12. Would like Emeritus status (senior rate).

13. Boring, irrelevant articles reduce readership. Be more selective. Articles should benefit members, not just authors.

14. Reduce expense of Journal, but not at expense of quality.

15. Journal name should reflect content.

16. Develop format for non-refereed papers.

17. APS is mostly an apple organization and the Journal mostly a publication for NC-140 members to publish their work. Small fruit workers feel left out.

18. Include research on sustainable, organic, and permaculture systems in Pomology.

19. Maintain variety orientation, but add pertinent abstracts from other journals. Should *not* include general pomology.

20. Provide better cultivar (variety) descriptions—disease, insect susceptibility, pollination, rootstock reaction, alternate names.

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Thirty-Seven Apple Varieties of Australian Origin

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Abstract

Australia's climate, location and history have influenced apple cultivar breeding and selection. Thirty-seven cultivars originating in Australia are described. 'Granny Smith' has been the most widespread success to date. Apple production districts are spread across six States, with Victoria producing 30% of the 310,000 tonnes produced annually in Australia. Cultivar improvement via conventional breeding and biotechnology research is ongoing and co-ordinated across four States.

Introduction

Australia's wide range of climates, its geographical isolation and the pattern of British colonization since 1788, have all influenced the development of a set of uniquely Australian apple cultivars.

Early settlement spread from where Sydney now stands, with most settlers being from the British Isles until the post-war migrations of the 1900s.' Initial apple production for local consumption grew into a sizeable export trade to Britain, that continued until the 1960s.' Thus, the early apple industry was based on cultivars transported by settlers, was most successful in the cooler climates of south-eastern Australia and expanded by supplying English markets.

As apple production spread to all States, unique climates and marketing niches were utilised by selection of local cultivars. For example, Queensland's five selections are all early maturing to enhance the early market advantage that State enjoys. Further, Western Australian districts are often too hot to produce quality 'Delicious' apples and quarantine restrictions preclude imports from other States. Consequently many late maturing red selections have been made there.

The geographic isolation of Australia has been enhanced by quarantine restrictions on pear budwood importation since 1909 (9, 10) apple budwood importation since 1920 (10) and a ban on fresh apple and pear imports since

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1921 (11). This isolation has restricted the introduction of germplasm and development of new varieties. However, this quarantine has also kept Australia free of the major apple bacterial disease, fire blight *(Erwinia amylovora)*, which could limit production of some cultivars in many districts.

A History of Selection

Selection of local cultivars began early and interestingly, one of the first recorded selections, 'Granny Smith,' has become Australia's most significant gift to world pomology. The history of apple selection is a chronicle of the activities of leading growers, nurserymen and district horticulturists. Some small scale breeding occurred early on, but most selection was of chance seedlings. Larger scale breeding programs were initiated in 1930 by the New South Wales Department of Agriculture, in 1947 by the Victorian Department of Agriculture, in 1950 by a private Stanthorpe breeder, Henry Franklin, in 1964 by the Queensland Department of Primary Industries and in 1972 by the Western Australian Department of Agriculture.

This review documents 37 Australian apple cultivars (Tables 1 and 2) that have had impact on the development of the local industry. Some are still grown but others fell from favour as market requirements changed, production technology advanced or new varieties were introduced. A variety was usually judged by its appearance, eating quality, ability to store and transport and harvest period.

Australian Apple Production

Australian apple production is spread across six States (Table 3). The southern mainland State of Victoria has many diverse districts and also grows most of Australia's pears (87%). New South Wales is the most populous State and its capital, Sydney, is the site of the nation's largest wholesale produce market. Tasmania previously grew over half of Australia's apples, exporting these around the world, and earned the title, 'The Apple Isle.' However, the United Kingdom's entry into the European Economic Community caused a loss of major export markets. A lack of aggressive, centralised marketing and increased production from southern hemisphere export districts, particularly New Zealand and South Africa, worsened the situation (48). This was further compounded by increased production from Chile, rising costs and a shift in consumer varietal preferences. Major industry restructuring occurred in the 1970s' and recently Tasmania has been building an export profile in Asian markets. Western Australia is isolated by the wide desert plains of central Australia and enjoys freedom from several major pests and diseases of apples. Consequently fruit from the other States cannot be marketed there. 'Granny Smith' grows particularly well in Western Australia and is sought after on all State markets. Stanthorpe in Queensland is Australia's most northerly apple district. Production is only possible because of the 900m elevation and consequent cold winters. Stanthorpe is noted for its earliness of production and quality, 'Granny Smiths.' South Australia's production mainly supplies its capital, Adelaide, and this State is noted for the quality of its 'Jonathans.'

