

Export broccoli to Japan -supply & quality

Michael Titley

17th June 2014

The challenge-continuity of export quality broccoli

- Harvest maturity date, head yield and quality are all affected by climatic variations during the production cycle, particularly low temperature episodes.
- There are also interactions between genotype and climatic variability.

Factors affecting continuity of supply export quality broccoli

- Specifications
- Examples from Japan - Californian broccoli (June 2014)
- Planning & crop scheduling-Titley's & Tan's thesis
- Classification of broccoli types & maturity times
- History in Lockyer Valley & Eastern Darling Downs
- Direct seeding versus transplants
- Plant density & arrangement- north/south row Brookstead
- Fertilizer programme
- Irrigation schedule
- Identifying optimum harvest time & harvesting
- Post harvest handling & cooling for optimum shelf life
- Sample cost of production –California
- References

Specifications-Japan

- Importing quantities is 1 x 40 F container (960 cartons)
- Questions ?
 - How many heads of broccoli per carton ?- 38 heads per carton
 - The carton size / 10 kg Nett
 - How long would the stalk be ?– refer slides
 - What would the average head weight ? 250 – 280g
 - Current C&F / US\$19.00
 - Packing Style / Iced carton (Direct application refer slides)
- Source
 - BGP International P/L Melbourne via John Baker (PMA)

Specifications-Japan -1



Specifications-Japan - 2



Specifications-Japan - 3



Specifications-Japan - 4



Specifications-Japan - 5

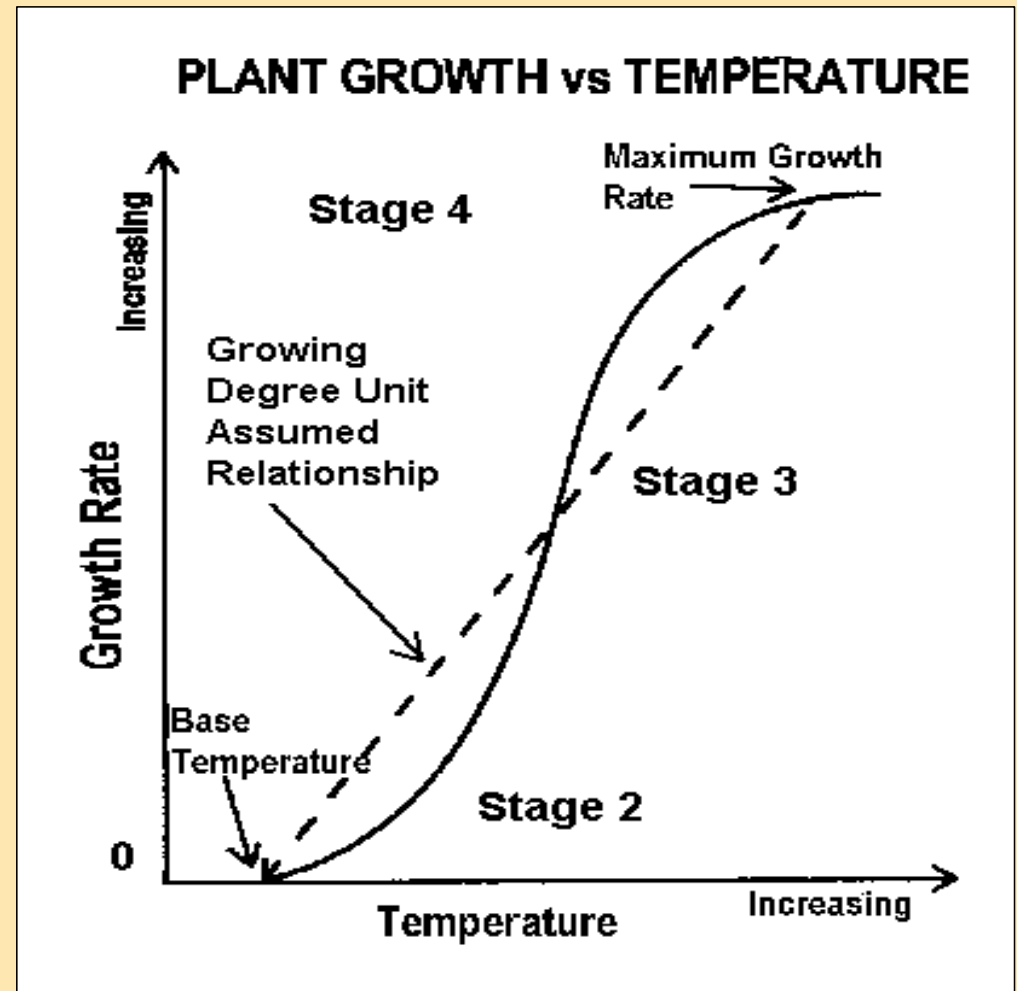


Planning & Crop Scheduling

- Titley's data 12 varieties x 19 seeding dates over 12 month period approximately every 3 weeks x four replications
- Tan's data 3 varieties (Fiesta, Greenbelt & Marathon) x 8 seeding dates from early March to end of May x two photoperiods (natural Gattton day length and 16 hour photoperiod)
- Several years intensive trial work to develop commercial model

