Lincoln University magnolia collection
- a working document

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Agricultural Sciences Group
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The Lincoln University Magnolia collection

Introduction

In June 1990, after discussions with Dr McArthur it was agreed by the Works Committee to fund a more comprehensive replacement collection of Magnolia species, hybrids and cultivars to replace established trees being destroyed. These were in the Old formal Garden area to the South west of the Lodge where the new Commerce building was to be built.

The replacement magnolias were largely sourced from Duncan and Davies Nursery in New Plymouth by Martin Capstick the then supervisor of the Grounds Department on our behalf and were funded in the first instance by the Works Committee. These magnolias were planted to the south west corner of an area then set aside for students of the Diploma in Parks and Gardens Technology just inside the gates of the Horticultural Research area at the western end of Farm Road.

Roy Edwards and Pamela Gibbons, with some help from Brent Richards planted the first of the collection on September 7th 1990. Subsequent plantings were made in 1991, 1992 and a few in 1993, these magnolias were also from Duncan and Davies. In more recent years plants have been procured as replacements, where some had died and only one or two additional accessions have been made, some of these from Peter Cave’s Nursery and Tikitere Gardens Nursery.

Other people have contributed in many ways, particularly with the maintenance of the collection, Richard Poole and Bruce Palmer in particular were both of great help to me over the years, but in both cases their funding was cut. More recently the Grounds have had an input into looking after the area, taking over its maintenance for about three years. The Field Services Centre has also provided considerable assistance in the maintenance of the area for a significant period. The green stands for the labels were provided for me free of charge by Warwick Scadden the then curator of the Christchurch Botanic Gardens through a temporary employment programme that was running at that time. Others have also donated plants or time.

Because this is seen only as a working document, I have listed the magnolias alphabetically with notes about the parentage and flowering times mainly. Some articles and papers, published before or not, are also included as they may be of interest. The former genera Michelia and Manglietia are included as both are now classified in the genus Magnolia.

While the following list is quite extensive (around 130 different species, hybrids and cultivars) there are still some gaps that could be easily filled in order to have a more complete collection. Labelling and some of the plants were funded by the Brian Mason Trust as was some research that was largely carried out by Dr Anthony Mitchell. Lincoln has the largest collection of magnolias in the South Island of New Zealand according to some research on plant collections (Lincoln code is 129) carried out by Dr Marion MacKay of Massey University in 1995. (1)

There is more work that needs to be done, a better way of funding the collection and promoting its value to the Lincoln community, each year, particularly in spring when the bulk of the collection is in flower there is a steady stream of visitors into that area, many of whom had not known it exists. Most, it seems, are pleased that it is there. I am grateful to all of the contributors who have assisted with the development and maintenance of this collection to now.

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**Magnolia acuminata**

Parents: *M. acuminata*  
Purchased: Peter Cave's Tree Nursery, Hamilton.  
Accession number: 103

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Photo 24th June 2009

Need photo when it flowers
**Magnolia acuminata** ‘Golden Glow’

Parents: *M. acuminata*

Purchased: Duncan & Davies, New Plymouth.


Accession number: 18

The cultivar that had been budded on this tree died within a few years of planting and the rootstock remained alive and subsequently grew. The cultivar did flower in the early years, but I have no photos of that. Symptoms associated with the demise of this scion included a black slime oozing from the grafted area prior to its death. The scion had flowered the previous season and had given no indication of potential graft incompatibility at that stage. The rootstock was not removed for various reasons and some years later began to flower. It produced very large flowers, not like any other in the collection and was observed for a number of years. See *Magnolia x soulangeana* ‘Vivienne’ p.104.
**Magnolia ‘Albatross’**

Parents: *M. cylindrica* x *M. x veitchii* ‘Peter Veitch’ 1.

Purchased: Cave’s Tree Nursery

Planted: Original tree was planted in 1999 and died soon after. A replacement tree was planted about 2004.

Accession number: 124

Photo 9th September 2008. Large flowers sit upright on branches on bare branches.

Photo 9th September 2008

**Magnolia amoena**
Parents: *M. amoena*
Purchased: Peter Cave’s Tree Nursery, Hamilton
Planted: 1998
Accession number: 98

Photo 9th September 2008. There are few records of flowering for this cultivar, but this tree flowered for the first time three years after planting with the majority of flowering occurring during early and mid September, with the odd flowering being recorded in January and February.

Photo 9th September 2008
Gardiner (1) describes this species as “The precocious pale pink flowers are slightly fragrant and cup shaped to 5cm tall. Three of the nine tepals are erect and six reflexed.” From this description there appears to be a discrepancy with what is shown above. This species needs further investigation to be certain of its correct identification.

**Magnolia ‘Ann’**


Purchased: Duncan & Davies, New Plymouth. 


Accession number: 61

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Both pictures 2nd October 2008. The majority of the flowering for this cultivar is normally late September and early October, although in some years a few flowers may be seen in February to May and from mid September to mid December. The flowering spread is a characteristic of *M. liliiflora* ‘Nigra’ one of its parents. Flowering began by the end of the first week of September in 2009.

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Note in the above picture the rootstock (appears to be a very good *M. x soulangiana* seedling) but it is taking over and needs pruning if the cultivar ‘Ann’ is to be retained.

**Magnolia ‘Apollo’**

Parents: *M. liliiflora* x *M. campbellii* subsp. *mollicomata* ‘Lanarth’ (NZ raised Jury hybrid) 1.  
Purchased: Duncan & Davies, New Plymouth.  
Accession number: 34  

The greatest bulk of flowering for this cultivar at Lincoln is during September and October with a second and smaller flowering again from January to the end of March. A few flowers may be seen outside these periods. The second flowering character is common in one of its parents *M. liliiflora*.

Photo 14th Sept. 2009. *Magnolia ‘Apollo’* is a small rounded topped deciduous tree that flowers from an early age and can produce at least some flowers for almost one third of the year.

**Magnolia ‘Athene’**

Purchased: Duncan & Davies, New Plymouth.
Accession number: 51

The bulk of the flowering of this cultivar is normally from the first or second week in September and finished by the end of the first week in October. There are generally no flowers seen outside of these times at Lincoln.

Flowers are large on bare branches, flowers appear from an early age.

**Magnolia ‘Atlas’**

Parents: *M. x soulangeana* ‘Lennei Alba’ x *M. ‘Mark Jury’*. (This is a New Zealand Jury raised cultivar, a sister seedling of *M. ‘Iolanthe’*). 1.

Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990 died, a second planting was made in 2002
Accession number: 141

Both pictures were taken 16th September 2008. The majority of flowering occurs from early September for up to three weeks. Flowers sit upright on branches, even on young plants as illustrated above (Six years after planting).

Flowers are very large, around 30cm across.

**Magnolia ‘Betty’**

Parents: *M. liliiflora* ‘Nigra’ x *M. stellata* ‘Rosea’ (De Vos & Kosar hybrids from the US National Arboretum, named in 1965) 1.

Purchased: Duncan & Davies, New Plymouth.


Accession number: 4

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Photo 16th September 2008 showing early flowers. This cultivar has two main peaks of flowering, the main peak is during September and October, a second smaller peak is during January and February. The actual number of days any flowers may be seen in any year is on average just over 130 days. Most flowers are seen from mid to late September and mid October.

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Photo 14th September 2009. This is spreading shrub more similar to *M. liliiflora* ‘Nigra’.

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Magnolia biondii
Parents: M. biondii
Purchased: Peter Cave’s Tree Nursery, Hamilton.
Accession number: 95

This tree to date has not yet flowered at Lincoln. It is a deciduous, precocious flowering magnolia. According to Gardiner (1) “This rare medium – sized deciduous tree is native to Central China - Henan Province”, “Magnolia biondii was not introduced to the west until 1977”, on flowers - “the nine tepals are white with a purple stripe running more or less the length, being broader at the base. They are about 5cm long, slightly fragrant and splay out to 10cm wide”. There is reportedly some variation (1) “numerous plants vary in tepal number (9-12), size, shape and colour (from creamy white, creamy yellow with purple spotting at the base, to purple), especially in the outer three tepals”.

Photo 24th August 2009. Magnolia biondii is the tree in the foreground, Magnolia ‘J.C. Williams’ is the deep purple flowering tree in the background.

Young foliage 2nd November 2009. The evergreen (aphid resistant strain of spruce) Picea sitchensis is seen in the background, this photo was taken from a slightly different angle to the above.

**Magnolia ‘Black Tulip’**

Parents: seedling of *M. ‘Vulcan’* x *M. ‘Iolanthe’* (NZ raised Jury hybrid) 1.
Purchased: by Grounds Department from Elliott’s Wholesale Nursery Ltd. Amberley
Planted: 1999
Accession number: 132

Photo 31\textsuperscript{st} August 2009. Flowering is likely to be in mid to late September with occasional flowering as early as the last week of August with a reduced flowering extending into mid November and beyond.

Photograph 16\textsuperscript{th} September 2008. Photo lower right 2\textsuperscript{nd} November 2009 shows late flowering with significantly smaller flowers than are seen in the first flush, note the developing fruit from the earlier flowers.

**Magnolia x brooklyensis** ‘Eva Maria’

*M. acuminata* x *M. liliiflora* (possibly backcrossed with *M. acuminata*) Named after Eva Maria Sperber and registered in 1968 1.

Purchased: Tikitere Gardens Rotorua
Accession number: 135

(Note the photos below are NOT ‘Eva Maria’)

Both photos 26th August 2009. This is clearly a rootstock as ‘Eva Maria’ should be yellow. The rootstock appears to be a seedling of *M. x soulangeana*. Like many seedlings this is quite an attractive one, but given the numbers of very similar cultivars is probably not one worth following up.

Magnolia x brooklynensis ‘Woodsman’

Parents: *M. acuminata* ‘Klassen’ x *M. liliiflora* ‘O’Neill’ 1.
Purchased: Duncan & Davies, New Plymouth.
Accession number: 16

Photo 16th October 2008. The main flowering for this cultivar is during late September and October. Flowering has been recorded for over 122 days at Lincoln in a single year with a few flowers in January to late April and again from mid September until early November.

Photo 30th September 2009. This cultivar is a curious mix of colours involving North American and Asian species in its parentage. Flowering is seen only when leaves are present, so it is not as dramatic in flower as the precocious Asiatic magnolias tend to be.

**Magnolia ‘Bubbles’ (syn. Michelia)**

Parents: *M. figo* crossed with *M. doltsopa* (1), bred by the late Oswald Blumhardt of Koromiko Nurseries in Whangarei (2).
Purchased: Peter Cave’s Tree Nursery, Hamilton
Planted: 14th July 1998
Accession number: 120

There are four years of flowering records at Lincoln University for this cultivar between 1999 and 2002. The peak of flowering for each of those years was generally at the very end of September and October. The earliest flowering was seen on the 16th September 2002 and the latest 4th November also in that year. Some flowers have also been recorded in late summer and autumn, in 2002 as late as May. 2009 has clearly been a much earlier season than any of the others for which records have been kept with both photos above and below taken on 14th September.

This is a fragrant flowering, evergreen shrub that has shown to be fully hardy at Lincoln.

2. www.rainbowtrees.co.nz/trees/exotic-trees.cfm
Magnolia ‘Butterflies’
Parents: *M. acuminata* ‘Fertile Myrtle’ x *M. denudata* ‘Sawada Cream’ 1, 2.
Purchased: Peter Cave’s Tree Nursery, Hamilton.
Accession number: 125

Both pictures were taken 2nd October 2008. Note the use of the wire cage to deter rabbits and hares. Rabbits in particular have caused significant problems by ring barking and digging up thick fleshy roots to feed on especially during winter and spring.

This cultivar was in full flower on 14th September 2009 after a very warm August and September.
Note there is slight difference between these two references as to the actual parentage of this cultivar. I have speculated that a hybrid of the two may be the correct version.

Magnolia ‘Caerhays Belle’
Parents: M. sargentiana var. robusta x M. sprengerii ‘Diva’
Purchased: Duncan & Davies, New Plymouth.
Accession number: 53

There are no photographs of this cultivar. There are only two flowering records taken in mid September 1999.
Magnolia campbellii

Parents: Magnolia campbellii
Purchased: Duncan & Davies, New Plymouth.
Accession number: 71

Photograph 17th August 2009.
There are five years of flowering records for this species at Lincoln between 1998 and 2002. From the records late August and early September are the most likely times for the main flowering to occur. The earliest recorded flowers were 24th July (1998), the latest were 17th September (2001). In 2000 the last flower record for that year was 21st August.

Photos 17th August 2009 left – the sepal like perules are partly shed, right - tree in flower
Magnolia campbellii var. alba

Parents: Magnolia campbellii var. alba
Purchased: Duncan & Davies, New Plymouth.
Accession number: 22

Four years of flowering records at Lincoln were kept from 1999 to 2002. From the records kept flowering was often quite sparse and this tree often suffered from frost damage when in flower. Because of the records I am a little uncomfortable suggesting when the main flowering will be as it may vary considerably as with other early flowering species depending on heat unit accumulation. For example there was little flowering of note for years 1999 and 2002, in year 2000 the majority of the flowering occurred in late July and early September and in 2001 the peak of flowering was the last week of August and the first two weeks of September. This tree has not done well in this situation and again only had a few flowers at the tops of the branches.
**Magnolia campbellii var. alba ‘Strybing White’** *

Parents: *Magnolia campbellii var. alba* (‘Strybing White’ was named ca. 1961 by Eric Walther, a former director of the Strybing Arboretum, San Francisco). The clone arose from a seedling received from G.Ghose and Company, Darjeeling, India. 1, 2.
Purchased: Duncan & Davies, New Plymouth.
Accession number: 52

*Note* this tree pictured is clearly NOT *Magnolia campbellii var. alba* ‘Strybing White’. The tree was presumably grafted and the scion has died. The tree pictured is the rootstock, it is probably a seedling *M. x soulangeana* rootstock only and should be replaced.

Both photos were taken 16th September 2008.
Five years of flowering records at Lincoln were kept from 1998 to 2002. From the records the main flowering was from the second week of September until the end of the first week in October. However, judging from the photos of the tree above flowering records are most likely for the rootstock pictured.

Magnolia campbellii subsp. mollicomata

Parents: M. campbellii subsp. mollicomata
Purchased: Duncan & Davies, New Plymouth.
Accession number: 87

Photos required and check species.

There are no flowering records from Lincoln for this species.
**Magnolia campbellii subsp. mollicomata ‘Lanarth’**

Parents: *M. campbellii* subsp. *mollicomata*

Purchased: by the Grounds sections

Planted: Probably mid to late 1990’s

Accession number: none.

Tree n.w. of Commerce and east of Library. This tree is close to the relatively uncommon *Gymnocladus* to the right in the photo above. Photo 24th August 2009.

Photo late September 2008. This tree was beginning to flower on 15th August 2010.
**Magnolia campbellii** subsp. **mollicomata** ‘Lanarth’

Parents: *M. campbellii* subsp. *mollicomata*

Purchased: Duncan & Davies, New Plymouth

Planted: September 1990

Accession number: 35

The above photo was taken 24th August 2009. There were just a few flowers at the top of this multi-stemmed tree. This tree is not as good as the much younger tree near the eastern side of the library. The bees above seemed at this stage anyway to be having a great deal of difficulty finding their way into the centre of the flower above.
Magnolia compressa (syn. Michelia compressa)
Parents: M. compressa
Purchased: Peter Cave’s tree Nursery, Hamilton.
Accession number: 129

This species was ring barked by rabbits and died in 1999 it has not yet been replaced.
**Magnolia dawsoniana ‘Chyverton Red’**

Parent: *M. dawsoniana* 1.
Purchased: Duncan & Davies, New Plymouth.
Accession number: 63

Both photos were taken on the 5th September 2002.
The majority of flowering recorded for this tree has been early to mid September. Occasional flowers have been seen late August and early October. Gardiner suggests some authorities believe ‘Chyverton Red’ may not be from *M. dawsoniana* only, but a hybrid with *M. sprengeri* var. *sprengeri* ‘Diva’ (2). I am uncertain if this example at Lincoln is what it should be and warrants further checking.

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**Magnolia ‘David Clulow’**

Parents: *M. x soulangeana* ‘Lennei Alba’ x *M. x veitchii* ‘Rubra’ – suggested as probable parents (1). Todd Gresham hybrid, N. America.

Purchased: Peter Cave’s Tree Nursery, Hamilton.

Planted: September, 2007

Accession number: 149

Photo 16th September 2008. Few observations of flowering have been made for this cultivar at Lincoln, but it is flowering freely from a relatively young age (first year after planting) with large open blooms. It appears to be flowering amongst the early spring species and cultivars at Lincoln, late August and September.

Photo 27th August 2009

Magnolia delavayi

Parents: *M. delavayi*

Purchased: Peter Cave’s Tree Nursery, Hamilton and Tikitere Gardens in Rotorua.

Planted: 1998 and 2001 (both plants are in the collection)

Accession numbers: 90, 152

This is a broad bun shaped evergreen shrub that does in time grow to tree like proportions. There are two specimens in the collection the above is accession number 90.

Flowering records are few for this species at Lincoln and flowering is not as obvious as that of most other magnolias. However, flowering records for location 90 suggest December as the main time although a significant flowering in March has also been recorded. Flower above (no.90) was photographed 17th December 2009. This particular species is not very common in Canterbury, possibly because it is not as showy as the precocious flowering deciduous species. It does appear to be completely hardy and in older trees in Christchurch appears to grow to around 6-8m or so in height and spread.
Magnolia denudata  (syn. M. heptapeta, M. conspicua)

Parents: Magnolia denudata  (commonly called Yulan magnolia)
Purchased: Duncan & Davies, New Plymouth.
Accession number: 39

Photo above 6th September 2006. The main flowering for this species is usually September, but with a warm winter it may flower heavily from as early as 21st August. Whilst the main flowering period is over within four weeks or so flowers were recorded over 97 days in 2001 with an isolated flower in January, the remainder from 27th August to 22nd October. Similarly in 2002 flowers over 92 days were recorded at Lincoln.