Australia did not experience the production increases that occurred in the other Southern Hemisphere countries in the 1970s' and 80s.' Production for the three years 1989-91 averaged 310,000 tonnes (3).

Major Early Maturing Cultivars

'Abas': This is a Jonathan type dessert apple also known as 'Brown's Seedling,' 'Bullock's Seedling,' 'Cole's Seedling' or 'Abys.' It has better shelf life than other early cultivars, but its main drawback is severe biennial bearing. It is still being planted in some early districts but will probably not compete with some of the new regular-cropping high-quality early cultivars.

'Adina' and 'Goldina': Bred by Henry Franklin's private program 'Adina' and 'Goldina' have only been planted in Queensland by a private consortium of growers. 'Adina,' a very dark, firm apple, has been commercialised by Stark Brothers Nursery, from Louisiana, MO, USA, as a lower chill, heat tolerant variety and trialled in a range of climates worldwide. 'Goldina,' a striped red over golden apple has the better eating quality of the pair. Both crop very heavily.

'Earlidel,' 'Summerdel' and 'GB 63-43': These are all early maturing apples from the breeding program at the Granite Belt Horticultural Research Station, Applethorpe, Australia. The initial crosses were made by Mr. Calvin W. Winks. Small size and short shelf life will limit the use of 'Earlidel' but its extreme earliness (six weeks before 'Delicious') is unique. 'Summerdel' bears heavily, attains good size and is harvested just prior to the New Zealand bred apple, 'Gala,' and should have wide application. 'GB 63-43' may have potential in medium chill environments.

'Bonza': Bonza was selected by Mr. B. Atkinson as a chance seedling on his Batlow orchard and tested by the New South Wales Department of Agriculture. It resembles 'Jonathan' but has better storage life and is less prone to powdery mildew. 'Bonza' is often sought as an alternative apple to 'Red Delicious' by retailers. Also known as 'Bonser.'

'Redbow': Notable because it was the only introduction from the New South Wales Department of Agriculture's breeding program, based at Bathurst. Named after Dr. F. T. Bowman, the breeder and later chief of the Division of Horticulture. A firm dark red apple, it was selected for resistance to apple scab *(Venturia inaequalis)* and its heavy cropping capacity. Although widely tested, only small commercial plantings were made.

Major Mid Season Cultivars

'Lalla Red Delicious': A limb sport (natural colour mutation) of standard Delicious, whose colour develops earlier and shows more blush than its parent line. The only Australian selection of 'Red Delicious' ever widely planted, it has since been superseded by sports of United States origin.

'Geeveston Fanny' and 'Tasman's Pride': Both these cultivars were minor but important export varieties grown mainly in Tasmania. 'Tasman's Pride' was used as a dessert and a cooking apple. Both show reasonable field resistance to *Venturia inaequalis*. 'Geeveston Fanny' is the heavier setting of the two and 'Tasman's Pride' is prone to biennial bearing. There is some doubt as to whether 'Geeveston Fanny' was a true Australian selection or a selection made from imported trees. 'Geeveston Fanny' is also known as 'Susan's Pride.'

'Stewart's Seedling' and 'Dunn's Seedling': Both are green cooking apples, often with some red blush on their exposed cheek. Heavy croppers but prone to biennial bearing, they were domestic and export varieties. 'Dunn's' was listed as the seventh (out of 42) ranking export variety in the years 1938-1940. 'Stewart's' were mainly planted in Victoria but 'Dunn's' were grown in all States, especially in Western Australia. 'Dunn's' was still a significant variety in South Africa in the 1970s. Although 'Dunn's' could be eaten as a dessert variety when green/yellow and mature, it often russetted or stem cracked and was unattractive. Both 'Dunn's' and 'Stewart's' were superseded by the dual purpose and attractive 'Granny Smith.' 'Dunn's' was also known as 'Munroe's Favourite.'

