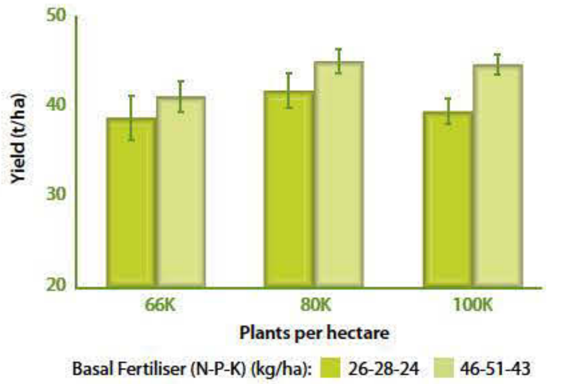


Figure 2. The Effect of Planting Density and Fertiliser Management on the Yield of Cos Lettuce (Cyclone) Gatton, 2004

Conclusions

The optimum density/fertilizer combination for this examples was 80,000 plants per hectare at 46:51:43 kg/ha NPK.

Density interacts with other factors such as fertilizer inputs, irrigation and head size. It is essential to trail combinations of density and crop inputs and then measure crop outputs in the correct unit (in this case kg/ha).

An economic analysis of inputs and returns should also be carried out to determine which combinations results in highest returns to the grower.

Crop scheduling

Outcome:

Improved scheduling models for lettuce for specific markets. The models incorporate:

1. Days from transplanting to harvest
2. Best varieties from the appropriate classification type
3. Estimated yield

Introduction

Harvest dates can be predicted by growers and commercial seedling suppliers from the previous year's crop records and from maturity estimates supplied by commercial vegetable seed companies.

Work in the UK on crop continuity and harvest prediction with Salinas type lettuce found that accumulated solar radiation from transplanting to harvest was more accurate than accumulated day-degrees (Wurr et.al 1988).

Later studies identified that the accumulated solar radiation 5 days prior to hearting and 11 days after hearting were the most critical developmental stages affecting lettuce maturity (Wurr & Fellows 1991).

The demands placed on processors, wholesalers and the retail sectors has resulted in all sectors placing huge importance on continuity of lettuce supply all year round and a smooth transition between warm season and cool season production regions.

Results for Cool season Iceberg Lettuce

Data from the Lockyer Valley (cool season) was used to demonstrate the principles of crop scheduling iceberg lettuce for supply from May-mid October. The data required for the model includes; long term weather information, varieties of the correct type (see Variety section), marketable yield changes over the season and the harvested percentage (Figures 1, 2 & 3).

Summer Vanguard types are scheduled for May-mid-June harvest, Salinas types for June harvest, Salinas x Vanguard for July-early September harvest and summer Vanguard for September-mid October as the temperatures and day length increases.

The most challenging periods are the transition periods of May and September when the environmental conditions often cause lower yields and physiological disorders (eg. Tip burn, slime and pinking). The summer Vanguard types have been found to be the most adaptable to the sub optimal growing conditions during these times.

The most stable and predictable harvest period is late June to early September when temperatures are cooler, the diurnal variation is also less and the rainfall is usually low (Figure 1).