Photo 5th September 2002. The yulan M. denudata has been an important species in the parentage of M. x soulangeana and M. x veitchii hybrids. It is in its own right a very good and reliable small – medium sized flowering tree.
*Magnolia denudata* ‘Forrests Pink’ (syn. *M. heptapeta* ‘Forrests Pink’)

Parents: *M. denudata*
Purchased: Duncan & Davies, New Plymouth.
Accession number: 26

This is an early photo, not dated, but I suspect around 1993. The main flowering of this specimen is late August and early September, although in some years its flowering may occur from early August. Records show flowering can occur over a wide range of up to 96 days in a year with occasional flowers as late as mid October. The identification of this specimen is doubtful at the moment and it may be largely a seedling rootstock.

Photos in boxes were taken 24th August 2009. This is a good hardy reliable flowering magnolia at Lincoln, but I believe it is a rootstock only, possibly a *Magnolia x soulangeana* seedling, rather than a cultivar of *M. denudata*. 
**Magnolia doltsopa ‘Silver Cloud’ (syn. Michelia)**

Parents: *Magnolia doltsopa*

Donated: Christchurch City Council Nursery

Planted: 7th August 1989

Accession number: 0 (This tree is in the Amenity area, but away from the main Magnolia collection, just to the west and south of the pond).

Both photos 14th September 2009

There are five years of flowering records for this species at Lincoln University from 1998 to 2002. The earliest flowering seen was 22nd July 2002 and the latest 5th November 2001. Flowers have often been frosted because this tree flowers so early, but it does flower over a long period, so there are always flowers that are not damaged each year, making it worthwhile growing.

This tree after twenty years is only around five metres or so in height making it an acceptable option for many smaller gardens.
Magnolia ‘Early Rose’

Parents: *M. liliiflora* x *M. campbellii* (This cross was made by Oswald Blumhardt of Whangarei in the 1970’s and is a sister seedling of ‘Star Wars’ and ‘Red Lion’) 1 & 2. Purchased: Duncan & Davies, New Plymouth. Planted: May, 1991. Accession number: 70

Both photographs were taken on 9th September 2008. Most flowering depending on the year occurs between mid August and mid September for about four weeks. Records show at least some flowers at Lincoln can be seen over 92 days in a single year. A few flowers are likely to be seen from January to March and again from as early as mid July and until mid October.

An early flowering cultivar, flowers on bare branches.

Magnolia ‘Elizabeth’
Parents: *M. acuminata* x *M. denudata*  (This cross was made by Eva Maria Sperber of the Brooklyn Botanic Garden in 1956)  1. and registered 1968.  2. Purchased: Peter Cave’s Tree Nursery, Hamilton. Planted: 1998 Accession number: 102

Photo above 16th October 2008 showing the tree in full flower.

Photo 14th September 2009. The cultivar ‘Elizabeth’ is in full flower after a very warm spell during August and September, a full month earlier than 2008. There were still about 50% of all flowers present by 1st October 2009. There are no other flowering records for this cultivar at Lincoln.

**Magnolia figo (syn. Michelia)**

Parents: *Magnolia figo*  
Donated: Dan Dennehy – Grounds Department  
Planted: 12th September 2001  
Accession number: 118

![Photo 14th September 2009. A small shrub, less than a metre after growing for eight years in this open exposed site.](image1)

The above was photographed on 2nd November 2009. Note the top right flower of the three displayed has lost its perianth parts and is just displaying stamens and the gynoecium of free carpels. This species has the smallest flowers, but is noticed because of its fragrance. The leaves are burnt on the sunny side of the bush. This species is best grown in a warm sheltered site out of full sun where the leaves would be expected to be a dark glossy green. Currently there are no formal flowering records at Lincoln for this species, but from October until mid December is likely.
Magnolia ‘Freeman’

You can expect to see some flowers on this evergreen tree at virtually any time of the year except after heavy frosts for a few weeks as the winter progresses. The greatest quantity of flowers is from December through to March or May depending on the autumn weather. Flowering records at Lincoln for 2001 for example show this cultivar flowering periodically from January to mid July before resuming flowering again in late November with the heaviest flowering in mid December. The flowers and leaves of this species are smaller than of *M. grandiflora* and larger than *M. virginiana*. The extended period of flowering is because *M. grandiflora* is typically in flower from December to May depending on autumn weather and *M. virginiana* is typically a mid autumn to early winter flowering species at Lincoln, possibly stopped early by frosts. This cultivar seems like a good option where a smaller tree than *M. grandiflora* is required with the benefits of extended flowering, although they are not as fragrant. In other respects it resembles *M. grandiflora* and is a better option because of its extended flowering than its sister *M. ‘Maryland’. Flowers don’t seem to open fully like ‘Maryland’ or the *M. grandiflora* cultivars, flowers are smaller than ‘Maryland’ and the *M. grandiflora* cultivars.

Magnolia ‘Galaxy’

Purchased: Duncan & Davies, New Plymouth.
Accession number: 11

Photo 2nd September 2009

This tree appears dead, although some shoots are emerging from senescent looking wood and from the base. The shoots with flowers appear to represent ‘Galaxy’ and should be selected, the remainder of the tree removed at some stage. This tree has been in decline for the last few years, possibly due to herbicide. Flowering records for five years for this cultivar indicate the main flowering period is usually between mid September and early October at Lincoln. In some years flowering has started as early as mid August and isolated flowers seen as late as early November with occasional flowers in early to mid January.

**Magnolia ‘Genie’**

Parents: (\textit{M. ‘Simplicity’} x \textit{M. liliiflora ‘Nigra’} = ‘Breeder’) x (\textit{M. ‘Sweet Valentine’} x \textit{M. ‘Breeder’}). This cultivar was the result of several crosses by Vance Hooper at Taranaki. 1.

Purchased: Grounds Department

Planted: Probably about 2006 by the Grounds Department

Accession number: (None allocated yet, nor is there an adequate label). ‘Genie’ is planted just to the west of the evergreen aphid resistant Sitka spruce (\textit{Picea sitchensis}) in the second block south of the post and wire fence for climbing plants on the west side.

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Photo 2\textsuperscript{nd} October 2008

1. www.vhplants.com/Genie/mag%20breeding.htm
Magnolia globosa  (syn. M. tsarongensis)
Parents: M. globosa
Purchased: Peter Cave’s Tree Nursery, Hamilton.
Accession number: none yet

This species needs further checking, has not yet flowered
**Magnolia ‘Golden Joy’**

Parents: *M. ‘Yellow Bird’* x *M. x brooklynensis* (bred by Ian Baldick, Auckland) 1.

Purchased: Tikitere Gardens, Rotorua

Planted: August 2001

Accession number: 148

Photo 16th October 2008. Currently there are few flowering records for this cultivar, in 2001 there were two records only with the heaviest flowering in mid October, in 2002 flowering was over a six week period beginning late September and was finished by the end of October with the heaviest flowering late September and early October.

Photo 16th October 2008. This is the best yellow flowering magnolia in the Lincoln collection in my opinion.

1. http://www.junker.co.uk/magnolia49a.htm
**Magnolia grandiflora ‘Ferruginea’**

Parents: “This cultivar has been in cultivation since 1817”.

Purchased: Duncan & Davies, New Plymouth

Planted: September 1990

Accession number: 31


Main flowering for ‘Ferruginea’ at Lincoln usually starts about mid December and continues until the end of February. Outside of these times, expect to see the odd flower from early December to the end of May. Although the flowers are still large this cultivar has smaller flowers than most *M. grandiflora* cultivars except for ‘Little Gem’.

Magnolia grandiflora ‘Goliath’

Parents: “This cultivar was a 1910 selection, Caledonia Nursery, Guernsey”. 1.
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 81

Photo 8th Feb. 2010
Flowering records for ‘Goliath’ at Lincoln show considerable variability between years. For example in 2000 the heaviest flowering was recorded for late January, in 2001 it was for early to mid December and 2002 during May, in other years occasional flowers have been recorded for both June and July, with one record for September. The flowers of ‘Goliath’ are very large, possibly smaller than ‘Samuel Sommer’ though.

Magnolia grandiflora ‘Little Gem’

Parents: This cultivar was selected by Warren Steed of Steed's Nursery N. Carolina in 1952 & registered in 1966. (1).

Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 17

Photos above both 24th June 2009. Leaves are smallest of all cultivars. Right - lower surface of leaves, young twigs and buds covered in rusty tomentum.

Photo 8th Feb. 2010

As with most of the *M. grandiflora* cultivars flowering is usually somewhat sparse especially when compared to the precocious Asiatic magnolias. Flowering records for ‘Little Gem’ at Lincoln show considerable variability between years. For example in 1999 the heaviest flowering was recorded for early to mid January, in 2002 it was for early March. Occasional flowers have been recorded for both June and July (2002).

**Magnolia grandiflora ‘Russet’**

Origin: This cultivar was selected by Mausell van Rensellaer in 1952 from Southern California and introduced by the Saratoga Horticultural Foundation, Florida in 1965. 1, 2.

Purchased: Duncan & Davies, New Plymouth

Planted: September 1990

Accession number: 19

Photograph 24th June 2009. Note lower leaf covered in rusty tomentum

Photo 8th Feb. 2010

Flowering records for ‘Russet’ at Lincoln show considerable variability between years. For example in 1999 the heaviest flowering was recorded for mid January, in 2000 it was for early February and again in early and late April and early May. In 2001 there was a heavy flowering at the end of January and during the first half of April and again for two weeks in the middle of May. Occasional flowers for this cultivar were recorded for both June and July and started again in early November in 2001. Of all of the *Magnolia grandiflora* cultivars at Lincoln, ‘Russet’ appears from records to produce flowers at more times of the year than all of the others.

Magnolia grandiflora ‘Samuel Sommer’

Parents: “This cultivar was introduced by the Saratoga Horticultural Foundation, Florida”. (1).
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 29

Flowering records for ‘Samuel Sommer’ at Lincoln show considerable variability between years. For example in 1999 the heaviest flowering was recorded for early to mid January, in 2000 it was for early and late February, in mid April and mid to late December. In 2001 the main flowering occurred at the end of January and all of February, with early April and early to mid December having significant flowering as well. In 2002 apart from early January and again in early February flowering records indicate sparse flowering for all of summer and autumn until early May. There are no records for flowering between mid May and late November as there are with some Magnolia grandiflora cultivars. This cultivar appears to have the largest flowers of all M. grandiflora cultivars at Lincoln.

**Magnolia grandiflora ‘St. Mary’**

(1. purchased as ‘St. Mary’, recorded in (2) as ‘Saint Mary’

Parents: This cultivar was named St. Mary by W.B. Clarke Nursery of San Jose in California after the Glen St. Mary Nursery from where it was purchased in 1939. 1.

Purchased: Duncan & Davies, New Plymouth

Planted: September 1990

Accession number: 30

Aggregation of follicles, photo 24th June 2009.

Photo 8th Feb. 2010

Flowering records for ‘St. Mary’ at Lincoln show considerable variability between years. For example in 1999 the heaviest flowering was recorded for mid to late January, in 2000 it was for mid January and again in early February, then late March and mid April with isolated flowering in June and again in July with nothing until some significant flowering again in mid December. In 2001 there was a heavy flowering at the start and end of January through until the end of February and during April with smaller quantities of flowers in May followed by no flowering again until December. Apart from ‘Russet’ this cultivar appears to have more flowers than most other Magnolia grandiflora cultivars at Lincoln. This cultivar produces larger flowers than most, slightly smaller than ‘Samuel Sommer’ and ‘Goliath’.

Magnolia ‘Heaven Scent’

Parents: *M. liliiflora* ‘Nigra’ x *M. x veitchii* (Todd Gresham – California) 1.
Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990
Accession number: 21

Flowering records show that this cultivar may have at least an occasional flower for up to 106 days a year. The main flowering period is typically during September with stray flowers appearing right through until mid November, with one record showing some flowers in January.

Magnolia insignis (syn. Manglietia)
Purchased: Peter Cave's Tree Nursery, Hamilton
Planted: 14th July 1998
Accession number: 110

Photo 2nd September 2009. This tree has not yet produced any flowers. It is a more or less upright evergreen shrub or small tree with a slow rate of growth at Lincoln.

Photo 2nd September 2009.
**Magnolia ‘Iolanthe’**

Parents: *M. x soulangiana* ‘Lennei’ x *M. ‘Mark Jury’* (New Zealand raised Jury hybrid) 1.

Purchased: Duncan & Davies, New Plymouth.


Accession number: 47

Photographs above and below 16th September 2002.

Flowering records for this cultivar over five years show that the heaviest flowering period tends to be from early to mid September to early October, although flowering can continue albeit somewhat more sparsely from early October through until March or April the following year as shown in the records for 1999 and 2000. Flowering records for 1999 show at least some flowers were seen over a total of 23 weeks.

**Magnolia ‘J.C. Williams’ (syn. M. ‘New Purple Caerhays Seedling’)**

Parents: *Magnolia sargentiana* var. *robusta* x *M. sprengeri* var. *sprengeri* ‘Diva’ “Raised by Phillip Tregunna, head gardener at Caerhays Castle, Cornwall between 1956 and 1996”1, 2.
Purchased: Peter Cave’s Tree Nursery, Hamilton.
Accession number: 106

Above photograph 9th September 2008. There are no long term flowering records for this cultivar at Lincoln, but late August to early September flowering is indicated. This cultivar appears to have a tidy upright habit of growth.

This is a large flowered (25-30cm diameter flowers) early season precocious magnolia that is a rich purple that gradually fades as it ages. This photo was 24th August 2009 during a very warm spell of weather. Because of the size of the flowers planting in an area sheltered from wind is recommended.

1. Cave’s Tree Nursery 2007 Mail Order Catalogue.
**Magnolia ‘Jersey Belle’**

Parents: Unclear from the literature, possibly *M. sinensis* x *M. wilsonii* (1), *M. sieboldii* subsp. *sinensis* x *M. wilsonii* (Spongberg 1989 cited in (2) or *M. wilsonii* ‘Highdownensis’ (2).

Purchased: Peter Cave’s Tree Nursery, Hamilton.


Accession number: 101

There is only one flowering record for this cultivar showing the tree in full flower at the end of December 2000 at Lincoln.

Recheck if this tree still exists now!

Photos required.
**Magnolia kobus**

Seedling from the collection of magnolias in the Old Formal Garden, where the western end of the Commerce Building now stands. A second seedling was given to the Grounds Department and they planted that on the south side of the Hort. Teaching lab.


Accession numbers: 82 in Magnolia collection – Amenity area. There is a third example donated by Richard Poole from the Christchurch Botanic Gardens planted in July 1998 as *Magnolia kobus* var. *borealis* in location 105. This name (var. *borealis*) was rejected by Sponberg 1998 as being no different to the species, cited in (1).

Above photos 31\(^{st}\) August 2009 Location 105. Left - flower showing 6 tepals, there are 9 in total with 3 much smaller ones on the outside (not seen in this picture). Right form of tree, flowering just starting. The main flowering recorded in 82 at the Amenity Area is typically from early to mid September until the end of September or occasionally early October. Flowering is usually no more than a four week period in total. Tree lower right is No.82

Photo 2\(^{nd}\) October 2008. Left. - tree south of the Hort. Teaching Lab. This seedling may be a polyploid or a hybrid and has larger tepals than in most other *M. kobus* I have come across, although it is similar to the tree in location 105. Gardiner (1) suggests polyploids have variable numbers of tepals, but also that they generally have leaves that are wider than normal and frequently crinkled. *Magnolia kobus* is a good hardy reliable plant now being used in parts of Christchurch where a small street tree is required.

**Magnolia kobus ‘Edward A. Kehr’**

Parents: Colchicine induced polyploidy from *M. kobus* ‘Two Stone’ 1.
Purchased: Tikitere Gardens, Rotorua
Planted: August 2001
Accession number: 133

Photo 16th September 2008. Only a few flowering records have been recorded at Lincoln so far, but the main flowering indicated from those is between early and mid September.

Photo 16th September 2008. Described by RHS web site as “an extremely vigorous, bushy plant2.1-2.4m high and wide. Larger leaves, thicker wood” 2.

1. http://zipcodezoo.com/Plants/M/Magnolia_kobus_Edward_A__Kehr_/  
2. www.rhs.org.uk/plants/plant_groups/magnolia2.asp
Magnolia liliiflora (syn. M. quinquepeta)

Parents: Magnolia liliiflora (commonly called Mulan or wood lily)
Purchased: Duncan & Davies, New Plymouth
Planted: August 1991
Accession number: 62

Photo 2nd October 2008. This species appears to be slow to establish, but once established grows quite rapidly. The records of flowering at Lincoln show flowering is generally early to mid September to early to mid October with a small second main flowering between January and March with isolated flowering between those two main periods.

Photographed 2nd October 2008. This is a much older and mature specimen in the old Formal Garden, north of the Commerce Building. This species has been one of the most important parents for a whole range of hybrids and cultivars. It is often seen in the extended flowering of cultivars and its second shorter flowering over the summer and into the autumn. This is a spreading shrub that often needs more room to spread than it is allocated initially. Like most magnolias they can be cut back if necessary and seem to have amazing recuperative capabilities.
Magnolia liliiflora ‘Nigra’ (syn. M. quinquepeta ‘Nigra’)
Mulan or wood lily
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 3

First flower bud showing colour 31st August 2009.

Flowering times for this cultivar have been shown to be quite variable at Lincoln. Records generally suggest that the main flowering time is mid September until mid or late October, however there is often a smaller flowering from February to April. In 2001 there was a significant flowering from 26th November until 24th December as well. For the three years 2000, 2001 and 2002 records showed flowering was observed on average for 24 weeks each year. This trait has clearly carried over into many of the hybrids and cultivars that have used this cultivar as one of the breeding parents. It is also the cultivar responsible for the new generation of dark purple flowering hybrids.