'Granny Smith': Named after Mrs. Maria Ann Smith who raised the seedling from some discarded rotten apples or cooking apple scraps. A green dual purpose apple that may sunburn and/or blush in very hot conditions. A vigorous, high yielder it can be picked

early as a tart cooker, picked mid-late season for long-term storage or left late as a well flavoured dessert apple. Crisp, juicy and adaptable to a range of environments it has become one of the world's great apples. Grown mainly in the Southern Hemisphere until relatively recently, it is now grown worldwide.

Mr. John G. Hannaford discovered a spur type mutation of 'Granny Smith' on his Mt. Bera orchard in 1966. This and further selections have been widely tested but usually found to have an inferior appearance or internal qualities.

Major Late Season Cultivars

'Democrat' and 'Crofton': These attractive, firm apples are often small and biennial bearing is a problem if trees are not thinned well. They were major export and domestic varieties grown particularly in Tasmania. Both store very well but have been largely superseded by controlled atmosphere stored 'Red Delicious.' 'Democrats' still comprised 2.5% of Australian production in 1989 and are still exported to Scandinavia. 'Crofton' is the sweeter of the two cultivars but its shape is too flat for Asian markets.

'Democrat' was officially renamed 'Tasma' in 1913 to avoid confusion with the 'Democrat' apple of New York. But by 1938 it was again referred to by its original name, even in official records.

'Legana': This late keeping firm apple has dark red-purple skin and sometimes a green tinge to the flesh. Being thick skinned it is less prone to pest attack and transports well. A heavy cropper with only low to moderate vigour the trees are often compact and of a spreading habit. The product of deliberate crossing by Mr. James Bulman, it has been superseded by better tasting, more attractive late cultivars.

'Statesman': An attractive, long storing variety that bears heavily and can be prone to biennial bearing. Grown in all States, it was used as a firm late season apple and for export, reaching greatest production in the 1950s' and 60s.' 'Pioneer' was a minor variety selected with 'Statesman' from seedlings originally grown as rootstocks by Mr. William Chandler.

'Red Statesman' and 'Warrior': Two distinct red sports of 'Statesman.' 'Warrior' was selected by William Chandler's grandson, Harry, on his Victorian orchard (32). Smith (38) incorrectly lists 'Warrior' as being of New Zealand origin. An orchardist, Mr. H. K. Caldicott selected another red sport of 'Statesman' some 27 years later in South Australia.

'Red Gem,' 'Red Granny Smith' and 'Murray Gem': 'Red Gem' is known as 'Red Granny Smith' in eastern Australia. It is similar in appearance to 'Jonathan' but because it is susceptible to deep scald in storage, this cultivar is usually sold soon after harvest. It is still a minor dual purpose variety in Western Australia.

'Murray Gem' is a firm, long keeping dessert apple. Of minor importance the name is derived from Australia's longest river, the Murray. 'Murray Gem' is also called 'Red Granny Smith.'

Major Very Late Season Cultivars

'Lady Williams': A very firm slightly acid apple that keeps outstandingly well in cold storage and has a long shelf life. 'Lady Williams' is named after Mrs. Maud Williams who nurtured it on the family orchard. Harvested some 3 months after 'Granny Smith,' it often does not mature properly in cooler districts where the growing season is too short. Most plantings did not occur until after 1970 and it has been recently superseded by its progeny, 'Pink Lady' and 'Sundowner' which are less prone to the storage disorders superficial scald and bitter pit.

'Pink Lady,' 'Sundowner' and 'Big Time': These apples were produced by Mr. John Cripps who combined the excellent keeping characteristics of the seed parent, 'Lady Williams,'

Table 1. Apple varieties of Australian origin.