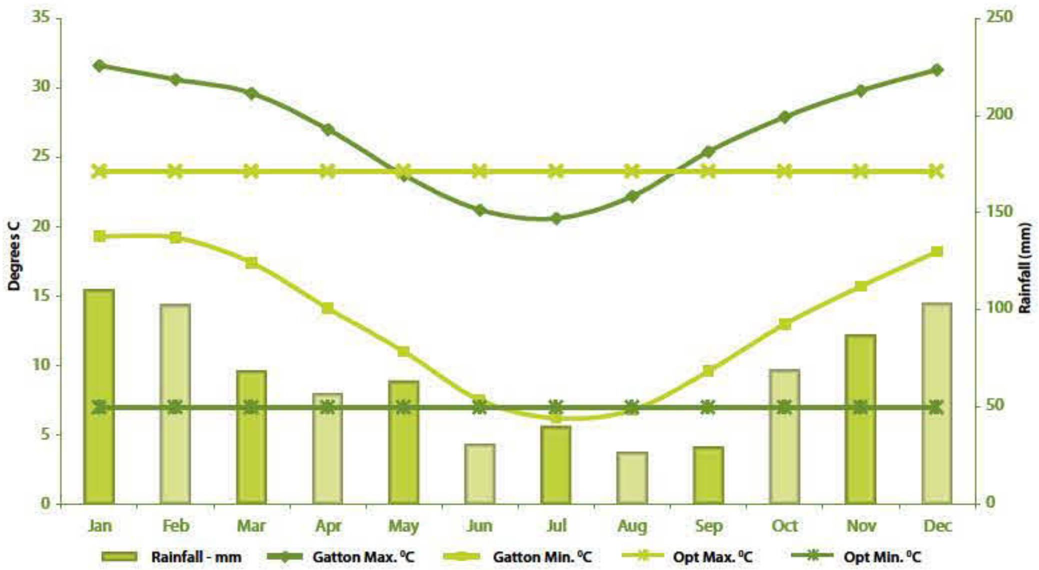


Figure 1. Gatton Weather x Optimum planting time

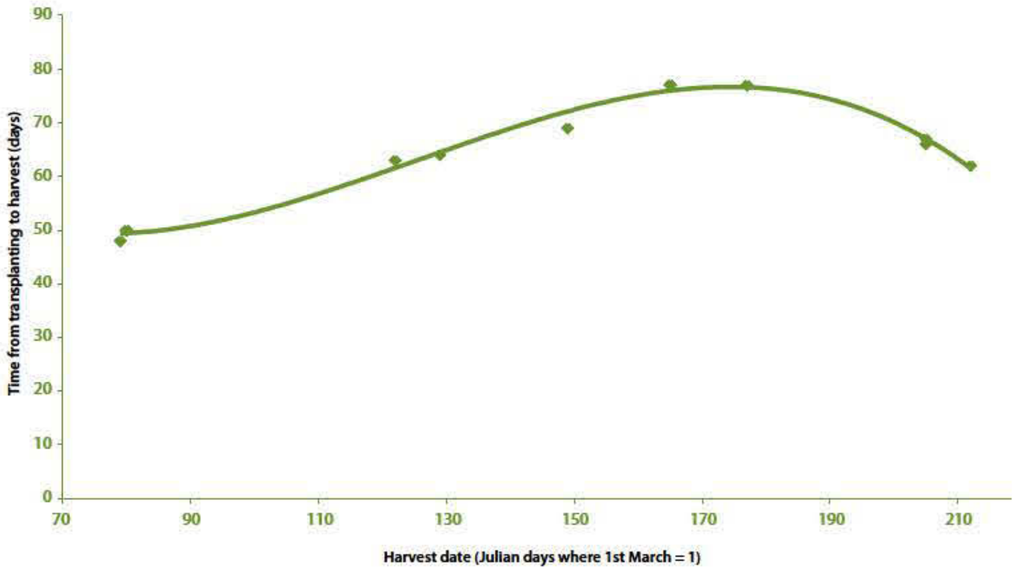


Figure 2. Days from transplanting to harvest Lockyer Valley 2004-05

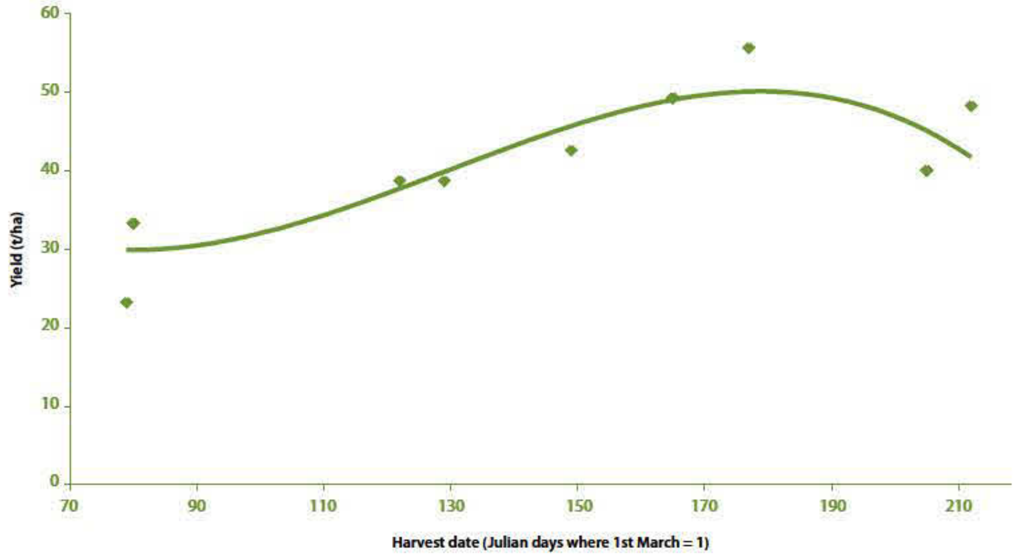


Figure 3. Yield changes over the Lockyer Valley harvest season 2004-05 data

Results for Warm season Iceberg Lettuce

Data from the East Gippsland area (warm season) was used to demonstrate the principles of crop scheduling iceberg lettuce for supply from October to mid May. The data required for the model includes; long term weather information, best varieties from the optimum type, marketable yield changes over the season and the % harvested cut out over the season (Figures 4, 5 & 6).

El Toro and Salinas x Vanguard types are used for transplanting in mid winter up to early spring and this ensures the lettuce produce a large frame during low light and cold growing conditions. Once the spring conditions occur in late September the transplanting of Salinas types is done until late January.

This is the key type grown over the main summer season and is relatively stable except when heat spikes occur (January 2006) when severe yield decline and quality issues can occur. In February transplanting of El Toro and Salinas x vanguard types commences until the close of the warm season.

In warm coastal micro climates in the southern states Winter Vanguard types can be transplanted to provide mid winter harvests.