Effects of temperature on growth broccoli

- **Cool season vegetable**
 - **Germination**
 - 2-35°C (wide range)
 - 7-27°C (opt. range)
 - **Growth**
 - 5-27°C (wide range)
 - 15-18°C (opt. range)
 - **Base Temperature**
 - 2.2°C
 - 0.0°C
- (Tan et al.1999)



Classification of broccoli x types

| Classification of hybrid broccoli | High temperature range which induces Floral Initiation @ appropriate leaf number |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Early maturity, Hot weather types | 21-22 oC |
| Mid-season, transitional types | 17-18 oC |
| Late maturing, cool weather types | 5-7 oC |
| Long season, cold weather /northern Europe/Dutch types | 2-3 oC |

Commercial classification 2014

| Category | Older standards | Sakata & SPS 2014 | Others |
|------------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------|
| Summer (warm season) | Green King/Embassy Atomic/Viper | Atomic/Viper Brumby , Aurora & SPS 478-2 | Marvel |
| Transitional (Autumn & Spring) | Greenbelt Green Valiant Triathlon | Aurora Brumby, Spinks & Annapurna | Iron Kuba |
| Cool-cold, mild- cold winter | Marathon/ Legacy Shogun etc. | Spinks Prophet Solitaire Bridge & Babylon | Tyson Heritage |
| Cold-very cold winter | Samurai/Victory | Minimal use now | |

Premature heading-spring transition period due to stress



Commercial co-operators –Lockyer Valley & Eastern Downs

- Lockyer Valley vegetable growers John Ford and Kev Connors after commercial model developed by Horticultural Field staff at QAC following trials by Titley
- Eastern Darling Downs group of four farmers who supplied Matilda from late 1992's until 2008 with support from Tan's work in crop scheduling

Direct seeding : the key!

- Californian broccoli predominately direct seeded with some transplanting in certain regions 10-30%
- ‘Crown cut’ broccoli for export: heads 12.5-13.7 cm across , stem 12.5cm
- Plant population – 102,000 pl/ha (40,000 pl/ac)

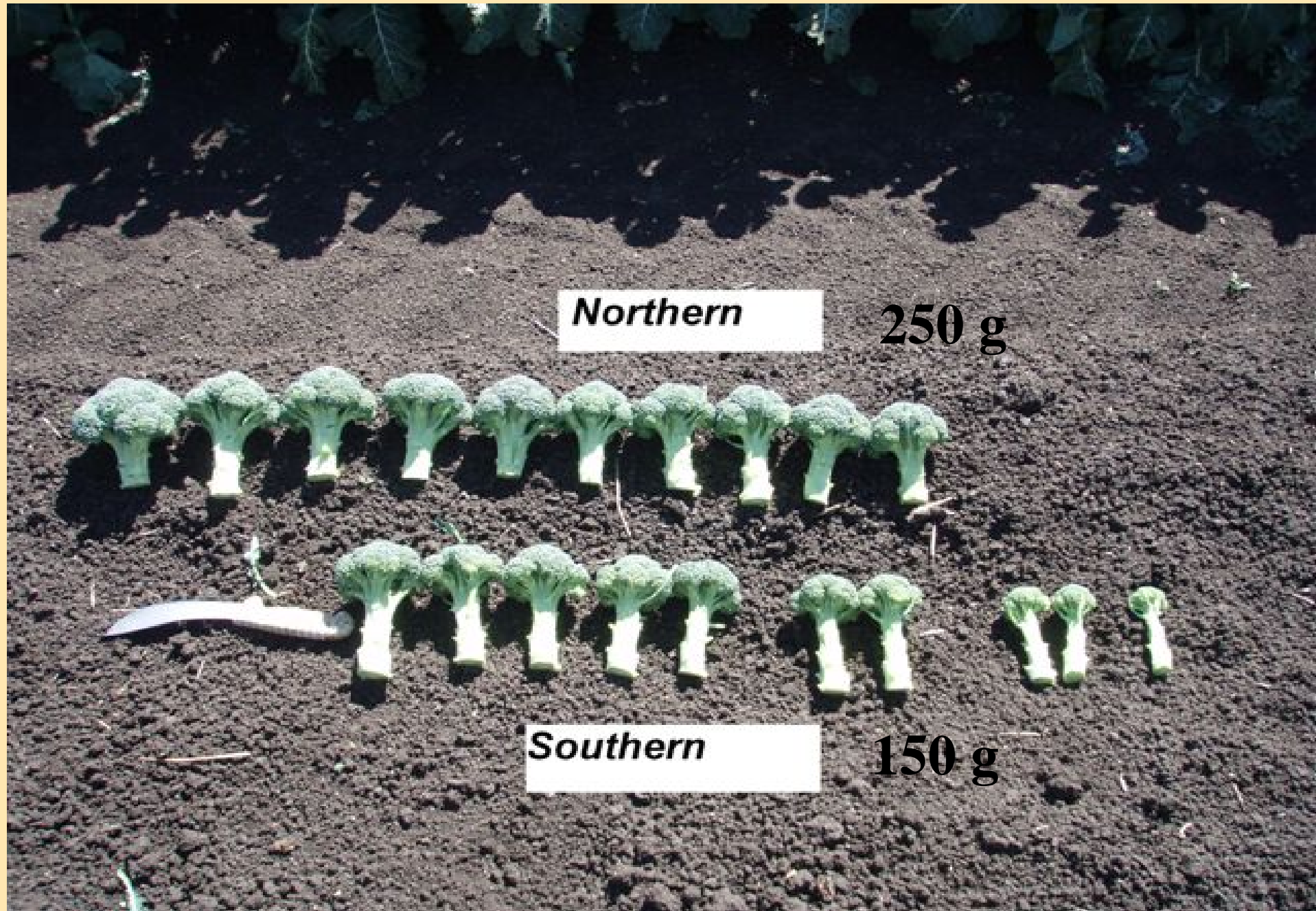
Agronomic programme to improve the uniformity of broccoli for once-over mechanical harvest-VG06053