Cultivar name	Pedigree[1]	Site & Year[2] of origin	Harvest season	Size[3]	Current[4] status	References
Abas	Seedling of ?Jonathan	Shepparton East, Vic, 1940	Early	M	Commercial	13, 17, 25, 51
Adina	Golden Delicious X ?Williams Favourite	Stanthorpe, Qld, 1950	Early	L	Commercial‖	14, 30
Big Time	Lady Williams X Golden Delicious	Stoneville, WA 1979	Very late	L	Under test	49
Bonza	Chance Seedling	Batlow, NSW, 1950	Early-Mid	M	Commercial	7, 8, 15, 16, 17
Cole	?Jonathan X ?Dutch Mignon	Lang Land, Vic, C. 1910	Late	M	Superseded	38
Crofton	Pomme De Neige X ?Scarlet Pearmain	Mount Stuart, Tas, 1870	Late	S-M	Commercial‖	17, 23, 38, 42, 46
Democrat	Seedling of ?Hoover	Glenlusk, Tas, C. 1900	Late	M	Commercial‖	21, 38, 39,46
Dunn's Seedling	Chance Seedling	Sth Australia C. 1850	Mid-Late	M-L	Superseded	12, 29, 38
Earlidel	Delicious X Early McIntosh	Stanthorpe, Qld, 1968	Very Early	S-M	Minor†	5, 14
GB 63-43	Delicious x Earliblaze	Stanthorpe, Qld, 1968	Early	M	Under test	35
Geeveston Fanny	Unknown	Geeveston, Tas	Mid-Late	S-M	Superseded	24, 38, 44, 46
Goldina	Adina X Golden Delicious	Stanthorpe, Qld, 1968	Early	L	Commercial‖	
Granny Smith	Seedling of French Crab	Ryde, NSW, C. 1850	Mid-Late	M-L	Commercial	1, 4, 13, 17, 20, 22, 38, 46
Lady Williams	?Granny Smith X ?Rokewood	Paynedale, WA. 1935	Very Late	L	Commercial	13, 17, 27
Legana	Democrat X Delicious	Legana, Tas, C. 1930	Late	M-L	Commercial‖	8, 28, 38, 45, 46
Murray Gem	Unknown	The Riverland, SA, C. 1940	Late	M	Superseded	34
Pink Lady	Golden Delicious X Lady Williams	Stoneville, WA, 1973	Very Late	L	Minor†	13, 14
Pioneer	Seedling of Blue Pearmain	Malvern, Vic, 1858	Late	M	Superseded	32, 50
Ranelagh	Unknown	Ranelagh, Tas, C. 1890	Mid-Late	M	Superseded	43
Redbow	Democrat X Jonathan	Bathurst, NSW, C. 1927	Early-Mid	M	Superseded	8, 15
Red Gem	?Jonathan X ?Granny Smith	Dwellingup, WA 1935	Late	M-L	Commercial	13, 14
Rokewood	Unknown	Dereel, Vic, C. 1870	Late	M	Superseded	12, 31, 32
Shepherds Perfection	Chance Seedling	Sommerville, Vic, C. 1870	Mid-Late	M	Superseded	12
Statesman	Seedling of Blue Pearmain	Malvern, Vic, 1858	Late	M-L	Superseded	32, 38, 46, 50
Stewart's Seedling	Seedling of ?Dunn's Favourite	Ballarat, Vic, C. 1870	Mid-Late	L	Superseded	12, 26
Summerdel	Delicious X Earliblaze	Stanthorpe, Qld, 1969	Early	M	Minor†	6, 14
Sundowner	Golden Delicious X Lady Williams	Stoneville, WA, 1973	Very Late	L	Minor†	13, 14
Tasman's Pride	Chance Seedling	Margate, Tas, C. 1890	Mid	M-L	Superseded	33, 40, 46
Wandin Pride	Emperor Alexander X Jonathan	Scoresby, Vic, 1948				

[1]Pedigree—Seed parent x pollen parent, "?" denotes an uncertain but most likely parent.
[2]Year of Origin—is the date of cross pollination of bred varieties or the date of first observed fruiting of chance seedlings.
[3]Size— S = small, M = medium, L = large.
[4]Current Status—Minor† = Cultivar presently of minor commercial importance but having good prospects, being actively trialled and planted; Under test = Cultivar with some potential, being trialled; Commercial‖ = Cultivar of diminishing commercial importance, not being planted; Superseded = Cultivar no longer of commercial importance, not being planted; Commercial = Cultivar of some commercial importance, still being planted.

Table 2. Bud mutations or sports selected in Australia from existing varieties.