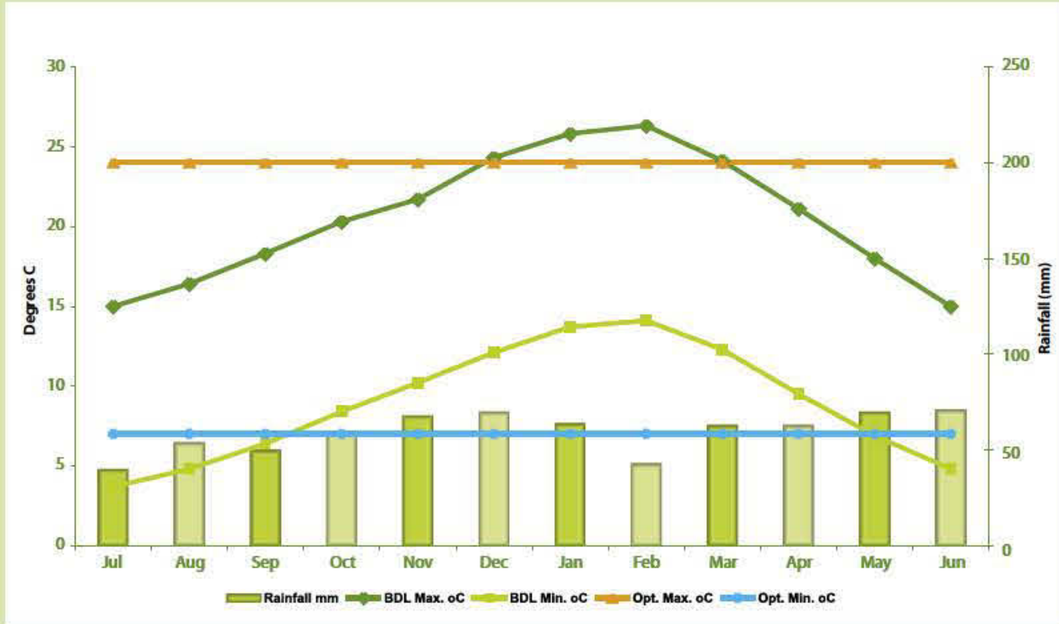


Figure 4. East Gippsland (Bairnsdale) weather x optimum planting time

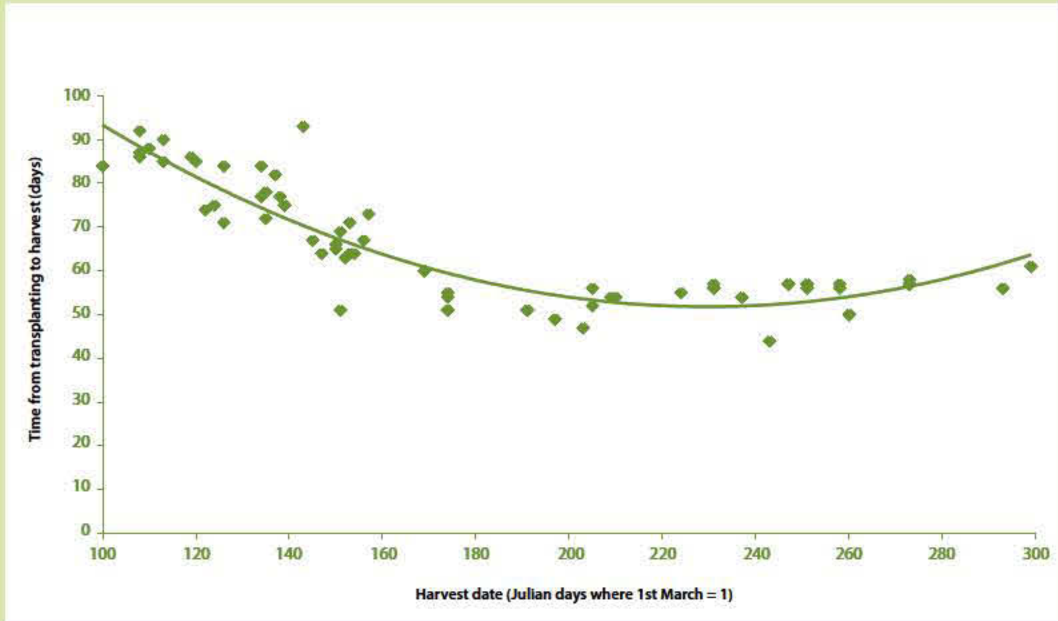


Figure 5. Days from transplanting to harvest East Gippsland 2004-05 data

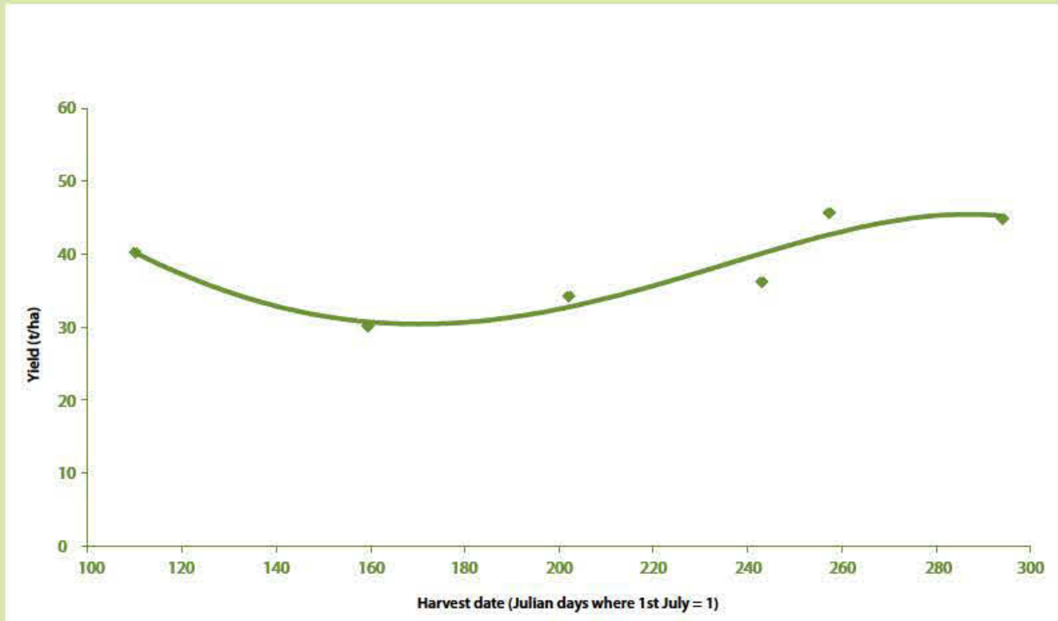


Figure 6. Yield changes over the East Gippsland harvest season 2004-05 data

Conclusions

When looking at scheduling either from a theoretical point of view or from a more practical one, there are several critical points that must be remembered.