Photo 14th September 2009, after a very warm August and early September.
**Magnolia x loebneri ‘Leonard Messel’**


The number of tepals for this cultivar are usually 12 or so, intermediate between the 18 of *M. stellata* and the 9 of *M. kobus*. Flowering records at Lincoln show this hybrid produces the heaviest flowering in September, but in 2000 had the first flower open on 31st July, with the last flowers seen on 16th October in that year.

Magnolia x loebneri ‘Merrill’ (syn. ‘Dr. Merrill’)


Photo 31st August 2009
Flowering records kept at Lincoln over a five year period from 1998 to 2002 showed flowering from as early as the first week of August in 2000 with the last isolated flowers seen in mid October. Most of the flowering is over a four to six week period during August and September that varies depending on the year.

Photo 31st August 2009

**Magnolia x loebneri ‘Spring Snow’**

Parents: *M. kobus* x *M. stellata* (Selected by Professor Joe Mc Daniel of Urbana, Illinois and registered in 1970.  

Purchased: Peter Cave’s Tree Nursery, Hamilton. 
Planted: July 1998 
Accession number: 96 

Photograph above 9th September 2008 
This cultivar has fragrant white flowers with 15-18 tepals. The main flowering at Lincoln is recorded as being from early to late September, with some years flowers starting in late August and tapering off by early October, but with the occasional flush in late December and January. Generally the flowering for this cultivar is very good for three to four weeks. Flowers are on bare branches. 

Photo 27th August 2009 during what appears to have been a very warm August. 
**Magnolia ‘Lotus’**

Parents: *M. x soulangiana* ‘Lennei Alba’ x *M. ‘Mark Jury’* (Felix Jury hybrids, north Taranaki, sister seedlings are ‘Athene’ and ‘Milky Way’). 1.

Purchased: Duncan & Davies, New Plymouth, (on both occasions).

Planted: First planted September 1990, accession no. 57. That tree subsequently died, a replacement tree was planted in late October 1992.

Accession number: replacement tree 83.

Both photos 31st August 2009.

Based on five years of flowering records for this cultivar at Lincoln, all flowering has been within a three to five week period from early to mid spring and finished by early October. The peak of flowering is usually the second and third weeks of September.

**Magnolia macrophylla**

Purchased: This tree was donated by the Grounds Department. It was relatively young and able to transplanted from the area where the Commerce Building was about to be built.

Planted: September 1990

Accession number: 9

Flowering on this tree is quite sparse, but individual flowers are really large and fragrant. The main flowering at Lincoln based on five years of records is mainly late November to mid December with some occasional flowers from mid November to mid January. Top right - Fruit terminates the stem, the fruit technically is termed an aggregation of follicles.

Above. This is a very large leaved species as indicated by the ball point pen on the leaf above. For that reason it is best planted somewhere sheltered from damaging winds, otherwise it is completely hardy at Lincoln.

Right. Large pudding bowl flower shape, similar in size or larger than *Magnolia grandiflora*. Flowers are 30cm or more across.
Magnolia macrophylla var. ashei

Purchased: Cave’s Tree Nursery, Hamilton
Planted: July 1998
Accession number: 94

Photo 14th November 2006. There are only a few flowering records for this tree at Lincoln so far. Indications are that flowering may start in early November, but the main period is late November to mid December with some occasional flowering until mid January. Flowers are fragrant and spotted red. This specimen should ideally also be in a site more sheltered from wind. Leaves and flowers are very large and like the previous species requires good shelter.

Photo 23rd April 2008 shows the debilitating effects on growth from the use of Tordon to control weeds by the Grounds Department over the summer of 2007-8.
Magnolia ‘Maharajah’

Parents:
Purchased:
Planted:
Accession number: 140
**Magnolia ‘Manchu Fan’**

Parents: *Magnolia* x *soulangeana* ‘Lennei Alba’ x *M. x veitchii* (Gresham hybrid, California) 1

Purchased: Duncan & Davies, New Plymouth

Planted: August 1991

Accession number: 74

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Photo 16th September 2008. Five years of flowering records kept for this cultivar at Lincoln show that the main flowering occurs from early and mid September until late September and early October. Occasional flowers have been recorded in November. The heaviest flowering is likely around mid September.

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Photo 16th September 2008. Flowers are precocious, produced on bare wood before leaves are seen.

Magnolia ‘Mark Jury’

Parents: *M. campbellii* subsp. *mollicomata* ‘Lanarth’ x *M. sargentiana* var. *robusta* (?) This was a chance seedling imported from Hilliers Nursery, England in 1950 as a seedling of *M.* ‘Lanarth’. This seedling has become an important pollen parent in the breeding of many other new hybrids and cultivars. It was named by Felix Jury. 1.

Purchased: Duncan & Davies, New Plymouth.

Planted: September 1990.

Accession number: 49


There are not many flowering records for this cultivar at Lincoln, but from what we have indications are that the main flowering occurs between early and late September. Large flowers are borne on bare branches and the flowering period is quite compact.


**Magnolia ‘Maryland’**

Parents: *M. grandiflora* x *M. virginiana* (bred by Oliver Freeman of the US National Arboretum, Washington 1930, a sister seedling of *M. ‘Freeman’*) 1.

Purchased: Duncan & Davies, New Plymouth.


Accession number: 80

Although this cultivar is from the same stable as ‘Freeman’ the flowering records for ‘Maryland’ are about one third of the number for the same years recorded at Lincoln as ‘Freeman’. As the trees are planted next to each other in the collection there is not likely to be any site differences influencing flowering times. The heaviest flowering in 2000 was mid to late January. In 2001 the heaviest flowering early to mid February and in 2002 late January and early February had the heaviest flowering. Flowers have only been observed during January and February with one record only for March 2001. This suggests the cultivar ‘Maryland’ flowering habits are more the result of the parent *M. grandiflora* than the winter flowering parent - *M. virginiana*. *M. ‘Freeman’* on the other hand has a much longer flowering period, way beyond that of a normal *M. grandiflora* and in my opinion a better option of the two. Flowers of ‘Maryland’ are larger and more open like *M. grandiflora*.

Magnolia maudiae  (syn. Michelia)
Parents: Magnolia maudiae
Purchased: Peter Cave’s Tree Nursery, Hamilton
Planted: 14th July 1998
Accession number: 114

There are three years of flowering records for this species kept at Lincoln University from 2000 to 2002. The earliest flowers recorded during this period was 2nd September 2002 and the latest 4th November in the same year. The maximum duration flowers were seen was over nine weeks in 2002.

This is a good (hardy at Lincoln), small garden species with flowers that are beautifully fragrant.
**Magnolia ‘Milky Way’**

Parents: *M. x soulangeana* ‘Lennei Alba’ x *M. ‘Mark Jury’* (NZ bred Felix Jury hybrid, sister seedling of ‘Athene’ and ‘Lotus’) 1, 2.

Purchased: Duncan & Davies, New Plymouth.

Planted: The first tree was planted in September 1990 but died. A replacement tree was planted in October 1992.

Accession number: 84

Both photographs were taken on 5th September 2002. From five years of flowering records at Lincoln the majority of flowering occurs between two and four weeks based around the middle of September, with the earliest start date being the 4th September and for three of the five years a few flowers produced until mid October. In 2001 a few flowers were recorded in early to mid February.

Flowers are largely white, but have some pink – purple on the outside and at the base of the tepals.

Magnolia nitida
Parents: Peter Cave’s Tree Nursery, Hamilton
Accession number: 131

Need photos and check its whereabouts

There are no flowering records for this species at Lincoln to date
Magnolia obovata (syn. M. hypoleuca)
Purchased: Peter Cave’s Tree Nursery, Hamilton.
Planted: July 1998
Accession number: 100

There are no flowering records or photos of this species yet. Cave suggests summer flowering.
**Magnolia ‘Pat’s Delight’**

Parents: ‘Pat’s Delight’ is a sister seedling of ‘Star Wars’, ‘Red Lion’ and ‘Early Rose’ (NZ bred cultivars of *M. liliiflora* x *M. campbellii* by Oswald Blumhardt, Whangerei) 1.

Purchased: Tikitere Gardens

Planted: August 2001

Accession number: 134

Photo 16th September 2008. Currently there are only a few flowering records for this cultivar.

Photo 31st August 2009. It is likely some flowering may occur from mid to late August, but most of the flowering in a normal year is likely from early September for a few weeks.

Magnolia ‘Pegasus’
Parents: *M. cylindrica* x *M.denudata* 1, 2.
Purchased: Duncan & Davies, New Plymouth.
Accession number: 67
(Note purchased as *M. cylindrica*, but I suspect it is ‘Pegasus’)

Both pictures were taken 16th September 2008. Main flowering is slightly variable between late August and an early September start with the main flowering over by mid September. Actual flowering days may be up to 96 at Lincoln with the odd flowering lasting until mid or late October and rarely seen again in January and February.

**Magnolia ‘Peppermint Stick’**

Parents: *M. x veitchii* x *M. liliiflora* (sister seedling of ‘Heaven Scent’, ‘Sayonara’ and ‘Royal Crown’ also in the Lincoln collection, there are others from this cross that are not in the Lincoln collection to date. Gresham hybrid, California 1960's. 1.

Purchased: Duncan & Davies, New Plymouth.

Planted: August 1991

Accession number: 65

Five years of flowering records kept at Lincoln from 1998 to 2002 showed the heaviest flowering for this cultivar is from early to mid September and early October. Some isolated flowers have been recorded for November, January, February and March. The earliest spring flowering occurs is recorded as September 2nd. Flowers were just starting to open on 31st August 2009.

Precocious flowering spreading shrub.

**Magnolia ‘Pinkie’**

Parents: *M. liliiflora* ‘Nigra’ x *M. stellata* ‘Rosea’ (De Vos & Kosar hybrid, US National Arboretum, Washington). (1). ‘Susan’ is a sister seedling of this hybrid cross and is in the Lincoln collection. 

Purchased: Duncan & Davies, New Plymouth.  
Accession number: 43

Photo 9th September 2009 shows the actual cultivar ‘Pinkie’ which is now just a branch or two of the existing tree, the remainder is rootstock. Flowering records were kept for this tree over 5 years at Lincoln from 1998 to 2002. The heaviest flowering was mainly September to mid or late October and significant flowering extended over 7 or 8 weeks in some years. The earliest recorded start date was August 17th, with a few isolated flowers recorded for November and December.

(Note the lower photo is NOT ‘Pinkie’ but the rootstock).  

Photo 29th August 2009. The rootstock has now grown at the expense of the grafted cultivar ‘Pinkie’ and like many seedling magnolias is in itself a very good tree, but for the integrity of the collection should be replaced with the actual cultivar. The rootstock is possibly *M. x soulangiana*, with perhaps some *M. kobus* in the mix. The rootstock is a good reliable tree at Lincoln and flowers about 2-3 weeks before the cultivar ‘Pinkie’ starts.

**Magnolia ‘Princess Margaret’**


Purchased: Tikitere Gardens, Rotorua
Plant: August 2001
Accession number: 143

Photo 29th August 2009.
This is a large flowered, precocious cultivar. There are no official records for this cultivar currently. From photographic records of this cultivar they suggest that flowering is likely to occur from mid to late August or early September for two to three weeks.

Photo 29th August 2009

**Magnolia ‘Pristine’**

Parents: *M. denudata* x *M. stellata* ‘Waterlily’ this cultivar was bred by Professor Joe McDaniel at Urbana, Illinois in 1968 using ‘Waterlily’ as the seed parent. Cultivar registered 1979. 1,2.
Purchased: Duncan & Davies, New Plymouth.
Accession number: 75

![Magnolia 'Pristine'](image1)

Photo 16th September 2008. Based on 5 years of flowering records kept at Lincoln for this cultivar the heaviest flowering is likely to occur in September. The earliest flowers have been recorded as 21st August and the latest 23rd October. Depending on the year this may be heavily in flower for between 3 and 5 weeks.

![Magnolia 'Pristine'](image2)

Photo 16th September 2008.

**Magnolia ‘Purple Eye’**

Parents: *M. denudata* x *M. x soulangeana*? Probably originated as a seedling from Caerhays Castle, Cornwall, England. The seedling was given to Peter Veitch and later distributed by Veitch and Sons Nurseries. 1.

Purchased: Tikitere Gardens, Rotorua

Planted: August 2001

Accession number: 145

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There are currently no formal flowering records at Lincoln for this cultivar. According to Callaway, this cultivar flowers approximately one week later than *M. denudata*. From photographic records flowering appears to occur from mid to late August through until late September.

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**Magnolia x raffillii ‘Charles Raffill’**

Parents: ‘Charles Raffill’ is the name of one of the seedling from a cross he made between *M. campbellii x M. campbellii* subsp. *mollisomata* whilst at the Royal Botanic Gardens, Kew in 1946. Other selections include ‘Kew’s Surprise’, ‘Wakefield’ and ‘Eric Walther’ 1,2. Purchased: Duncan & Davies, New Plymouth. Planted: September, 1990. Accession number: 37

Photo 24\textsuperscript{th} August 2009. “Raffillii Group hybrids are in many ways preferred to *Magnolia campbellii* because they are more reliable in flower when grown in cold climates” (2). I agree with this comment for Lincoln, and obviously further afield in Canterbury and beyond. “It appears that there are several forms of *M. campbellii* grown in New Zealand and some may be hardier than others. It is possible that the one most propagated in most nurseries is the more tender Yunnan form, at one time classed as a distinct species and then known as *M. mollisomata*” (3).

Five years of flowering records from 1998 to 2002 were kept at Lincoln for this cultivar. The majority of flowers are seen from late August to mid September. The earliest spring flowers recorded were 14\textsuperscript{th} August (2000), the latest were 28\textsuperscript{th} September (1998).

Magnolia x raffillii ‘Charles Raffill’

Planted: Possibly early 1960’s?
Accession number: None

This tree is at the northern entrance to the old formal garden north of Commerce and east of the Library. Photo 24th August 2009.

Magnolia ‘Red As’

Parents: *M. x soulangeana* ‘Pickard’s Ruby’ x *M. ‘Vulcan’* bred by Ian Baldick, Auckland.

1. Purchased: Unsure where the Grounds Department purchased this cultivar. (Possibly Duncan & Davies, New Plymouth which lists this cultivar on the website below)
3. Accession number: 155

Photo 31st August 2009, showing the first flower bud with colour about to open.

There are no official flowering records that have been kept at Lincoln for this cultivar, but photographs suggest that flowering is likely in most years to occur from early September and continue until early October.

Photo on 16th September 2008. Robinson (1) suggests “this may be one of the outstanding hybrids of all time”

1. Robinson, M. ‘Large flowered magnolias from New Zealand’ in The Plantsman. Pp. 16-20. (Note Robinson describes as cultivar ‘Red as Red’, I have made the presumption that this is the same plant as that of Duncan & Davies production list which includes ‘Red As’.
Magnolia rostrata

Purchased: Cave's Tree Nursery, Hamilton
Planted: August 2001
Accession number: 104

Flowers have not been seen yet.
Magnolia ‘Royal Crown’

Parents: *M. liliflora* ‘Nigra’ *x M. x veitchii* Gresham hybrid, California, named in 1962. 1. ‘Royal Crown’ has the same parentage as ‘Heaven Scent’ and ‘Peppermint Stick’, both of which are also in the Lincoln collection.

Purchased: Duncan & Davies, New Plymouth.

Planted: September 1990.

Accession number: 38

Photo 9th September 2008. Flowering records kept at Lincoln for 5 years show that this cultivar can have at least a few flowers for 28 weeks of the year. The most substantial flowering occurs from mid to late August and may continue until mid October, there is a second lighter flowering during January and February. As well as these two clear flowering periods, records from 1998 to 2002 inclusive show, that occasional flowers have been recorded at least once for every month of the year.

Photo 5th September 2002. ‘Royal Crown’ is a good, small, precocious flowering tree.

Magnolia ‘Ruth’

Parents: *M. campbellii* subsp. *mollicomata* ‘Lanarth’ x an unknown *M. x soulangeana*. Bred by Ian Baldick of Auckland. 1.

Purchased: Tikitere Gardens, Rotorua.
Planted: August 2001
Accession number: 146

There are no formal flowering records for this cultivar at Lincoln to date. From dates on photographs it appears as though this cultivar is likely to flower from late August until late September, the actual start and finish dates varying depending on the season.

Magnolia salicifolia
Purchased: Cave's Tree Nursery, Hamilton.
Planted: July 1998
Accession number: 93

Photo 2nd September 2009 Currently there are no other flowering records for this species. The flowers compared to many magnolias are small, similar to M. kobus in their simplicity and tend to point south like the M. x soulangeana hybrids and M. liliiflora. This appears to be a compact, upright growing tree that should flower more prolifically as it ages.
Magnolia sargentiana (Dark Form)
Purchased: Tikitere Gardens, Rotorua.
Planted: August 2001
Accession number: 151

Photo 9th September 2008. There are currently no other flowering records at Lincoln for this specimen at present. I suspect it will be similar to the parent species with all flowering more or less after the first week and finished within the month of September. This cultivar is dark purple in bud and opens dark purple, before gradually fading to a lighter colour. Further to the above this specimen had about 20% of all flowers fully open on 24th August 2009, 80% two days later.

Left photo 26th August 2009. This is a very large flowered (about 25cm across) precocious cultivar.
**Magnolia sargentiana var. robusta**

Purchased: Tikitere Gardens, Rotorua  
Planted: August 2001  
Accession number: 137

There are no formal flowering records for this tree that have been kept to date. The photo below shows the flower stages. It is highly likely this is a seedling form of *M. x soulangeana* and resembles the cultivar ‘Ruby’, but is different with a less formal larger flower. The rootstock is attractive and could be retained, re-labelled and further evaluated for potential registration as a new cultivar.  
(***Note*** photos below are NOT what the label indicates)

27\(^{th}\) August 2009.  
31\(^{st}\) August 2009.  
31\(^{st}\) August 2009  
16\(^{th}\) September 2008
**Magnolia sargentiana var. robusta**

Purchased: Duncan & Davies, New Plymouth (no.6)
Planted: September 1990.
Accession number: 6

Photo 27th August 2009 (no.6). Note there are two trees of *Magnolia sargentiana* var. *robusta* no.6 and 137. No. 137 does not appear to be true to form and may be a rootstock only. Flowering records kept for Number 6 at Lincoln from 1998 to 2002 inclusive show that this species has a compact flowering period where it flowers heavily for no more than two to three weeks from the end of the first week in September until about the end of the third week in September. The earliest flowers recorded during the five year period was 6th September and the latest was between 28th September (100% flowering) and the 5th October (0% flowering), both observations were 1998. **Note** in 2009 flowers were seen from 24th August following a warmer than usual spell.