Sport name	Origin	Site and year of origin	Current status[1]	References
Bryant Gravenstein	Red sport of Gravenstein	Wantinwa, Vic, C. 1932	Commercial	37
Caldicott Delicious	Red sports of standard Delicious	Lenswood, SA, C. 1950	Superseded	19
Dearmans Delicious		Norton Summit, SA, C. 1965	Superseded	19
Glen Vimey Delicious		Hahndorf, SA, C. 1965	Superseded	17
Lalla Delicious		Lalla, Tas., 1914	Commercial	8, 41, 46, 47
Mt Bera spurred Granny	Spur type sport of Granny Smith	Cudlee Creek, SA, 1966	Superseded	18
Red Statesman	Red sports of Statesman	Lenswood, SA, 1940	Superseded	8
Warrior		The Basin, Vic, 1913	Superseded	32, 38, 50

[1]Current Status—As per previous table.

with the good fruit quality of the pollen parent, 'Golden Delicious.' 'Pink Lady' has been the most planted of the three to date, it is very vigorous and if not managed correctly produces pale fruit. 'Sundowner' is a less vigorous cultivar that produces darker, slightly sweeter fruit. Both are being developed as premium domestic and export apples and are being grown under trial worldwide. 'Big Time' has larger fruit but has yet to be widely tested.

Ornamentals

'Wandin Pride': 'Wandin Pride' was selected from the Victorian Department of Agriculture's breeding program at the Scoresby Research Station (now the Institute of Horticultural Development, Knoxfield). A weeping apple tree, it was propagated by a nurseryman at Silvan in the Wandin district. It was first noticed in the Scoresby Nursery and was the only selection from a small program that aimed at producing improved quality dessert apples (L. Jaeger, personal communication).

Future Breeding Directions

Despite the wide range of fresh fruit available in Australia, high quality apples continue to experience strong consumer demand. Apples are second only to citrus for production and gross value of fruit (3). To meet the future demand for new cultivars the apple industry has given varietal improvement a high priority. In 1992/93, 22% of apple and pear research grant funding was directed towards the creation and development of new cultivars. This research included conventional breeding, biotechnology and post-harvest development. To be successful, a new cultivar has to have superior qualities to the present standards or fill a vacant niche. If research support is maintained new Australian cultivars will be available for future growers and consumers.

Table 3. Distribution of Australian apple production districts.

State	% of Australian production[1]	Main districts
Victoria	30%	Bacchus Marsh, Coldstream-Wandin, Dandenong Ranges, Goulburn Valley, Harcourt, Mornington Peninsula, Narre Warren, Packenham, Stanley-Beechworth
New South Wales	21%	Batlow, Bilpin, Camden, New England, Orange
Tasmania	17%	Huon Valley, Mersey Valley, Tamar Valley, Tasman Peninsula
Western Australia	13.5%	Donnybrook, Manjimup, The Hills
Queensland	11.5%	Stanthorpe
South Australia	7%	Lenswood-Forest Range, The Riverland, Mt Gambier

[1]Source: Aust. Bureau of Statistics, average of years 1990 and 1991.

There are two conventional apple breeding programs in Australia. The Western Australian program is continuing to breed cultivars which are adapted to the Australian mild winters and long hot summers. Lower chilling, high quality cultivars that handle and store well are being selected. The emphasis is on the mid to late harvest period and domestic and export markets are being targeted. Queensland is continuing to select for superior quality early red cultivars harvested prior to 'Gala.' Additionally, since 1986 disease resistance has been a breeding objective. Cultivars resistant to apple scab *(Venturia inaequalis)* and powdery mildew *(Podosphaera leucotricha)* and suitable for production in a range of Australian districts are being bred and selected for at Applethorpe. In both Western Australia and Queensland attention is paid to consumer preferences for improved taste and acceptable appearance.

Biotechnology research at Sydney University and at the Institute of Plant Science at Burnley, Victoria, is developing transformation and regeneration techniques for the major Australian apple varieties. Post-harvest or pest and disease resistance genes may be introduced to existing cultivars. Cooperation and exchange between the four programs is ongoing.

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'York'—Firmness

Pre-storage flesh firmness and soluble solids content were the best predictors of post-storage firmness. Other storage predictors (ethylene, starch, seed color) did not improve firmness prediction. See Evensen et al., 1993, Hort. Technology 318-322.