Row orientation direct seeded broccoli



Plant density & Arrangement



Variety types - VG06053



Agronomic programme to improve the uniformity of broccoli for once-over mechanical harvest-VG06053 summary

- Improved the harvest percentage by up to 90%, by ensuring a uniform plant stand.
- Increasing plant density from **60,000** plants per hectare to **90,000** plants taller, straighter stems and suitable machine harvest,
- Varieties Gypsy and Atomic consistently produced tall straight stems with small heads at this density
- It is important to note that the season (autumn , winter or early spring) and the district had a greater influence on yield than the individual variety.
- This result highlights the importance of growing a crop in the correct seasonal and geographic location for optimum yield and quality.
- It is also important to have uniform irrigation and nitrogen applications for a uniform plant stand. Variations in these two inputs across a planting will produce variability in plant height and reduce the efficiency of the mechanical harvester.

Winter broccoli export ready for cooling



Optimum temperature & relative humidity

- Low temperature is extremely important to achieve adequate shelf life in broccoli
- A temperature of 0°C with >95% RH is required to optimize broccoli storage life of **21-28 days**.
- Heads stored at 5°C can have a storage life of 14 days
- Heads stored at 10°C can have a storage life of approximately 5 days
- Broccoli is usually rapidly cooled by liquid-icing the field-packed waxed cartons in USA.
- Hydro cooling and forced-air cooling also can be used, but temperature management during distribution is more critical than with iced broccoli.

Sample cost of broccoli production California 2012

- Growing costs - USD 4,530/ha
- Harvest and packaging - USD 7,803/ha
- Overhead costs cash - USD 2,132/ha
- Overhead non-cash - USD 415 /ha
- Total USD 14,880 /ha

- Revenue @ 1,438 10 kg cartons at USD x /carton
- Revenue @ 2,000 10 kg cartons at USD x /carton

References

- Marita Cantwell & Trevor Suslow (UCD Post harvest specialists)
- S.L. Gillies and P.M.A. Toivonen (1995) ‘Cooling Method Influences the post harvest quality of broccoli’ HortSci 30:313-315
- David Simons (Post harvest specialist at QAC in 1980’s) who worked on broccoli project at Gatton College in 1980’s
- Dr Gordon Rogers (2009) ‘Agronomic programme to improve the uniformity of broccoli for once-over mechanical harvest’ Applied Horticultural Research P/L Project Number VG 06053
- Tan, D (1999) ‘Effect of temperature and photoperiod on broccoli development, yield and quality in south-east Queensland’ (PhD Thesis)
- Titley, M E (1985). ‘Crop scheduling in broccoli.’ (M.Sc.Agr. Thesis) 196 pp. (University of Sydney: Sydney.)
- Dara, S K et al (2012) ‘Sample costs to produce fresh market broccoli in Central Coast Region California’ University of California Co-operative Extension Service

Acknowledgements

- Queensland Agricultural College (QAC) field staff and Horticulture Department
- COD especially Arthur Shand
- Messrs. Ford & Connors
- Four farmers who supplied Matilda Fresh
- Dr Daniel Tan
- Dr Gordon Rogers and all AHR staff working on mechanical harvesting broccoli project
- Peter Scott Sakata Seeds & Ross Edser SPS Seeds