Photo 6th September 2006 (no.6). A very good precious flowering magnolia. This is one of the best early flowering magnolias in my opinion.
Magnolia ‘Sayonara’

Parents: *M. liliiflora* × *M. x veitchii*. Gresham hybrid Santa Cruz, California, registered by Todd Gresham 1966. 1.
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 45

Photo 9th September 2009 showing first flower buds opening.
Records were kept at Lincoln over a five year period between 1998 and 2002 at Lincoln University. For most of those years flowering was at its peak in the last week of September and usually for a period of two to three weeks with isolated flowers seen from the second week of September until as late as mid December. Flowering in 2001 and 2002 was earlier peaking from 17th September.

Photo 14th September 2009

Magnolia ‘Serene’

Parents: *M. liliiflora* x *M. ‘Mark Jury’* A New Zealand raised cultivar by Felix Jury, north Taranaki in the 1970’s. 1.

Purchased: Duncan & Davies, New Plymouth.


Accession number: 20

Flowering records at Lincoln were kept for this cultivar from 1998 to 2002 inclusive. During that time this cultivar did not appear to flower as heavily as many others. The heaviest flowering periods recorded varied depending on the year. The best flowering in 1999 and 2000 occurring in late July, in 2001 the best flowering was early September and in 1998 and 2002 flowering was affected badly by frosts. The earliest flowering record for the five year period was 5th July 1999 and the date for the latest flowering record was 30th September 2002. The first flowers in 2009 were seen on 11th August and there were only a few buds at the top centre of the tree. Flower buds were absent from all of the lower branches.

Herbicide damage causing gross leaf distortion April 2008 (Tordon was unfortunately used by the Grounds Department to kill weeds at the base of the magnolias in summer 2007-8, although the effect of this is expected to gradually dissipate over many years).

**Magnolia sieboldii**  
Purchased: Duncan & Davies, New Plymouth.  
Planted: September 1990  
Accession number: (32)

This species died, a likely reason was a fresh truck load of pine bark was dumped close to and around the base of this species and *M. x wiesneri*. The bark was not spread for some time and I suspect toxins leached from the bark and affected the root systems of these trees. The latter *M. x wiesneri* is slowly recovering, although for many years I assumed that it was dead. A tree labelled *Magnolia sieboldii* has been planted between 93 and 86. I need to confirm this was a replacement tree I had from a group of seedlings at the nursery. This needs further checking.

Records of flowering for *Magnolia sieboldii* were kept for five years at Lincoln between 1998 and 2002. The peak of the flowering occurs in November and December, usually from mid to late November to mid December. The earliest recorded flowers 22nd October 2002 and the latest (25%) full flowering were 3rd January 2000. Other flower records for the odd flower were as late as the 26th March 2001.
Magnolia ‘Snow White’ (syn. ‘Wada’s Snow White’)
Parents: M. denudata x M. salicifolia This hybrid was developed by K. Wada of Hakoneya Nurseries, Yokohama, Japan (1) and introduced to the British Isles by Sir Peter Smithers (2).
Purchased: Duncan & Davies, New Plymouth.
Accession number: 66

Flowering records were kept for this cultivar for five years from 1998 to 2002 at Lincoln. The heaviest flowering is typically around mid September and is usually good for four to five weeks. In 2000 flowering was estimated at 40% of full flowering by 21st August and continued well until a few days after the 18th September at 90% and the 25th September estimated at 20% of full flowering. The latest flowering recorded for this cultivar was the 9th October, also in 2000.

Both photos above were taken 16th September 2008.

Magnolia x soulangeana  (syn. Magnolia x soulangiana)
Parents: M. liliiflora x M. denudata
Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990
Accession number: 27

This is possibly the most commonly grown magnolia in New Zealand. It resulted from a cross made in 1820 and first flowered in 1827 by Etienne Soulange-Bodin in Paris. Since then numerous other selections have been made. Gardiner (2000) suggests that this clone “thought to be the type” (2) should be named Magnolia x soulangeana ‘Etienne Soulange-Bodin’. Both Callaway (1) and Gardiner (2) provide interesting accounts of this cross and other cultivars. Second and third generation crosses include a range of coloured flowers and flowering times.

Photo 16th September 2008.
Flowering records kept for this tree at Lincoln over five years from 1998 to 2002 show the heaviest flowering occurs after the end of the first week of September until the end of September. Occasional flowers have been seen as early as the 31st October in 1998 and the latest flowering record in any year was for the 6th November in 2002.

Photo 2nd September 2009, not fully out yet, M. x loebneri ‘Leonard Messel’ to the right is.

**Magnolia x soulangeana ‘Alba’**

Parents: *M. liliiflora* x *M. denudata* Grown by Louis van Houtte of Belgium and named after him in 1867. This is probably the same as *Magnolia x soulangeana* ‘Alba Superba’ 1.

Purchased: Duncan & Davies, New Plymouth

Planted: September 1990

Accession number: 14

Photo 16th September 2008.

Flowering records were kept for five years from 1998 to 2002 at Lincoln for this cultivar. The heaviest flowering is after the first week of September until the end of September. A few flowers have been recorded as early as 24th August and as late as 16th November, both extremes were in 1998.

Photo 31st August 2009.

**Magnolia x soulangeana ‘Alexandrina’**

Parents: *M. liliiflora* x *M. denudata* Both Callaway and Gardiner suggest there are at least two different clones under this name, the North American clone has deep red-purple cup shaped flowers (1) and the French clone with nine tepals is white flushed with purple on the outside, introduced by Cels of Montrouge, Paris, in 1831. 2.

Purchased: Duncan & Davies, New Plymouth.

Planted: September 1990.

Accession number: 23

![Magnolia x soulangeana 'Alexandrina'](image)

Photo 31st August 2009, showing some early flowers.

Flowering records at Lincoln kept for five years from 1998 to 2002 show that the heaviest flowering for this cultivar occurs in September and may continue into early October. The earliest records for spring flowering were the 28th October, 2000 and the latest were the 1st November 1999. A few flowers were recorded in January 2000 and January and February 2002.

Magnolia × soulangeana ‘Amabilis’

Parents: *M. liliiflora* × *M. denudata* Listed by Baumann Nursery in France, 1865 1.
Purchased: Duncan & Davies, New Plymouth.
Planted: August 1991
Accession number: 76

Flowering records for this cultivar at Lincoln from 1998 to 2002 show there is some variability in flowering times. The heaviest flowering occurs in September and up to mid October with mid to late September the likely peak period. A smaller flowering period is likely also in January and February in some years extending into March. For the spring period, the earliest flowers recorded were 28th August in 2000 and the latest the 4th November 2002.

In 2009 the first flowers were seen 25th August. See above.

Magnolia x soulangiana ‘Burgundy’

Parents: M. liliiflora x M. denudata (Received by Clarke Nursery, San Jose, California from an unknown source, named in 1943). 1.
Purchased: Duncan & Davies, New Plymouth.
Planted: August 1991
Accession number: 72

Flowering records were kept for this cultivar for five years from 1998 to 2002 at Lincoln. Flowering records suggest there is some variability in flowering times, but the heaviest flowering is early to mid September to mid October. Significant flowering is likely to last four weeks, but in some years up to six weeks. Beyond that there are records for spring flowering starting as early as the 14th August in 2000 and as late as 15th November in 1999. There is also likely to be a few flowers in January and February of some years.

This tree has largely reverted to rootstock (possibly M. x loebneri) seedling and needs remedial pruning or replacement.

**Magnolia x soulangeana ‘Lennei’**

Parents: *M. lilifiora* × *M. denudata* Raised in Lombardy, Northern Italy by Giuseppe Manetti about 1850 and named in honour of Peter Lenne a German botanist. 1, 2.  

Purchased: Duncan & Davies, New Plymouth  

Planted: September 1990  

Accession number: 46

Photo 9th September 2009

Five years of flowering records were kept for this cultivar between 1998 and 2002 at Lincoln. The heaviest flowering was typically late September and all of October. In 1998 flowering continued from 14th September until 22nd March the following year with sparse flowering after the main flowering was over in early November. Some flowering from January to March occurs in most years. This cultivar has been an important plant in plant breeding work, possibly in part for this reason.

Photo 14th September 2009

Magnolia x soulangeana ‘Lennei Alba’

Parents: *M. liliiflora* × *M. denudata* is recorded as a backcross between *Magnolia x soulangeana* ‘Lennei’ and *M. denudata*. Named by Froebel, Switzerland. 1.

Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990
Accession number: 40

Both photos were taken on 16th September 2008. Flowering records were kept for this cultivar for a period of five years at Lincoln during 1998 and 2002. During that period the majority of the flowering occurred from midway through the second week to the end of September. Occasional flowering occurred as early as the 4th September in 1999 and as late as 12th December in 1998.

This is a precocious flowering cultivar.

Magnolia x soulangeana ‘Nancy’

Parents: M. ‘Rustica’ x M. ‘Ruby’? (1) Parents: Seedlings from the gardens of Deryk and Nancy Lawrence Te Puke. A second seedling ‘Roslyn’ was also registered from the same source. (pers comm. 2000).  

Purchased: Tikitere Gardens Rotorua
Planted: August 2001
Accession number: 142

Photo 29th August 2009.

Photo 16th September 2008. This is a precocious flowering cultivar, but at present there are no flowering dates recorded, although late August and September are suggested. This cultivar has the characteristics typical of M. x soulangeana.

1. www.vanplant.co.nz
2. Two letters from Deryk and Nancy Lawrence, 185 Otamarakau Rd, RD6, Te Puke 3071. 12th March, 2000 and No date 2000.
**Magnolia x soulangeana ‘Norbertii’ (syn. ‘Norbertiana’)**

Parents: *M. liliiflora* x *M. denudata* There are reputedly two forms of this cultivar. 1. ‘Norbertii’ was introduced by Cels of Montrouge, Paris. 2. Purchased: Duncan & Davies, New Plymouth. 
Accession number: 69

Photo 31st August 2009.

Flowering records at Lincoln kept for five years from 1998 to 2002 show that the heaviest flowering for this cultivar occurs in September and may continue into early October. The earliest records for spring flowering were the 28th October, 2000 and the latest were the 1st November 1999. A smaller, but continuous flowering occurred in 2000 from 24th January until 13th March. In 2001 and 2002 similar flowering from January to March were recorded.

Photo 31st August 2009.

**Magnolia x soulangeana ‘Picture’ (‘Wada’s Picture’)**

Parents: *M. liliiflora x M. denudate*. There are reputedly two forms of this cultivar. 1. ‘Picture’ is a Japanese clone introduced by Wada’s Nursery of Yokohama, Japan in the 1930’s. 2. Purchased: Duncan & Davies, New Plymouth.

Planted: September 1990. Note this cultivar pictured was purchased around 2000’s by the Grounds Department and is on the north side of the Commerce Building.

Accession number: none for tree pictured below and 24 in collection.

Photo 12<sup>th</sup> October 2006. Note the typical rounded form of Magnolia x soulangeana.

Photograph 9<sup>th</sup> September 2008. There are no other flowering records kept for this tree, but because of its warmer site than the collection I would expect the flowering dates to normally be from about mid August to the end of September for the main flowering to occur. Tree 24 in the collection has five years of flowering records that show the main flowering period is predominantly September, but flowering may begin as early as 17<sup>th</sup> August (1998) and finish as late as 16<sup>th</sup> November, also 1998. This is a precocious flowering species.

Magnolia x soulangeana ‘Roslyn’

Parents: Seedlings from the gardens of Deryk and Nancy Lawrence Te Puke. A second seedling ‘Nancy’ was also registered from the same source. (pers comm. 2000). 1.

Purchased: Tikitere Gardens, Rotorua
Planted: August 2001
Accession number: 139

There are no official flowering records for this cultivar at Lincoln, although the two dates for the photos suggest in an early season a mid to late August and into September, but probably more likely from early September through until the end of September as the main flowering period.

Photo 16th September 2008.

This is a precocious flowering cultivar that is most likely a M. x soulangeana hybrid.

Photo 31st August 2009.

1. Two letters from Deryk and Nancy Lawrence, 185 Otamarakau Rd, RD6, Te Puke 3071. 12th March, 2000 and No date 2000.
Magnolia x soulangeana ‘Ruby’

Parents: *M. liliiflora* x *M. denudata* “derived from Magnolia x soulangeana ‘Picture’” 1.
Purchased: Duncan & Davies, New Plymouth.
Planted: August 1991
Accession number: 78

Photo 31st August 2009. Five years of flowering records from 1998 to 2002 were kept at Lincoln for this cultivar. The heaviest flowering is from early to mid September until early to mid October. A smaller second flowering was also recorded in 2000 during February and March and in March only in 2001 and 2002. The earliest spring flowers were recorded as the 28th August (2000) and the latest 10th December (2001).

Photo 31st August 2009. This appears to be a very compact cultivar, potentially a good small garden choice.

**Magnolia x soulangeana ‘Rustica Rubra’ (syn. ‘Rubra’, ‘Rustica’)**

Parents: Seedling of *Magnolia x soulangeana* ‘Lennei’ (1), Dutch clone raised in Boskoop (2)  
Purchased: Duncan & Davies, New Plymouth.  
Planted: September 1990  
Accession number: 1

Photograph of early flower bud 31st August 2009.
From flowering records kept at Lincoln for a five year period from 1998 to 2002 the heaviest flowering was towards the end of the second week in September until early October. There were isolated flowers recorded as early as 24th August up until 19th November with one record for 14th February.

Photo 9th September 2009

**Magnolia x soulangeana ‘San Jose’**

Parents: *M. liliiflora* x *M. denudata* Named by Clarke and Company, San Jose, California in 1940. (1). There are reputedly two forms of this cultivar. 1, 2.

Purchased: Duncan & Davies, New Plymouth

Planted: September 1990

Accession number: 2

Photo 31st August 2009.

Flowering records for five years from 1998 to 2002 were kept for this cultivar at Lincoln. The heaviest flowering for this cultivar is likely from late August until early October with the peak of flowering shifting by a week or two, usually mid-late September. The earliest recorded spring flowers were 3rd August (1998) and the latest 29th November (1999). During 2000, 2001 and 2002 there was also a smaller amount of flowers produced between January and February, in 2000 this extended until 17th April.

Photo 31st August 2009.


**Magnolia x soulangeana ‘Sweet Simplicity’**

Parents: *M. liliiflora* x *M. denudate*. Probably a seedling of *M. x soulangeana* ‘Lennei’ 1.

Purchased: Duncan & Davies, New Plymouth

Planted: August 1991

Accession number: 64

Both photos 30th September, 2009.

Five years of flowering records were kept for this cultivar at Lincoln between 1998 and 2002. Flowering typically occurs from mid to late September and mid October. Flowering is generally quite compact most within three weeks. The earliest flowers recorded were 16th September (2002) and the latest recorded were the 6th November (2000). This cultivar has been the slowest growing *Magnolia x soulangeana* in the collection. The flowers are later than most soulangeana’s and the leaves above show the typical young growth of yellowish leaves that gives an appearance at this stage of nitrogen deficiency.

Magnolia x soulangeana ‘Verbanica’

Parents: M. liliiflora x M. denudata Named by Andre Leroy, Angiers, France, 1873. (1).
Purchased: Duncan & Davies, New Plymouth
Planted: August 1991
Accession number: 77

Flowering records kept at Lincoln for five years from 1998 to 2002 show that this cultivar flowers the heaviest from mid September to between the first and second week of October. Good flowering usually lasts three to four weeks, but in a mild spring may last for six weeks or so. The earliest spring flowers recorded were 28th August (2000) and the latest 9th November (1998).

**Magnolia x soulangeana 'Vivienne'**

Parents: *M. liliiflora* x *M. denudata* a chance seedling rootstock, selected by Roy Edwards, Lincoln University.

Purchased: As *M. acuminata* ‘Golden Glow’

Planted: September 1990

Accession number: 18

This was a grafted tree that flowered for about three years before the scion died. I never got around to removing the rootstock which continued growing. At a later stage the rootstock began flowering and it was not anything I recognised. Later I met Dr Anthony Mitchell by chance at the Hanmer pools and discussed this with him. As a result of that meeting I obtained funding through the Brian Mason Trust to allow Anthony to carry out some DNA analysis of what I suspected were the likely parents and some *M. x soulangeana* cultivars. From Anthony’s work the tree turned out to be unique, but close to two other *soulangeana* cultivars. After determining it was different I named it ‘Vivienne’ after my wife. In late 2002 the rights to this cultivar along with some other selections of *Lophomyrtus* and *Corokia* I had made were sold by the University.

Records for this tree over a five year period shows the heaviest flowering occurs from late August until early or mid September. The earliest spring flowering recorded date was 14\textsuperscript{th} August (2000) and the latest flowering record was 16\textsuperscript{th} October (2000).

Flowers tend to be larger than other *M. x soulangeana* cultivars and that may reflect greater ploidy levels.
Magnolia ‘Spectrum’


Purchased: Duncan & Davies, New Plymouth.

Planted: September 1990, died. Replaced October 1992

Accession number: 88 (replaced location 48)

Both photos 9th September 2009

Flowering records for ‘Spectrum’ were kept at Lincoln for a five year period between 1998 and 2002. The peak of flowering was usually in the last two weeks of September and the first week of October. The earliest flowering record for spring was 2nd September (2002) and the latest recorded date 20th November (2000).