First is the quality of the data. The reliability of any harvest timing or yield prediction will only be as accurate as the information used in the scheduling model. It is of vital importance to ensure that the best possible data is used when constructing schedules for transplanting and harvests. Clear and complete historical days-to-harvest (DTH) data is a very good point to start. The data is of greater value if it is variety or at least type specific.

Another important factor when looking at DTH data is to ensure that the accompanying weather data from the specific season in question is available. DTH data should never be looked at in isolation from weather data or any other relevant crop records that may help explain the time from transplant to harvest for each specific crop. Sources of DTH data can include; grower crop records, records from seedling producer, seed companies' records, on-farm weather records or the bureau of meteorology data if it is suitable.

It is possible to develop models that will accurately predict days-to-harvest when a combination of data is used to develop the model. However this is only part of the information required in many cases. The volume of lettuce that will be harvested at any point is also of great importance.

For fresh market producers the number of cartons produced per hectare is quite simple to calculate. It is simply the number of plants transplanted per hectare multiplied by the expected harvest percentage divided by the numbers of lettuce in the carton, usually twelve.

For producers of processed lettuce sold on a per kg basis, the same principle can be used. Rather than dividing the number of harvestable plants by twelve to get the number of cartons produced per hectare, the number of harvestable heads per hectare is multiped by the average weight of each head to arrive at the number of kilograms produced per hectare.

It is this estimation of the final weight of each individual head that can cause much variation in the estimation of yield per hectare. As can be seen in figures 3& 6 the time of year will dramatically influence the total tonnes of material produced per hectare.

It is in areas such as these that grower knowledge is extremely valuable. Past seasons' harvest records from the grower or harvesting contractor can provide a good insight into the likely final head weights as well as seed company estimations.

References

Wurr, D. C. E.: Fellows, J. R.: Suckling R.F. (1988). 'Crop continuity and prediction in the crisp lettuce variety Saladin' Journal of Agricultural Science, 111:481-486

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Varieties

Selecting the appropriate variety

Outcome:

New varieties can be classified into one of five types and scheduled into appropriate transplant times. Varieties with good horticultural properties and full downy mildew resistance and Nasanovia resistance were identified.

Introduction

Selection of the appropriate variety is one of the most important decisions commercial lettuce growers must make each season.

Some factors to be considered before adopting a variety include:

- **Yield** of trimmed heart/head at least equivalent to or greater than the current commercial variety.
- **Disease** and insect pest resistance (especially downy mildew and Nasanovia) is the most economic and effective means of disease and insect pest management.
- **Adaptability** of new varieties under Australian conditions up to 30°C diurnal range especially during the transitional periods.
- **Tolerance** to physiological disorders such as tipburn, rib discolouration, bolting and russetting.
- **Marketable** hearts must exhibit acceptable horticultural traits.
- **Maturity range** you need to mange your season, supply your market, and reduce the risk of weather related crop failures.

Results

Table 1. Classification of iceberg lettuce variety types in Australia into five major groups

Type	Commercial Varieties 2006
Summer Vanguard (Heat tolerant)	Raider, Sahara, Devil Sun, Aztec Sun, Invader
Salinas (Main Season)	Casino, Target, Silverado, Foxtrot Nr, Cartagenas Nr, Barcelona Nr
Salinas x Vanguard (Intermediate)	Patagonia, Titanic, Lily Nr, Kong Nr
El Toro (Cool Season)	Greenway, Marksman, Gatlin
Winter Vanguard (Cold season, frost tolerant)	Winguard

Table 2. Classification of Cos lettuce variety types in Australia into five major groups

Type	Commercial Varieties 2006
Paris Island Cos-PIC (Full traditional cos warm season)	Cosmic, Verdi, Outback, Saxon, Julius, Challenger
Paris Island Cos-PIC (Full traditional cos cool season)	Saxon
Slow Closing (Intermediate)	Shrek Nr, Goblin Nr
3/4 Cos (Slow bolting)	Cyclone
Mini Cos (Compact)	Amadeus

The winter production of iceberg lettuce in the Lockyer Valley (south east Queensland) highlights the need to do variety x time of sowing x location to ensure continuity of supply of lettuce from May to October. This is a 22 – 24 week harvest period commencing in early May and continuing through until early October.