*Magnolia sprengeri var. sprengeri* ‘Burncoose Purple’

Parents: The original plant is a seedling of *Magnolia sprengeri* var. *sprengeri* ‘Diva’ and is at Burncoose & South Down Nurseries, Redruth, Cornwall, England. 1.
Purchased: Duncan & Davies, New Plymouth
Planted: August 1991
Accession number: 68

This is a tree which always impresses in flower. From flowering records kept at Lincoln over a five year period from 1998 to 2002 this tree flowers the heaviest from early September for two to four weeks. Occasionally it may flower earlier as it did in 2000. The earliest flower record at Lincoln for spring flowering was 14<sup>th</sup> August (2000) and the latest spring flower record was the 2<sup>nd</sup> October (2000). Note the flower colours change from dark to paler as they age.

**Magnolia sprengeri var. sprengeri ‘Copeland Court’**

Parents: This clone originated as a seedling of *Magnolia sprengeri var. sprengeri ‘Diva’* given to Bishop Hunkin by George Johnstone, and planted in the grounds at Lis Escop, Truro. The grounds were sold to the Copeland family, who donated the property to the Truro Cathedral School as a hall of residence and renamed it Copeland Court.

1. Purchased: Cave’s Tree Nursery, Hamilton
3. Accession number: 91, 144.

There are only flowering records for 2002 for this cultivar. These records indicate late August and early to mid September is the likely flowering period.

Photos required

**Magnolia sprengeri var. sprengeri ‘Diva’ 3 (syn. Magnolia sprengeri ‘Diva’) 1.**

Parents: There are two forms of Magnolia sprengeri (1,2) suggests while the pink form is typical there is a less common white form Magnolia sprengeri var. elongata. ‘Diva’ is a cultivar of the pink form originally grown by J.C. Williams at Caerhay Castle. (2).

Purchased: Duncan & Davies, New Plymouth
Accession number: 56, 86

Four years of flowering records were kept for this species at Lincoln from 1999 to 2002. The heaviest flowering is mostly from late August until mid September. The earliest flower record was 14th August (2000) and the latest was the 15th October (2001).

Originally, before the early 1990’s, there was an example of this species where the Commerce Building was erected, that example always impressed me as one of the most beautiful flowering species there was. This is a small to medium sized tree that flowers regularly, is completely hardy and will perform best with a bit of wind shelter like most magnolias, but otherwise are of easy culture. Some of the crinkling of the tepals in the photo above appears to be the effects of herbicide.

3. http://zipcodezoo.com/Plants/M/Magnolia_sprengeri_var_diva/
**Magnolia ‘Star Wars’**

Parents: *M. liliiflora ‘Nigra’ x M. campbellii* (Bred by Oswald Blumhardt, Whangarei. ‘Early Rose’ is a sister seedling of ‘Star Wars’). 1,2.

Purchased: Duncan & Davies, New Plymouth.


Accession number: 12

Flowering records were taken over a five year period at Lincoln between 1998 and 2002. There are one hundred and sixty seven weekly records of flowering over the five year period, this is a yearly average of more than thirty three weeks per year when at least a flower is present. The heaviest flowering in spring is likely after the end of the first week in September and mid October. There is a second flowering of significance from mid January to mid February. In 2000, 2001 and 2002 flowers were recorded in every month except December, the tree taking a rest from early November until early January when flowering resumes.

All photos were taken 16th September 2008.

**Magnolia stellata** (syn. *Magnolia kobus var. stellata*)

Parents: *Magnolia stellata*
Purchased: Duncan & Davies, New Plymouth
Planted: August 1991
Accession number: 59

Photo 16th September 2008

Five years of flowering records at Lincoln were kept for this species between 1998 and 2002. The main flowering period is September and early October, although flowering may be seen outside of these times. The earliest spring flowering record is 22nd July (2002), the latest was 14th November (2002). Flowers were also recorded during January and February 2000.

Photo 16th September 2008.

*Magnolia stellata* is a good hardy precocious flowering shrub that appears unaffected by frosts, even while in flower.
Magnolia stellata 'King Rose' (syn. Magnolia kobus var. stellata 'Rosea King')

Parents: New Zealand selected cultivar 1.
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 5

Photo 16th September 2008. A precocious flowering deciduous shrub, flowers with 20-25 tepals. There are five years of flowering records kept at Lincoln between 1998 and 2002. The main flowering period for this cultivar is September, but flowers can be expected from mid August and may continue until late October. The earliest flowering record is 14th August (2000), the latest was 23rd October (2000) and there is one record for flowers observed in January 2001.

Photo 27th August 2009. A bushy shrub that is suitable for smaller gardens.

**Magnolia stellata ‘Royal Star’** (syn. *Magnolia kobus var. stellata ‘Royal Star’*)

Parents: A seedling of *Magnolia stellata* 'Waterlily' selected in 1955 by J. Vermeulen and sons, New Jersey and registered in 1960. 1,2.
Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990.
Accession number: 33

Both photos 16th September 2008.

Flowering records have been kept for this cultivar at Lincoln over a five year period between 1998 and 2002. The main flowering period occurs between late August and early October. The earliest spring flowers recorded were 7th August (2000) and the latest 12th November (2001). Some flowers have been observed in January (2002) and February (2000).

Magnolia stellata ‘Rubra’
Parents: “Introduced from Japan by K. Wada ca. 1925”
Purchased: Duncan & Davies, New Plymouth
Planted: August 1991, later died and has not yet been replaced.
Accession number: 60

There are no flowering records for this cultivar at Lincoln.

Magnolia stellata ‘Waterlily’ (syn. M. kobus var. stellata ‘Water Lily’)

Parents: There is some confusion with clones, as there are two different cultivar names for distinct forms ‘Water Lily (two names)’ and ‘Waterlily’ (one name). (1) Treseder described three distinct American selections of M. stellata that bear the name ‘Waterlily’ (one word). Each is vigorous, carries pink – flushed flowers with more than 30 tepals and flowers between one and two weeks later than other forms of M. stellata. They are all quite distinct from the ‘Water Lily’ (two words) cultivated in the British Isles, which has no trace of pink in the flower’. (2). It would appear that both No.28 and no.99 are the American clones (have pink in the tepals, but the number and shape of tepals needs to be checked – see photos below).

Purchased: Duncan & Davies, New Plymouth and Peter Cave’s Tree Nursery, Hamilton
Planted: September 1990 and July 1998
Accession numbers: 28, 99

Photo of no. 28 taken 6th September 2008. Flowering records were kept for ‘Waterlily’ no.28 for five years from 1998 to 2002 at Lincoln. The main flowering occurs during September and early October. Flowers may start as early as 24th July (2000) and finish as late as 19th November (2001). A few flowers have been recorded in January (2000 and 2001) and February (2001). There are four years of records for accession no.99. Flowering appears to be more compact for this plant and may be affected by the location, however the majority of flowering is again September and early October. The earliest flower date recorded is 2nd September (1999) and the latest is 1st November (1999).

Photo of no. 99 ‘Waterlily’ taken 27th August 2009

**Magnolia x suishoren**

Parents: *M. denudata* x *M. stellata* 1.
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990, died 1992 and has not yet been replaced.
Accession number: 10

This magnolia is described as “A profusion of dainty small upright flowers with elongated tepals of creamy white. Attractive massed display in early spring. D. 4m.5.” (1). There are a few flowering records for this magnolia at Lincoln. *Magnolia x suishoren* began flowering on 10th September, was in full flower on 24th September and all flowering was over by 22nd October of 1991.

**Magnolia ‘Sundance’**

Parents: *M. acuminata x M. denudata* This cultivar was selected by August Kehr, North Carolina from a seedling cross made by Professor Joe McDaniel, Urbana, Illinois. 1,2.
Purchased: Duncan & Davies, New Plymouth.
Accession number: 41

The above photos show some frost damage occurred, this tree is not looking healthy at present.

Flowering records kept over a five year period between 1998 and 2002 at Lincoln show that this cultivar has its main flowering period in late September and early October. The earliest flowering date observed was for the 16th September 2002, the latest record any flowering was observed was the 12th November 2001.

**Magnolia ‘Sunspire’**

Parents: Presumably *M. acuminata* as one parent

Purchased: Peter Cave’s Tree Nursery, Hamilton.


Accession number: None allocated yet.

Photos required

“There have been a large numbers of new yellow magnolias bred in recent years and we have been assessing them to make sure they really are improvements before growing them. One that has really impressed is *Magnolia ‘Sunspire’* Its narrow upright growth is very useful in the age of small sections, and its good yellow blooms are larger than *M. ‘Butterflies’* which has been the standard. 3m.” (1)

1. Cave’s Tree Nursery 2007 Mail Order Catalogue.
**Magnolia ‘Susan’**

Parents: *M. liliiflora* ‘Nigra’ x *M. stellata* ‘Rosea’ (De Vos & Kosar hybrids from the US National Arboretum, named in 1965) 1.

Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990.
Accession number: 7

Photo 16\textsuperscript{th} September 2008. Flowers are both precocious (above) and with leaves (below).

Photo 16\textsuperscript{th} October 2008. Flowering records from Lincoln indicate the main flowering period is usually mid September to mid October, although that may start earlier and finish later. In 2000 first flowers were seen late August with the heavy flowering startin September 11\textsuperscript{th} and finished by about 25\textsuperscript{th} October. Lesser flowering continued until 4\textsuperscript{th} December and resumed January 2001 on 29\textsuperscript{th} continuing until the end of February.

**Magnolia ‘Sweetheart’**

Parents: Seedling of *M. ‘Caerhays Belle’* (*M. sargentiana* var. *robusta* x *M. sprengeri* ‘Diva’) first released in 1991. 1, 2.

Purchased: Peter Cave’s Tree Nursery, Hamilton.


Accession numbers: above 136, lower picture no. 97.

Photo 9th Sept. 2008. At present there are no other flowering records for this cultivar. According to a newspaper report in the Christchurch Press May 9th 2009 section D. page14 Peter Cave has been honoured by the Royal New Zealand Institute of Horticulture for the “breeding and selection” of *Magnolia* ‘Sweetheart’ and *M. ‘Royal Purple’*.

Photo 9th Sept. 2008. This is a precocious spring flowering magnolia.

1. Cave’s Tree Nursery (2007) Mail order catalogue
**Magnolia ‘Sweet Valentine’**

Parents: *M. ‘Sweet Simplicity’* x *M. ‘Black Tulip’* Bred by Vance Hooper, Taranaki in the late 1990’s. 1, 2.

Purchased: Tikitere Gardens Rotorua
Planted: August 2001
Accession number: 147

Photo 16th September 2008. There are no formal flowering records that have been kept for this cultivar, flowering was observed to have started by 25th August 2009 after a warm period that seemed quite unseasonal. There is an apple seedling tree growing against the tree in the photo above that has since been removed.


1. www.vhplants.com/Genie/mag%20breeding.htm
2. www.vhplants.com/history.htm
Magnolia ‘Tina Durio’

Parents: Magnolia x soulangeana ‘Lennei Alba’ x M. x veitchii. A Gresham hybrid named in 1984 by Ken Durio, Louisiana in honour of his daughter. 1, 2.
Purchased: Duncan & Davies, New Plymouth
Planted: September 1990.
Accession number: 54

Photo 16th September 2008
There are five years of flowering records for this cultivar from 1998 to 2002 at Lincoln. Most of the flowering occurs in September and around the middle or toward the end of the month the heaviest flowering is likely to occur. The earliest flower date recorded for this cultivar is 31st August (1998) and the latest 29th October (2010).

Photo 16th September 2008. Large, precocious flowering cultivar.

Magnolia ‘Todd Gresham’

Parents: M. x soulangeana ‘Rustica Rubra’ X M. x veitchii 1, 2.
Purchased: Duncan & Davies, New Plymouth.
Planted: September 1990.
Accession number: 13

There are five years of records for flowering for this cultivar from 1998 to 2002. The main flowering period was usually over a long period from mid August to mid October. In 2000 and 2001 isolated flowering was recorded in late November. In 2000 some flowers were also recorded in March and April.

Photo 31st August 2009.

This tree is in a poor state with more than half dead.

Magnolia tripetala

Parents: Magnolia tripetala
Purchased: Peter Cave’s Tree Nursery, Hamilton.
Planted: July 1998
Accession number: 92

There are no other flowering records for this species at Lincoln, from the above and below photos mid October to mid November might be a reasonable assumption until other records are taken. This is a North American species that is deciduous, but is not a precocious flowering magnolia and although the flowers are large is not particularly showy.
**Magnolia x veitchii**

Parents: *M. campbellii* x *M. denudata*. Peter Veitch of the Royal Nurseries successfully made this cross at Exeter, England 1907. This hybrid cross has been used for the breeding of a number of magnolias. 1, 2.

Purchased: Duncan & Davies, New Plymouth.

Planted: August 1991

Accession number: 73

Photo 27\(^{th}\) August 2009. This tree is showing a branch sport in flower on one side of the tree only at this stage. This part of the tree is probably *M. x soulangeana* seedling rootstock. From five years of flowering records kept at Lincoln University from 1998 to 2002 the main flowering period is during September. The heaviest flowering is likely to be after the second week of September and before October. The earliest spring flowering recorded for the five year period was the 26\(^{th}\) August (2002) and the latest record is for the 8\(^{th}\) October 2001.

Photo 31\(^{st}\) August 2009. This part of the tree is *Magnolia x veitchii*

Magnolia virginiana
Parents: Magnolia virginiana
Purchased: Peter Cave's Tree Nursery, Hamilton
Planted: July 1998
Accession number: 89

There are three years of flowering records for this species, 1999, 2001 and 2002. From these records all flowering is during April, May and June. The main flowering varied with mid April to mid May being the main periods for 1999 and 2001, whilst in 2002 all flowering occurred in May, the best was from mid May until the end of May, finishing on June 10th.

This is a small North American evergreen shrub.

Photo 24th June 2009. This is the latest record of any flowers seen on this species at Lincoln to date.
**Magnolia ‘Vulcan’**

Parents: *M. liliiflora* ‘Nigra’ *x campbellii* subsp. *mollicomata* ‘Lanarth’  
Vulcan is a New Zealand raised Jury hybrid.  

Purchased: Duncan & Davies, New Plymouth.  
Accession number: 55

There are five years of records for ‘Vulcan’ at Lincoln University from 1998 to 2002. The earliest this cultivar flowered during this period was the 14th August 2000, with the latest flowers recorded 12th November 2001. Flowers can be seen over a period of up to 96 days based on the Lincoln records, the later flowers are generally much smaller than those of the first flush. The majority of flowers occur from about mid to late August until early October.

1. Robinson, M. ‘Large flowered magnolias from New Zealand’  
**Magnolia x wieseneri** (syn. *M. x watsonii*)

Parents: *M. obovata* x *M. sieboldii* The original plant of this naturally occurring hybrid was found in the garden of Mr Weisener, who had purchased it as *M. sieboldii* from Mr Tokada of Japan. The plant was described by Carriere in 1890 and named by him. 1.

Purchased: Duncan & Davies, New Plymouth
Planted: September 1990
Accession number: 42

Photo 30th September 2009 showing the characteristic shape of a bud about to flower.

Photo 11th November 2009 - shows some flower damage after a cold southerly. Note the native hover fly. These are usually prevalent during spring and early summer. There are only records of flowering for 1999 and 2000 for this species. The main flowering is indicated by the few records as late October to mid November (early December). This is a very pleasantly fragrant magnolia worth growing for that reason alone. The fragrance as the flower as it is opening is reminiscent of feijoas. This specimen was probably affected by a load of bark that was left around the base of this tree and a nearby *M. sieboldii* and was not spread soon enough. It is possible toxins from the bark leached into the soil affecting the root system. For many years I had assumed this tree was dead, but as with many other examples, magnolias seem to have a remarkable recuperative capacity and this tree has for the last few years gradually obviously returning to health and growth is progressing well again.

**Magnolia wilsonii**

Parents: *Magnolia wilsonii*

Purchased: The original tree planted was donated by the Grounds Department as a transplant from the Grounds, it later died. The second tree was purchased from Peter Cave’s Tree Nursery in Hamilton.


Accession number: 8 died, replaced at 123

Currently there are no flowering records at Lincoln for this species.

Require pictures
**Magnolia ‘Yellow Fever’**

Parents: *M. acuminata* x *M. denudata* “This form was registered by Ken Durio of Lousiana Nursery, Opelousas, Louisiana about 1980”. 1.

Purchased: Duncan & Davies, New Plymouth. This tree was provided by the Grounds Department.


Accession number: 58

Photo 2\(^{nd}\) October 2008. There is only one full year of flowering records for this cultivar at Lincoln. In 2002 flowering began after the third week of September and the last flowering record was for the 21\(^{st}\) October. The heaviest flowering was observed in the last week of September and the first week of October. This cultivar seems to have both an unfortunate cultivar name and is only yellow in bud, soon fading to cream as above when in flower.

Photo 14\(^{th}\) September 2009, showing flowering one month earlier than 2008. This is a precocious flowering cultivar.

Magnolia yunnanensis  (syn. Michelia)
Parents: Magnolia yunnanensis
Purchased: Peter Cave’s Tree Nursery, Hamilton
Planted: 14th July 1998
Accession number: 115

There are four years of flowering records at Lincoln University for this cultivar between 1999 and 2002. The peak of flowering for each of those years was generally at the very end of September and during October. The earliest flowering was seen on the 2nd September 2002 and the latest 4th November also in that year. Flowers were also recorded in 2001 and 2002 during January and February. Both photos above and below were taken on 14th September, 2009 indicating an earlier than usual flowering season.

A good, fragrant flowering shrub.
Magnolia yunnanensis ‘Velvet and Cream’ (syn. Michelia)
Parents: Magnolia yunnanensis A cultivar introduced into New Zealand by Peter Cave.
Purchased: Peter Cave’s Tree Nursery, Hamilton
Planted: 14th July 1998
Accession number: 119

Both photos 14th September 2009
There are four years of flowering records at Lincoln University for this cultivar between 1999 and 2002. The peak of flowering for each of those years was generally at the very end of September and October. The earliest flowering was seen on the 23rd September 2002 and the latest 4th November also in that year.
**Magnolia yuyuanensis** (syn. *Manglietia*)

*Parents: Magnolia yuyuanensis*
*Purchased: Peter Cave's Tree Nursery, Hamilton*
*Planted: 14th July 1998*
*Accession number: 107*

Photo 2nd September 2009. This tree has not yet produced any flowers. It is an upright evergreen shrub or small tree with a slow rate of growth at Lincoln.

Photo 2nd September 2009. The leaves of this species tend to have a drooping habit. The form of the shrub is a narrow vase with ascending branches.
**Magnolia ‘628’ (syn. Manglietia)**

Parents: *Magnolia* unknown  
Purchased: Peter Cave's Tree Nursery, Hamilton  
Planted: 14th July 1998  
Accession number: 111

This tree has not yet produced any flowers and the correct name needs to be determined. The Grounds department planted a tree of the same name about 2000 on the south side of the Recreation Centre. That tree is more upright and has grown quite quickly in that site. It has not yet flowered either.

Photo 2nd September 2009. This is an evergreen tree that seems tolerant of the Lincoln climate so far.
Observations on magnolias at Lincoln University
by R.A. Edwards, Plant Sciences Group, Lincoln University

(Notes prepared for The Friends of the Christchurch Botanic Gardens Inc. at a presentation to be given on 10th November 1999 at the Information Centre, Christchurch Botanic Gardens at 7.30pm.)

Introduction
In the winter of 1990 the nucleus of a *Magnolia* collection was planted at Lincoln University. This was in a block within the Horticultural Research Area that was no longer required as a stool bed for producing apple rootstocks. Additional plants were purchased in 1991 and 1992. These replaced a smaller existing number of established magnolias, removed to make way for the then new Commerce Building. After 1992 further development was slow until a grant was given by the Brian Mason Scientific & Technical Trust to increase the collection. In June 1998 the Brian Mason Scientific & Technical Trust awarded a grant of $5000 for additional plant material and labelling. With that grant the collection has been broadened from magnolias to include other genera and species within the Magnoliaceae family. The collection now includes approximately one hundred and twenty plants from four genera; *Magnolia, Manglietia, Michelia* and *Liriodendron*.

Three other lesser known genera; *Elmerrillia, Kmeria* and *Pachylarnax* also belong to the Magnoliaceae family, but are not represented in the collection. The closest New Zealand examples includes *Pseudowintera* species which at one stage were regarded as being in the Magnoliaceae, but are now classified in a closely related family the Winteraceae.

Much of the early plant material was purchased from Duncan and Davies Nurseries Ltd. In New Plymouth, latterly additional material has been procured from Cave’s Tree Nursery in Hamilton. Two Lincoln University Forestry lecturers, Dr. Mead and Dr Chang, who visited China in 1997 arranged a contact there to obtain seed of species that were not in the collection. Unfortunately this contact in China wanted to charge $500 US per species for seed. So that potential source was quickly rejected. (They also offered to provide the seed quickly on receipt of a deposit of $2500 US). Currently there are still a number of species that will be added to the collection when we able to source the seed or plants. Most of the species within the Lincoln University collection are native to temperate eastern Asia and North America.

A second grant of $7000 has recently been awarded by the Brian Mason Scientific & Technical Trust for further development of the Magnoliaceae collection and work which Dr Anthony Mitchell will carry out to look at other ways of identifying plants within the collection by DNA extraction. This work will be starting in the near future.

Rabbits and other challenges
Rabbits and to a lesser extent hares are the major pests of the collection at Lincoln. Rabbits are extremely active throughout the year, but are particularly noticeable during the winter months when they attack the roots of the magnolias. They also attack unprotected young plants by chewing young stems, breaking and or ring barking them. Occasionally hare damage is evident where newly planted trees have had shoots nipped off. In late spring of 1998 the rabbit numbers dropped off substantially and it was assumed that rabbit calicivirus could have affected the rabbit population at that time. Rabbit numbers now appear to be building up again. Rankin in the UK.(1993) wrote “Rabbits. Magnolias must be their ultimate delicacy. They have been known to strip the bark off quite mature plants. If rabbits are present, protect the base of the plant with wire netting immediately after planting”. De Spoelberch (1998) in discussing the development of a collection of nearly 800 magnolias at Herkenrode 25km north of Brussels in Belgium suggests “mice, hares and rabbits have been a constant problem, but eventually a fence was placed around the entire collection.
and the rabbits and hares shot.” He goes on to suggest “mice can ring bark plants where mulch or ground cover plants grow up to the base of the trees and provide shelter and protection”. On rabbits again “In parks which have become rabbit infested, big magnolia shrubs and even old trees of Magnolia acuminata and Liriodendron tulipifera will be completely ringed over one winter by starving rabbits. It is quite extraordinary to see the thick bark of a Liriodendron patiently scraped away until the last tender cambium layer can be reached”. Any new plantings of the Magnoliaceae at Lincoln University are now routinely protected with wire cages for a few months as a protection against rabbits and hares. Shooting has also been carried out in the past.

Magnolia production systems

It appears that most magnolias are grafted on to rootstocks of seedlings. From my experience to date this may not produce the best results and there have been many instances of magnolias that have shown reversion to the rootstocks. This is easily observable when the plants are in flower as two different types of flowers or colours may appear on the same plant. In one specific instance where a plant of Magnolia acuminata ‘Golden Glow’ was grown it flowered the second and third year from planting, but the scion died after flowering in the third year. In the spring of the third flowering I observed a black exudate oozing from the point of the graft union. While I did not do anything about this at the time, it appeared to me that this was indicative of delayed graft incompatibility. The rootstock however did not die and has since flowered with extremely large flowers that appear to be of Asiatic hybrid parentage. The flowers of this rootstock are up to 270mm across and unlike any other Magnolia x soulangeana I am familiar with. Magnolia acuminata however is a North American species. (Recent DNA analysis work by Dr Mitchell at Lincoln University has shown this to be a Magnolia x soulangeana hybrid). In discussing the ethics of selecting rootstocks, J.G. Millais in his 1927 monograph -the first ever written on magnolias, states. “Those who are forming gardens should always give magnolias their first consideration when planting, and put in two or three examples of all the best species and hybrids that can be procured on their own roots”. From my observations so far I would endorse that suggestion and encourage nurserymen to consider trying cutting grown plants as an option, rather than grafted plants. Wilkinson (1978) however, suggests genera such as Magnolia are notoriously difficult to produce roots from cuttings. If grafting is to be considered necessary, then at least use rootstock species that closely match the scion. More recent authors such as Callaway (1994) suggest most of the magnolias grown today are from cuttings. De Spoelberch (1998) states “Too many magnolias in old collections are but stock which has sprouted back after the scion has been killed by frost. Cuttings are much better than grafted material, more than half of our accessions are cuttings taken from the plants that have performed best here”.

Pruning

To date very little pruning has been carried out on any of the magnolias in the collection with the exception of storm damage, weak crotch angles or removing errant rootstock growth that has developed at the expense of the scion. The latter has usually been cut from tagged branches soon after flowering. The different flowers of the rootstock and scion make it easy to select the material for removal. In a few cases, some heavy pruning has been carried out to remove branches with weak crotch angles to prevent future problems. Where heavy pruning has been carried out there has been a response by the plants in producing a large number of shoots. These need to be cut out very early. It is better to avoid heavy pruning by correcting branch angles or removing unwanted shoot growth as early as possible. Flower initiation for most spring flowering magnolias appears to occur in early summer so to avoid potential flower loss, prune as soon after flowering as possible. De Spoelberch, 1998 states “Pruning is essential when transplanting magnolias and removal of most of the lateral branches is carried out leaving only one leader, even if the plant will end up as a shrub.”
Flowering
Since 1998 I have been fortunate to have Mr Bruce Palmer work on a voluntary basis to assist with the management of the area. Bruce also undertook to record the magnolias in flower once a week. Flower records were based on an estimate of flowering for each plant in flower on that day. From those records information has been put into a database and a graph for each species showing expected flowering times can be produced. By aggregating all of the flowering records kept for 1998 together, the best two weeks to have visited Lincoln in 1998 to view magnolias was in the weeks starting the 21st and 28th September. For 1999 the best two weeks started the 20th and 27th September. Bruce Palmer is continuing to record magnolia flowering this year at Lincoln University and Kristian Davies of the Auckland Botanic Gardens kept flowering records of *Magnolia kobus* var. *stellata* ‘King Rose’ for 1999. This has enabled us to get an overview of the likely differences in flowering period by comparing the same cultivar between the two sites.
Once we have sufficient flowering records, flowering times can be compared with past climate data and we may then be able to predict when flowering will occur on the basis of heat unit accumulation after flower initiation. Comparisons of flowering times with other species at Lincoln University and with Auckland Botanic Gardens and with climatic data of both regions to determine heat unit accumulation will help fine tune the results. From observations to date it is possible to have some magnolias in flower in Canterbury from July to May, nine to ten months of the year.

Frost damage to flowers
Early flowering plants can be susceptible to damage by frost. Frost damage is observed as a browning or blackening of the perianth prematurely, effectively reducing the amenity values of that plant. The tepals (tepals is a term coined by Johnstone for units of the perianth that are indistinguishable as either sepals or petals. The outer hairy units are perules, which enclose spathaceous bracts outside of the tepals. (Treseder, 1978) then fall within a few days. From my observations not all flowers open at once, flowering is usually a progressive event and frost damage tends to only destroy the flowers that are open, buds enclosed by the large hairy perules seem to be protected and these subsequently open later. If the temperatures remain low for a few days it appears as though flowering is also delayed, resuming as temperatures increase. The most severe frost damage is usually in September although this year with very early flowering of Magnolia ‘Serene’ frost damage has been observed in late July. The second flush of flowering then appeared to delay for a period of about ten days before flowering resumed.

Pollination and seed set
A number of seedlings grew during the last summer. These were tagged with the intention of lifting and bagging the seedlings in the early winter. Rabbits or hares it seems took every seedling in late autumn 1999, leaving just a few decapitated seedlings as evidence. This summer Magnolia sieboldii has produced numerous seedlings (approx. 80 plants have been potted up) growing in the bark mulch beneath the branch spread. Any other tree in the collection has only ever produced a few seedlings at most. Magnolias are protogynous plants, the carpels mature before the anthers are ready to release pollen within the same flower. In order for pollination to occur pollen must then be brought from another flower where the stamens have released pollen. Soon after the pollen has been released from the stamens appear to collapse. At this stage thrips, honey bees and a type of fly have been observed on the flowers.

Selecting the ‘best’
Rankin, 1993 states “I was once told by an eminent plantsman that ‘every magnolia is beautiful yet some are superior.’ There appears much truth in that statement, my personal favourites are the Asiatic magnolias as a group and within those there are many fine options. In terms of beauty M. sprengerii ‘Diva’ has always impressed me, for fragrance M. x weisneri is superb. In terms of beauty and reliability in Canterbury the M. x soulangeana and M. stellata are hard to beat. This brief summary however leaves out M. denudata and M. liliiflora both of which are hardy in Canterbury and beautiful in their own right. As an aside these are the parents of M. x soulangeana from which a number of fine cultivars have been selected. How do you leave out of any discussion of magnolias the early flowering magnolias such as M. campbellii or the serenely beautiful flowers of M. sargentiana? At this point I should give up, but in finishing will briefly touch on some of the NZ raised hybrids such as those of Felix Jury, plants such as M. ‘Serene’, M. ‘Vulcan’. M. ‘Iolanthe’, M. ‘Apollo’ and M. ‘Mark Jury’ to name but a few. These are all large flowered hybrids. Others such as ‘Star Wars’ (a NZ. cultivar selected by Oswald Blumhardt) and ‘Royal Crown’ greatly extend the flowering period and all are well worth growing. For something different the large leafed M. macrophylla flowers in late November and into December. This plant has deep pudding plate shaped flowers to about 25cm in diameter. All the above covered are white, cream or pink shades
through to deep rich purple. There are other magnolias now available that have yellow flowers. Flowers such as those of *M. acuminata* ‘Golden Glow’, *M.* ‘Yellow Fever’ (an unfortunate name), *M.* ‘Elizabeth’ and *M.* ‘Yellow Bird’ are possibilities worth growing. *M. acuminata* one of the parents of most of the yellow flowered hybrids is a deciduous North American tree which needs a lot of space. Another North American species well worth space in the garden is *M. grandiflora*. This species is evergreen and produces large lemon scented flowers over the summer, a few at time until frosts occur. There are also number of selected cultivars of *M. grandiflora* as well as hybrids between this and *M. virginiana* another North American species.

![Picture of “unknown” rootstock of *Magnolia acuminata* ‘Golden Glow’, recent DNA analysis by Dr Mitchell has shown the rootstock to be a *Magnolia x soulangeana* hybrid.]

References

Mary Lovell-Smith wrote for a Press article.

Magnolias at Lincoln.

In a breakthrough use of the science, DNA fingerprinting has been used to distinguish hybrid and cultivar magnolias. Roy Edwards, lecturer in environmental horticulture at Lincoln University and in charge of the university's magnolia collection says many magnolias are grafted onto rootstocks of seedlings. The seedlings are often of mixed parentage. At Lincoln about 10 per cent of the grafted magnolias exhibit a mix of the grafted scion and rootstock – only noticed when the two types of flowers appear on the same tree. In some cases the scion is often weak and dies and the seedling rootstock continues growing.

On one particular grafted tree, an American species *Magnolia acuminata* 'Golden Glow' the scion died after three years of producing flowers. The rootstock was never removed and some years later it began to flower. From the flowers, Edwards suspected the rootstock of having Asiatic hybrid parentage, but with its huge flowers it was different from other *M. x soulangeana* he was familiar with and also suspected the influence of the larger flowered *M. campbellii*. A grant was received from The Brian Mason Scientific and Technical Trust to provide funds for work to determine if DNA fingerprinting could be used to separate out the parentage. Dr Anthony Mitchell a colleague, was able to compare the DNA of the parents of *M. x soulangeana, M. campbelli* and cultivars of *M. x soulangeana* and identify the unknown rootstock as *M. x soulangeana*. This is not possible using plant morphology. The next step after determining the plants actual parentage and that it is different could be to decide if it is good enough to be given a new cultivar status. *M. x soulangeana* is an interspecific hybrid between two other species of *Magnolia*. The two species involved in the original cross were *M. liliiflora* and *M. denudata*. The cultivars that exist today are selections of the seedlings that have occurred from time to time as a result of crossing the two species and have been vegetatively propagated from there on. Another outcome from the DNA analysis was that a number of plants that have been named as cultivars of *M. x soulangeana* clustered more closely to just one of the parents - *M. denudata* suggesting regression or back-crossing had occurred. What is also interesting in this regard is that a number of *M. x soulangeana* cultivars have a second flowering after the main spring burst in mid or late summer. This is a characteristic of the parent *M. liliiflora*, but not *M. denudata*. Comparing flowering records could be used to support whether or not back crossing to *M. denudata* has occurred in those cultivars that flower only once during the year.

Edwards warns of the problem of using grafts for genera such as magnolias. The scions are often not as vigorous and the tendency for the rootstock to take over has repercussions for the gardener who may buy a particular flowering plant only in years to come have a completely different one. Likewise, he says, a gardener may admire a magnolia, note the name it was bought under, buy one of the same name, once more to end up with a different tree. In view of the problems with rootstocks he thinks more research into cutting grown plants on their own roots could be done. As with many other ornamental trees, there has been very little research into magnolias. There is no economic impetus such as there is with food crops or for production horticulture or forestry, Edwards says. He believes his current research on thermal time may provide a model applicable to a number of other woody garden plants. Thermal time is a technique used to predict flowering on the basis of accumulated heat units above a particular base temperature. With many crop plants this is used as a more reliable predictor than calendar dates. A 1994 survey of New Zealand magnolias identified Lincoln Universities collection as No. 1 in the South Island, and third in New Zealand. The collection has grown significantly since then due to further grant money from the Brian Mason Scientific and Technical Trust. Currently the collection of Magnoliaceae includes approximately one hundred and thirty cultivars, hybrids and species of *Magnolia*, and just a few examples of the closely related genera - *Michelia, Liriodendron* and *Magnlietia*. While early to mid September is peak flowering time for magnolias, Edwards says it is possible in a year such as 2000 with its mild winter to have magnolias flowering for nearly 10 months of the year. The early magnolias are of
Asiatic origin and start from late July or early August, these include; *M. campbellii*, *M. sargentiana*, *M. sprengeri*, *M. denudata*, *M. kobus*, followed by the *M. x soulangeana* cultivars and *M. liliiflora*. *M. sieboldii* and *M. wilsonii* begin in October. In December the giant leaved *M. macrophylla* flowers at the same time the evergreen *M. grandiflora* and cultivars begin flowering. The latter continues until the frosts stop them in the winter. During all of this time there are a number of cultivars with *M. liliiflora* in their parentage that will flower in the late summer, intermittently through the autumn. *M. ‘Freeman’* a cultivar of a hybrid cross between two American species *M. grandiflora* and *M. virginiana* starts to flower in May. This is a tree similar to *M. grandiflora*, but has smaller leaves and more flowers, this would be an ideal smaller tree for warmer sites. The tree is hardy at Lincoln, but heavy frosts, such as we had this July put paid to flowering prematurely. *M. virginiana* is a shrubby species that starts flower at the end of autumn.
Thermal time requirements for flowering of precocious Asiatic magnolias

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Abstract
Observations on flowering times of 55 different Magnolia species, hybrids and cultivars were made at Lincoln University over a period of five years. Results from June 1st until 50% full flowering showed thermal time was a better predictor of flowering time than number of days.

Key words
Base temperature, flowering, magnolia, precocious, thermal time.

Introduction
The magnolias used in this study are primarily precocious - those that flower on bare wood, before the leaves appear in spring. Bud dissections on a range of precocious magnolias at Lincoln showed that flowers have been initiated by early to mid summer. The hypothesis was that heat unit accumulation alone would be responsible for flowering times of precocious magnolias. The eight species involved in this study are Magnolia liliiflora, M. denudata, M. campbellii, M. kobus, M. stellata, M. sprengeri, M. sargentiana and M. acuminata. All but the last species are Asiatic in origin, M. acuminata is North American. All magnolias included are in one of the three sections, Yulania, Tulipastrum and Buergeria within the subgenus Yulania. Hybrids and cultivars from crosses between species listed above are also included.