The challenge in this environment is that you have to transplant summer Vanguard types in mid-March that will cope with extremely high temperatures and decreasing days that will be harvested in May. Growers then transition to Salinas types in June, then move to winter Vanguard types for July/August harvest and then returning to the summer Vanguard types for late September/early October harvest (Figure 1). This involves a coordinated approach with the selection of the correct variety and the growing of an optimum sized seedling to ensure that there is a minimum amount of bolting (Figure 2).

The time from transplanting to harvest varies from as little as 42 – 49 days for the March transplant extending out to 70 – 77 days for the mid-winter harvest and then decreasing back to 63 and 56 days for September/October harvesting. The other factor to consider is that during this time yield can vary from 30 t/ha in the May and October period, up to 45 – 50 t/ha in the optimum harvest period in July through to August.

The summer and autumn production of iceberg lettuce in the southern Australia (e g East Gippsland) highlights the need to do variety x time of sowing x location to ensure continuity of supply of lettuce from October to May. This is a 28 – 30 week harvest period commencing in mid October and continuing through until early May.

Figure 1. Winter iceberg lettuce planting sequence.

Figure 2. Bolting in Iceberg lettuce.

The challenge in this environment is that you have to transplant El Toro, Vanguard and Winguard types in mid winter (July and August) that will cope with cold temperatures, cloudy days and increasing day lengths that will be harvested in early spring October/November. The Salinas types are transplanted from mid September to early February as the main season type, then changing back to El Toro, Vanguard types to complete the southern main season (Figure 3). This involves a coordinated approach with the selection of the correct variety and the growing of an optimum sized seedling.

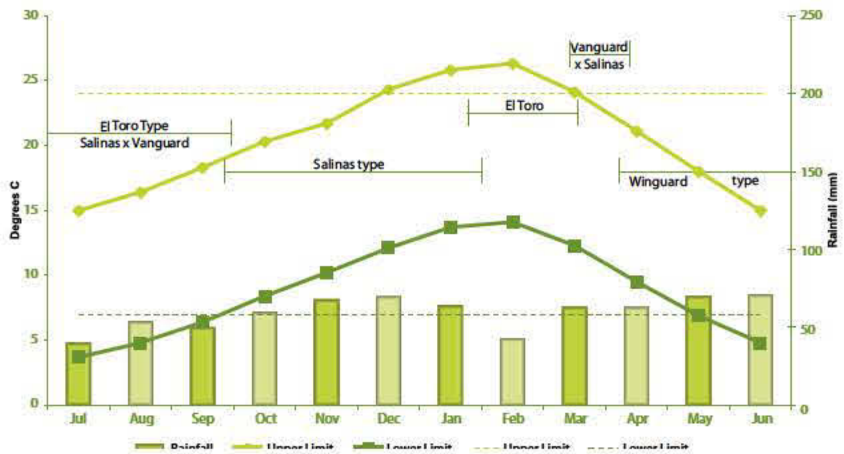

Figure 3. Summer iceberg lettuce planting sequence for southern Australia.

Conclusions

- Trials with lettuce varieties are relatively easy to design, establish and grow to harvest. However, they are very time consuming in terms of making observations, collecting data, analyzing and interpreting the data before making a decision on adopting a new variety.
- Well designed replicated trials with thorough data collection are the only objective way of determining the benefits of a new variety.
- Attributes other than marketable yield (Nasonovia resistance for iceberg and slow bolting for cos) must be taken into account when adopting new varieties.

Risk management

Lettuce production risk management strategies

Goal:
To produce a continuous supply of high yielding, good quality lettuce delivered to the retailer.

Risk	Risk Minimisation Strategy	Booklet Reference
Sub optimal Weather	1. Plant the correct variety type for the region and season 2. Schedule plantings using yield and days to maturity data.	Page 15 Page 11
Pest/Disease pressure	1. Use resistant varieties 2. IPM and scouting	
Limited Water	Use accurate irrigation scheduling and reliable soil moisture monitoring equipment.	Page 8
Poor quality water	Drip irrigation allows more saline water to be used than overhead sprinkler, and uses less water.	Page 8
Monoculture – reduced crop vigour	Adopt crop rotation	
Supply	1. Geographical diversity 2. Adopt crop scheduling	Page 11
Poor quality on delivery	1. Good temperature management through the supply chain 2. Prevent physical damage 3. Ensure best quality product	Page 2

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