Thermal Time
A common approach for expressing the relationship between temperature and plant development is to calculate the thermal time (Tt) (also known as heat units or growing degree-days (°Cd)) required between two growing stages (Arnold & Monteith 1974). In its simplest form Tt is calculated as the mean temperature minus the (Tb) or threshold temperature below which no development takes place. Angus; Cunningham, Moncur and Mackenzie (1981) used this approach to define Tb and Tt required for field emergence of a range of tropical and temperate crops. For temperate species Tb was below 4°C compared with 10 to 14°C for tropical crops. Sangoi and Silva (1986) found 3 methods for calculating heat units were more reliable than calendar dates for the developmental stages of 2 cultivars of sunflower. They found no differences between the methods for calculating heat units. Jackson (1999) suggests, for fruit crops, 10°C is a suitable base, since little growth occurs below that temperature. Degree-days may be calculated using the following formula, Degree days = (M –10) x N where M = mean monthly temperature and N = the number of days in the month. Alternatively heat units can be calculated on a daily basis, i.e. the days when the temperature is above 10°C (M-10) are added to give an annual total which is higher than that calculated on a monthly basis. Besselat, Drouet and Palagos (1995) monitored temperature and phenological development of different grape cultivars at 5 different sites and concluded that; (1) it is better to take account of maximum rather than mean temperatures, (2) some models are better adapted to a fixed date rather than budburst and (3) variability in thermal requirements can usually
be explained as a climatic adaptation, although climatic conditions at the time of flowering can perturb this effect. Pitacco, Guerriero, Cipriani and Giovannini (1992) describe both chilling units as the number of hours below 7°C and the number of growing degree hours to determine the phenological stages of flower and leaf bud development for the peach ‘Springcrest’ at 3 different locations. Salinger, Kenny and Morley-Bunker (1993) investigated the climatic influences on growing kiwifruit in New Zealand showed the timing of the end of dormancy was determined by the amount of winter chilling. When sufficient chilling occurred, the time from dormancy end to bud-burst was positively correlated with temperature over this period but when insufficient chilling occurred, bud-burst dates were determined by the amount of exposure to low temperature. The transition from bud-burst to flowering required 415°C days above a base temperature of 7°C to be completed. Salinger and Kenny (1995) identified three important determinants for the distribution of kiwifruit cv. Hayward as winter chilling, growing season thermal time and annual rainfall to enable mapping of the most suitable areas in New Zealand for growing kiwifruit. These were May-July temperatures of 11°C as the optimal winter chilling requirement, a thermal time accumulation of 1100 degree-days above 10°C from October to April and an annual rainfall of 1250mm. Song-ChiaWei and Ou-ShyKuan. (1997) used a $T_b$ of 10°C to show the time from full bloom of eleven cultivars of low chill peaches to harvest depended on both the length of the flowering period and the fruit development period. The eleven cultivars concerned were grouped by thermal time requirements into early, moderate and late ripening. Erez, Yablowitz, Korcinski, Bodson and Verhoyen (1998) showed vegetative buds of peaches normally need more heat units to break than floral buds and they respond differently to higher temperatures. Under natural cool climate conditions flower buds develop more quickly than vegetative buds adjacent on the same node, while under warmer conditions, leaf production may advance to the stage that flowering will occur concomitantly with vigorous vegetative growth.

**Methods and materials**

During a five-year period between 1998 and 2002 estimates of the percentage of flowering were made for temperate magnolias in flower in a collection at Lincoln University. Observations were made for individual species, hybrids and cultivars. The Magnolia collection at Lincoln University has been developed since 1990 and plants included in this study are typically from the earlier plantings that now flower regularly. Visual estimates of the percentage flowering were recorded every 7 days. Estimated flowering percentage data and flowering dates were entered into a database. Climate data was obtained from Broadfields Meteorological Station nearby and these data were compared with flowering. June 1st each year was used as a start point for accumulation of thermal time. Observations made for each species, hybrid or cultivar was based on a sample of the one plant in the collection. Results were analysed by looking at each plant separately and by aggregating records for species, hybrids and cultivars with common parents as well as combining the results for all and comparing heat unit accumulation for each of the five years. Many of the references reviewed dealt with annual crops, few deal with woody perennials and those that do have concentrated on thermal time requirements from flowering to fruit harvest. The $T_b$ of 10°C chosen is the period from spring and is therefore too high for the period being looked at with the magnolias in this study. Base temperatures between 0°C and 5°C were compared with flowering data 0°C was selected as appearing to be most appropriate. June 1st was chosen as a starting date each year, coinciding with the completion of leaf fall for the magnolias involved in this study at Lincoln. Because the magnolias involved in this study are precocious, leaves were not present until flowering is well underway for the period and therefore light levels were not considered.
**Statistical analysis**  
Calculations of means for 1998 and 1999 as observed against flowering in 2000 as the predicted were made. Comparisons between groups of hybrids and cultivars of different numbers were standardised using coefficient of variation (CV). Root mean square deviations (RMSD) were used to compare days to flowering with accumulation of thermal time (TT).  
RMSD formula: $\left\{ \frac{\sum (\text{observed} - \text{predicted})^2}{n} \right\}^{1/2}$. Observed values come from the mean of years 1998 and 1999 minus 2000 as the predicted.

**Results and discussion**  
Magnolias were analysed individually and collectively based on their reputed parentage (Table 1). The main parents involved in the 53 magnolias involved are *M. liliiflora*, *M. stellata*, *M. campbellii* and *M. denudata*. *M. liliiflora* tends to have two flowering periods, the main one in early to mid spring, followed by a lesser flowering in mid or late summer. This characteristic is clearly evident in a number of cultivars with this parent. *M. campbellii* tends to be amongst the earliest flowering and cultivars with this as a parent are variable, but usually early. ‘Star Wars’ however will flower over a large range of times, presumably based on *M. liliiflora* being the other parent, whilst ‘Early Rose’ has shown it can flower in early August, although at Lincoln is usually early to mid September (Table 1). The RMSD calculations showed that TT as a predictor of flowering for the sum of all the magnolias was less than half of that for number of days. (Table 3). All groups except 17 had larger RMSD’s for number of days compared with those for thermal time. The largest RMSD’s for number of days were also generally with the earlier flowering magnolia groups. This difference was not apparent with the RMSD’s for TT. It is likely that the earlier flowering magnolias exhibiting the larger RMSD’s is due to the variable nature of winter temperatures compared with the later flowering magnolia RMSD’s where fluctuations in accumulated temperature have evened out by this stage. All groups except 5, 8 and 14 had larger CV’s for number of days compared with those for thermal time. The largest CV’s for number of days were generally with the earlier flowering magnolia groups. This difference was not seen with the CV’s for TT.
Table 1. Magnolias grouped by similarity of reputed parents

<table>
<thead>
<tr>
<th>Species, hybrids and cultivars</th>
<th>Groups</th>
<th>a liliiflora</th>
<th>b stellata</th>
<th>c kobus</th>
<th>d denudata</th>
<th>e acuminata</th>
<th>f campbellii</th>
<th>g spergerti</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>a1 ‘Nigra’</td>
<td>b1 ‘Rosea’</td>
<td>d denudata</td>
<td>e acuminata</td>
<td>f1 ssp. mollicomata</td>
<td>f2 ssp. mollicomata</td>
<td>g1 spergerti</td>
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<tr>
<td></td>
<td></td>
<td>a2 ‘O’Neill’</td>
<td>b2 ‘Waterlily’</td>
<td>e acuminata</td>
<td>f1 ssp. mollicomata</td>
<td>f2 ssp. mollicomata</td>
<td>f3 var. alba</td>
<td>g1 spergerti</td>
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<tr>
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<td></td>
<td>a3 ‘Reflorescens’</td>
<td>b3 ‘Waterlily’</td>
<td>e acuminata</td>
<td>f1 ssp. mollicomata</td>
<td>f2 ssp. mollicomata</td>
<td>f3 var. alba</td>
<td>g1 spergerti</td>
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<td>c</td>
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<td>d</td>
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<td>d</td>
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<td>8</td>
<td>a2</td>
<td>e</td>
<td></td>
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<td>f</td>
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<td>d</td>
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Table 2. Magnolias first observed at 50% or more of full flowering from June 1st for each of 5 consecutive years at Lincoln University

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<td>1</td>
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<td>24/09</td>
<td>21/09</td>
<td>20/9</td>
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<td>09/09</td>
<td>28/08</td>
<td>11/08</td>
<td>31/8</td>
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Table 3. Mean durations to 50% full flowering for a five year period for temperate (mainly precocious) *Magnolia* species, hybrids and cultivars grouped by parentage and recorded from June 1st each year. Durations are expressed in calendar time (days) and thermal time (TT), with respective coefficients of variation (CV) and root mean square deviation (RMSD).

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<th>CV Days</th>
<th>RMSD Days % Predicted</th>
<th>TT</th>
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Conclusion
TT is a better predictor of flowering than number of days. Early flowering magnolias are likely to show greater variation in number of days to flowering depending on the vagaries of the winter weather, more so than the later in spring flowering magnolias, when accumulated thermal time equates more closely to number of days. This was observed with many of the magnolias with M. campbellii as a parent during the warmer winter of 2000. In a practical sense the information about flowering times could be used to plan flowering displays for an event with more certainty later in the season rather than with early flowering magnolias….

Acknowledgements
The Brian Mason Scientific and Technical Trust for helping fund the development of the Magnolia collection, without which this study would not have been possible. Bruce Palmer and Cristina Null for helping to record flowering times. Keith Pollock for helping organise the data on to spreadsheets.

References


A Review of Factors Affecting the Establishment of Magnolias in New Zealand

Michael B. Thomas, Roy A. Edwards and Mervyn I. Spurway
Plant Science Department, Lincoln University, Canterbury

INTRODUCTION
It was noticed that several grafted plants within the Lincoln University magnolia collection had performed poorly or died. It was decided to examine the possible reasons for this and to evaluate other plantings with the objective of explaining why these problems of establishment have occurred, so that recommendations can be made to help improve the success in establishing magnolias in the future.

PROPAGATION METHODS
A wide range of magnolias are commonly grafted (mostly by chip budding) onto rootstocks in New Zealand. Hooper (1950) discussed the grafting of magnolias and reported on the growth of several understock/bcion combinations at one nursery. Up to the early 1960s most deciduous magnolias were grown from layering (Hillier, 1956) but Johnstone (1955) records how grafting was also becoming an important method of propagation. One experienced nurseryperson commented that the "early" layered magnolias, like Magnolia campbellii, had established really well; however later grafted plants of this species, have suffered several losses during establishment (Hughes, pers. comm.). Clones of M. grandiflora, M. sieboldii, M. x soulangiana, and M. stellata (syn. M. kobus var. stellata), as well as Gresham hybrids, are now commonly grown from cuttings. Callaway (1994) states "today propagation by cuttings is the most common form of vegetative propagation, though some Magnolia species and cultivars, such as, M. denudata still remain difficult to root by this means." Early methods of commercial production by grafting, which began about 40 years ago, were approach and veneer grafting (Hillier, 1960). Chip budding has now become a very popular and successful means of propagation for the grafted species (Callaway, 1994; Haya, 1981; Knuckey, 1989; Lone, 1996; Tubesing, 1987).

SURVEY RESULTS
A survey was carried out whereby a range of magnolia growers were asked for their observations on problems in establishing these plants. In addition the Lincoln University and Trott's Nursery plantings were visited and plants measured and evaluated (only conclusions from this are included generally within this article).

Legend: C indicates species or hybrids of M. campbellii.

- Auckland Botanic Gardens, Auckland.
  Generally good establishment of M. campbellii hybrids particularly if open-ground stock planted in good soils with shelter (Hobbs, pers. comm.).

- Blue Mountain Nurseries, Otago. Magnolias that have died:
  M. campbellii ssp. mollizoma C
  M. campbellii ssp. mollizoma 'Strybing White' C
All these plants appeared to establish but then experienced scion death after 2 years with the rootstock remaining alive.

- Dunedin Botanical Gardens, Otago. Magnolias (examples only) that have died:
  - *M. 'Athene'*
  - *M. campbellii ssp. mollicomata 'Lanarth'*
  - *M. 'Seren'*

* This cultivar has failed three times, with the fourth plant currently growing well (Matchett, pers. comm.).

- Elliott's Nursery, Canterbury. Magnolias (examples only) that have died:
  - *M. xbrooklynoensis 'Woodsman'*
  - *M. 'Susan'*

Both plants were planted on a moist bank (Elliott, pers. comm.).

- Lincoln University, Canterbury. This collection consists of 80 plants which were mostly planted between 1990 and 1992. Magnolias that have died:
  - *M. acuminata 'Golden Glow'*
  - *M. 'Atlas'*
  - *M. 'Cuerhays Belle'*
  - *M. campbellii ssp. mollicomata*
  - *M. campbellii ssp. mollicomata 'Lanarth'*
  - *M. campbellii ssp. mollicomata 'Strybing White'*
  - *M. 'Lotus'*
  - *M. 'Mark Jury'*
  - *M. 'Milky Way'*
  - *M. 'Spectrum'*
  - *M. sprengeri 'Diva'*
  - *M. xquinshoren*

** This plant flowered in its 2nd and 3rd years but the scion (only) died the following winter with the scion height at 2.06 m.

# These plants later sent up suckers indicating scion death only. Most graft unions were measured and assessed for growth characteristics. Unions were generally smooth and in most cases the diameter of the stock was greater than that of the scion. One exception to this was the marked overgrowth of 'Mark Jury' compared to the stock.

- Tikitike Gardens, Rotorua. Magnolias (example only) that have died:
  - *M. 'Vulcan'*

There had been several failures with container-grown stock, especially plants with *M. campbellii* "blood", particularly *M. 'Vulcan'. Open-ground plants were found to establish more successfully (Robinson, pers. comm.).

- Trotta Nursery, Canterbury. Magnolias that have died:
  - *M. acuminata*

Mostly container-grown stock which have all established well, including *M. campbellii* hybrids (Trotta, pers. comm.). About 30 plants were measured to compare the diameter of stocks and scions close to the graft union. Matching was generally excellent with
REASONS FOR FAILURES

Species and Cultivars. There was a very high proportion of magnolia losses that were *M. campbellii* or cultivars directly related to this species, as indicated in the survey list. *Magnolia campbellii* ssp. *multiflora* 'Lanarth' is an example of a cultivar that has proved particularly difficult to establish. At the Dunedin Botanic Gardens they are currently attempting to grow their fourth plant of this cultivar having failed with the previous three (Matchett, pers. comm.). It was also noted, in the survey, that *M. "Vulcan"* had given repeated failures and this hybrid has 'Lanarth' as one of its parents. *Magnolia campbellii* ssp. *multiflora* 'Strybing White' is another cultivar that has been noted to often give problems in establishment (Rumbal, pers. comm.). Further comment on individual species can be found under subsequent sections.

Soil and Climate Effects. Several plants that died were grafted ones where the scion died but the rootstock remained alive. Frost killing the top of the plant is a possibility. Harrison (1967) comments that there are several forms of *M. campbellii* grown in New Zealand and that the one most propagated in nurseries is the more tender Yunnan form. He states that the previous season’s young growths can be badly damaged by frost. Hillier’s Manual of Trees and Shrubs (Aron, 1977) also states that there is a considerable variation in the degree of hardiness. However, Fleming (1989) pointed out the value of grafted plants compared to cutting-grown plants of identical clone and grown in the same area were observed to be much less hardy than those that had been grafted. One would expect that planted magnolias would establish more readily in the warmer and more favourable climates of the North Island of New Zealand than in the South Island, although the climate in the latter is still a good deal more favourable than situations in the British Isles where so many species have been successfully established. The dry summer conditions in Canterbury are also a big contrast to the natural habitats of species like *M. campbellii* which comes from conifer-clad mountain slopes of southern China to a height of 3000 m or more (Treseder, 1978) but this should not result in death. There are very suitable conditions in autumn in Canterbury for the ripening of wood, a factor which has proved important for plants to avoid frost injury in England (Millais, 1927).

In the magnolia collection (over 100 plants) at the Auckland Botanic Gardens it has been noted that soil type and shelter are major factors in the establishment and successful growth of plants (Hobbs, pers. comm.). Plants grown in deep open soils tend to do well while those plants in sheltered areas have a much greater chance of success. It had been noted that magnolias on good soils, but exposed to the wind, would usually sulk and often die. This clearly concurs with Millais’s (1927) statement that the rate of growth of magnolias depends entirely on their cultivation, situation, and climate.

Graft Incompatibility. The recorded evidence in the literature concerning incompatibility problems in magnolias does not appear to be strong or widespread. However, Humphrey (1966) reported that Hillier's nursery in England needed to grow five different stocks of magnolia in order to avoid incompatibility. Also Nelson’s (1988) summary of incompatibility in grafted horticultural plants does record several instances. This review specifically states that *M. acuminata* and *M.*
stocks. In contrast, and only a year later, there was a report on the case of budding magnolias in which there was no mention of incompatibility even between evergreen and deciduous species, citing the example of *M. grandiflora* budded onto the deciduous stock, *M. kobus* (Knuckey, 1969). More recently Tubbs (1987) stated that he knew of no cases of intraspecific graft incompatibility in the genus *Magnolia*, such as occurs in *Acer rubrum*. Unisegments unions formed when *M. campbellii*, *M. sprengerii*, etc., were grafted onto *M. kobus* or *M. x soulangiana*, but were not seen as a sign of incompatibility. In a recent report on chip budding of magnolias, Lane (1995) commented on the desirability of having stocks and scions of close genetic affinity, but again there was no information on actual problems. This was also the case for a New Zealand study recording the use of different magnolia clonal rootstocks (Hooper, 1990).

It appears that there is general acceptance of the fact that graft incompatibility in magnolias is seldom a problem and the genus has high affinity even between widely differing species. *Magnolia campbellii* is readily grafted onto *M. x soulangiana* as reported by Hooper (1990) and there are also many other successful combinations, even between deciduous and evergreen species. Treseder (1978) also states that even though some people surmise that there are problems, "there is no evidence of graft incompatibility." Callaway (1994) in her recent book on magnolias summaries this situation by stating that some graft incompatibilities do arise where there are differences in growth between stock and scion which may result in a weak union. Also, the comment was made that graft incompatibilities are not as common with magnolias as with other genera, such as maples, so grafted magnolias are usually successful if the process is carried out correctly. It is noteworthy that of the many recent articles on magnolia grafting there is little or no emphasis on the danger or risk of graft incompatibility in magnolias.

However, there are some losses that are hard to explain other than incompatibility since only the scions died up to 3 years after planting, while often extensive suckerings occurred from the rootstock. For example, *M. acuminata* 'Golden Glow' was planted at Lincoln University in 1990 (Edwards, 1994) and recorded as having flowered in 1991 and 1992. The scion died in 1993 when at a height of 2 m while the regrowth of the rootstock is now almost 2 m high and growing strongly. The cultivars 'Lanarth' and 'Straining White', which are both selections of *M. campbellii* ssp. *mollis*omata, also showed scion death at Lincoln University and have since produced basal shoots from the stock. The latter cultivar had flowered in its second growing season but failed to grow after that. Sectioning of graft unions of some plants indicated that in the case of 'Lanarth' and 'Golden Glow' there is a strong indication of graft incompatibility due to the distinct dark colouring in the tissues shown in Fig. 1. This darkened area appears to indicate graft incompatibility and was completely absent in the section taken from M. 'Caerhays Belle'. There is, therefore, some evidence that graft incompatibility is a factor in the early death of some plants, particularly 'Lanarth' and 'Golden Glow'. Callaway (1994) has also stated that delayed incompatibility does occur and that cutting propagation, where possible, has the advantage of avoiding this problem.

**Disease Losses.** Magnolias are subject to a range of diseases, many of which are leaf spots and die-back disorders (Callaway, 1994; Pirone, 1978). Severe losses occurred with a planting of *M. grandiflora* in recent years in Canterbury (Morgan,
has been noted on magnolias overseas (Pirone, 1978). However, no wilt symptoms were noted as occurring on any of the deciduous plants included in the survey, also there were no M. grandiflora losses. Some plants at Lincoln University have shown scion death followed by regrowth of the rootstock and as stated above there is some evidence to link this with graft incompatibility. Other possibilities are that disease could have entered the top part of the plant resulting in scion death but not root death. Magnolia campbellii (and others) may have greater susceptibility to this type of disease attack. Several plants at Lincoln University show tip die-back which results in dead wood for 10 to 15 cm from the ends of shoots. Growers (Blumhardt, pers. comm.; Hooper, pers. comm.) have noted major die-back on well-grown species of M. campbellii which was thought to be Verticillium wilt. Blast (bacterial wilt, Pseudomonas syringae) has been identified and recorded as a pathogen on magnolias in New Zealand and is a possible reason for scion death, however, Calloway (1994) only records this as causing leaf spots. A further consideration may be that systemic diseases like Verticillium wilt could readily be transmitted on budwood.

Transplanting Loss. Millais (1927) begins this topic in his book by saying: "Practically the only difficulty with magnolias is to get them established after planting." The roots are thick, fibrous, and fleshy, and it is important to avoid damaging the soft and fragile roots of young seedlings when potting (Bean, 1973; Tresseder, 1978). Damage could be done by rough handling or excessive firming. It is most important to avoid planting too deeply and to plant sensitive species preferably in late winter to early spring (Huxley et al., 1992; Millais, 1927; Tresseder, 1978). Several authors also recommended deep cultivation in the planting hole, incorporation of organic matter, and the value of mulching. The Royal Horticultural Society Dictionary of Gardening (Huxley et al., 1962) states that planting too deep is one of the most common causes of poor growth or even subsequent death in newly

Figure 1. Cross sections of the graft unions of three cultivars of magnolias. Left to right.
planted magnolias. Young plants are probably more prone to loss than large plants since there are accounts of moving large specimens, for example a 10-metre-high specimen of *M. campbellii* was successfully moved from England to Ireland on a truck (Tresseder, 1978).

Harrison's (1967) comments on transplanting and establishment of magnolias are worthy of special attention as they link several factors together. He states that these plants are quite easy to grow in any good free-draining soil but in districts with very cold and wet winters, losses often occur during transplanting. This is due to the fact that the fleshy roots, damaged by lifting and handling, die back from the cut and bruised portions, and under such conditions spring planting is best. Husley et al. (1990) suggest that to leave the planting until the sap begins to rise, as is sometimes advocated. is doubtful advice. Harrison (1967) also states that *M. campbellii* and the *M. stellata* forms are particularly subject to root collapse under such conditions.

CONCLUSIONS AND RECOMMENDATIONS

The difficulty of assessing the cause of losses is compounded by the fact that certain species are sensitive to transplanting shock, so that although genotype is probably the key factor in incompatibility problems, the genetic constitution is also very significant in being the cause behind many failures to establish magnolias. Based on this review it was noted that a large proportion of the losses involved species and hybrids of *M. campbellii* and clearly the "blood" of this species does confer a weakness in the establishment phase.

It is probable that graft incompatibility was the cause of the death of the scions in those cases where the rootstock remained alive and sent up suckers. In the majority of cases, where the whole plant died, causes other than graft incompatibility are likely. Disease infection of the scions is considered another possibility (disease attacking the scion of a grafted plant is not strictly graft incompatibility unless the graft union is affected). It is suggested that this again indicates the sensitivity of *M. campbellii* and that in this case it is disease susceptibility. Graft incompatibility and disease susceptibility would appear to warrant further study to establish their relative significance.

It is recommended that nurseries take special care with the production of magnolias, and especially grafted *M. campbellii*, so that they are produced with healthy compatible root systems and not allowed to become pot bound or lacking in vigour in the nursery. Growing advice needs to be passed on to customers to help minimise losses, especially on *M. campbellii* plant labels, etc. Such aspects as site selection, shelter, soil preparation, and planting depth, need to be publicised through educational pamphlets and labels.

Finally, the authors acknowledge that some conclusions and evaluations of factors causing losses have been rather speculative given the lack of conclusive evidence. Clearly more research is needed. We would greatly appreciate receiving comments and observations from magnolia growers around the world so that we can continue to "seek and share" and fulfill this noble aspiration of our society, for the establishing of magnolias is clearly one of the most dominant problems which stand in the way of more widespread use of these magnificent plants.

Epilogue: A valuable comment was made after the conference paper by Phil Carson. He pointed out that he had looked on *M. campbellii* as a plant with a


very subject to damage when transplanting is carried out, since the roots always have some degree of activity.

LITERATURE CITED
Distinguishing between *Magnolia* cultivars using AFLP fingerprinting

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Abstract

Amplified fragment length polymorphisms (AFLP) were used to generate informative DNA fingerprints from *Magnolia denudata*, *M. liliiflora* and cultivars of their hybrid cross, i.e., *M. × soulangiana*, *M. × soulangiana* ‘Lennei’, *M. × soulangiana* ‘Rustica Rubra’, *M. × soulangiana* ‘Alba’, *M. × soulangiana* ‘Ruby’, and *M. × soulangiana* ‘San Jose’. A single specimen of unknown origin and representatives of the closely related *M. campbellii* and *M. stellata* were also included in the analysis. We show how this method may be used for distinguishing between cultivars.

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Key words amplified fragment length polymorphism, cultivar, DNA fingerprinting, hybrid, *Magnolia*.

**INTRODUCTION**

A cultivar must be clearly distinct, uniform and stable in its characteristics (Trehane et al., 1995). Distinguishing between cultivars based on morphology can be difficult because the diagnostic characters are often small or may not be apparent all year round. DNA fingerprinting provides a means to test the hybrid origin of cultivars and cultivar similarity and may lead to a better understanding of our cultivated plants (Lee et al., 1996).

*Magnolia × soulangeana* or the saucer magnolia, resulted from a cross between *Magnolia denudata* (seed) and *Magnolia liliiflora* (pollen) made by Etienne Soulange-Bodin in 1820. Soulange-Bodin, a former diplomat in the French Army, established and was the first director of the Royal Institute of Horticulture near Paris where he produced this hybrid (Spongberg in Hunt, 1998). Although commonly listed as *M. × soulangiana*, the correct spelling for this hybrid is with the termination –*eana* as described by Hunt (1998). Callaway, (1994), considered it likely that Soulange-Bodin’s cross was also made independently in Japanese nurseries, possibly occurring spontaneously when the two parent plants were grown in close proximity. After the introduction of the hybrid by Soulange-Bodin, a plethora of named forms were introduced, including seedlings from backcrosses and open pollinations. These forms cover the complete range between the two parents in flower colour, shape, and size. It is now practically impossible to keep track of all of the forms and account for their origins.
A rootstock of unknown origin in the *Magnolia* collection at Lincoln University that grew after the death of the scion *M. acuminata* 'Golden Glow' produced flowers similar to *M. × soulangeana* cultivars in shape and colour, but were generally much larger. Flowering period and morphological characters were insufficient to distinguish this taxon, which has potential as a new cultivar for amenity horticulture.

The DNA fingerprinting technique known as amplified fragment length polymorphism (AFLP) (Vos et al. 1995, Mueller and Wolfenbarger, 1999) may be applied directly to distinguish between and identify cultivars (Baraccia et al. 1998, Dirlewanger et al. 1998, Tignon et al. 2000, O'Hanlon et al. 1999, Nadarajan et al. 1999). The use of DNA profiling for plant variety registration is attracting particular attention (Law et al., 1998). The AFLP method allows the generation of 10–100 times more markers per reaction than other fingerprinting techniques, the large number of putative loci sampled providing a measure of variation across a wide portion of the genome (Sharma et al., 1996).

In the present investigation, we used AFLP to study genetic variation in *M. denudata* Desr., *M. liliiflora* Desr. and cultivars of their hybrid cross *M. campbellii* Hook. & Thoms. and *M. stellata* (Sieb. & Zucc.) Maxim. were included for reference because these species are estimated (Qui et al., 1995) to be among the closest relatives of *M. denudata* and *M. liliiflora*. The main question we addressed was: Can *Magnolia* cultivars be distinguished using AFLP markers?
MATERIALS AND METHODS

Plant materials and DNA samples

Samples from 12 mature Magnolia specimens were used for the present study (Table 1). A single cultivar of unknown origin was included for investigation, plus samples of M. campbellii and M. stellata. Two leaves were used for separate extractions from M. × soulangeana and carried through the complete AFLP process as a control. All selective amplifications were repeated for the first primer combination and subsequently carried through as a test of reproducibility.

DNA extraction, digestion and ligation

Total DNA was extracted using a modification of the CTAB method ((Doyle and Doyle, 1987)). DNA was precipitated in ethanol and resuspended in 25 μl TE (10 mM Tris-HCl, pH 8.0, 0.1 mM EDTA) buffer. DNA concentrations were estimated and standardised against known concentrations of Lambda DNA on 1% agarose gels.

The AFLP protocol followed Vos et al. (1995), with a modification to the thermocycling profile after Lockhart and McLenachan (1997). Initially 12 μl of the total DNA extract was digested with two restriction enzymes, EcoRI and MseI for 2 h. at 37° followed by 15 min at 70°. The digest included 6 μl buffer (50 mM Tris-HCl, pH 7.5), 5 μl water, and 1 μl of each enzyme. A 5 μl aliquot was run on a 1% agarose gel to check
digestion was complete and the remaining DNA was then ligated by adding 2 μl of the EcoRI and MseI adapters to 2 μl of buffer (100 mM Tris-HCl, pH 8.3, 15 mM MgCl2, 500 mM KCl), and 1 μl T4 DNA ligase. The mixture of ligation cocktail plus digested DNA was incubated overnight at 4°C.

_Pre-and selective amplifications_

Pre-amplification of a prepared template was carried out with EcoRI and MseI primers, each having one selective nucleotide, EcoRI+1 primer 5’–GACTGCGTACCAATTCA–3’ and MseI+1 5’–GATGAGTCCTGAGTAC–3’. Pre-amplification was carried out in a thermocycler using the following temperature profile: 40 cycles of 30 s at 94°C, 30 s at 50°C, 60 s at 72°C.

A dilution of 1:10 was made from the preamplification products and used for selective amplifications with EcoRI primers labelled with HEX (labelled primers purchased from Life Technologies). An aliquot of 1 μl, taken from each of the preamplification dilutions, was used for selective amplifications. Selective amplifications were made using four primer combinations: 1) EcoR1-AGC/MseI-CAG; 2) EcoR1-AGC/MseI-CAT; 3) EcoR1-AGC/MseI-CTG; 4) EcoR1-ACG/MseI-CAT. The following cycle profile was used for selective amplification: 5 cycles of 30 s at 94°C, 30 s at 65°C, 60 s at 72°C, followed by 6 cycles of 30 s at 94°C, 30 s at 60°C, 60 s at 72°C, followed by 24 cycles of 30 s at 94°C, 30 s at 56°C, 60 s at 72°C.
Generation of AFLP fingerprints

From the 20 µl selective amplification product, 4 µl was run out on a 3% agarose gel to check for distinct amplification products. The remaining 16 µl was purified via ethanol precipitation and aliquots of the products run out on an ABI 377 automatic sequencer. Fragments were detected by laser and accurately sized with an internal standard. Digitally converted raw data were saved as samples migrated past the fluorescence detector. Multilocus profiles were visualised using ABI GENESCAN software. Fragment differences between samples were identified as those differing by 1 bp. AFLP profiles were scored for presence/absence of fragments between 50 and 400 bp and a binary matrix prepared.

Data analyses

The statistical software package SYSTAT vers. 5 was used to calculate the percentage congruence between replicate samples using the simple matching coefficient.

SYSTAT vers. 5 was also used to compare three levels of genetic variation: 1) between replicate selective amplifications; 2) between M. × soulangeana cultivars; and 3) between species. A similarity matrix was generated for primer combination 1 based on the coefficient of Jaccard (S) (Sneath and Sokal, 1973). This coefficient does not consider the shared absence of a character as indicating similarity.

\[ S = \frac{a}{a + b + c}, \]

Where \( a \) = number of fragments present for both samples; \( b \) = number of fragments present for sample A, but not for sample B; \( c \) = number of fragments present for sample
B, but not for sample A. When comparing variation between samples, the similarity between every possible pair was used to calculate the median similarity index (Sokal & Rohlf 1981) for each level of variation present among the operational taxonomic units (OTUs) in primer combination 1.

Using the numerical taxonomy program NTSYS-pc (Rohlf, 1990), similarity matrices were generated from each of the binary matrices for each primer combination based on Jaccard’s coefficient. A pairwise correlation was calculated between the elements of each of these similarity matrices and the Mantel test (Mantel, 1967), with 100 random permutations performed to test for significant similarities between primer combinations.

Binary matrices for each primer combination were modified so that each contained only those OTUs shared among all matrices. The matrices with identical OTUs were then pooled to form a single matrix. The coefficient of Jaccard was then used to generate a matrix of similarities for: 1) cluster analysis using the unweighted pair-group method arithmetic average (UPGMA); and 2) principal coordinates analysis (PCOORDA). A UPGMA dendrogram was constructed and the first two coordinates were plotted from the PCOORDA.

The program AFLPapp (Benham, 1997) was used to identify the fragments inherited from each putative parent for all primer combinations. The method takes the first parent and compares every fragment to the second parent. Fragments were not used in the analysis if: 1) a fragment from the first parent is also present in the second parent and 2) if a fragment was not shared between any of the cultivars and parents. The *Magnolia* of unknown origin was included for analysis.
RESULTS

The congruence between replicate amplifications was 91 % (81-100 %). Median levels of similarity among OTUs in primer combination 1 based on the Jaccard coefficient were as follows: 1) between replicate selective amplifications, 85 %; 2) between *M. × soulangeana* cultivars, 64 %; and 3) between species, 55 %.

A total of 1401 AFLP fragments were recorded for 13 OTUs for the four pooled AFLP primer combinations, with an average polymorphism of 81.2 % (Table 2). The Mantel test showed a highly significant (*p* <0.001) correlation between all combinations of primer matrices. The matrix correlation statistics for each primer combination were: *r* = 0.62 for primer 1 versus 2, *r* = 0.69 for primer 1 versus 3, *r* = 0.69 for primer 1 versus 4, *r* = 0.85 for primer 2 versus 3, *r* = 0.86 for primer 2 versus 4, *r* = 0.86 for primer 3 versus 4. Good separation was achieved using principal coordinates analysis, with the first coordinate explaining 64.2% of the variation. The second and third coordinates explained only 5.1%, and 4.3% of the total variation respectively. Principal coordinate axes 1 and 2 (Fig. 1) and UPGMA clustering (Fig. 2) were generally congruent, both showing that: 1) *M. campbellii* and *M. stellata* were separated from other OTUs; 2) *M. × soulangeana* cultivars grouped more closely with *M. denudata* than with *M. liliiflora*; 3) samples originating from separate leaves of *M. × soulangeana* grouped closely together; 4) the sample of unknown hybrid origin appeared among the OTUs representing *M. denudata* and *M. × soulangeana* cultivars. No ties were encountered during UPGMA analysis.
Magnolia × soulangeana cultivars contained greater proportions of fragments inherited from M. denudata compared with M. liliiflora (Fig. 3). Numbers of fragments shared between cultivars and parents ranged from M. × soulangeana 'Alba' (165 fragments shared with M. denudata and 73 fragments shared with M. liliiflora), to M. × soulangeana 'Lennei' (139 fragments shared with M. denudata and 99 fragments shared with M. liliiflora).

DISCUSSION

The results show AFLP data are useful for detecting variation within and among Magnolia cultivars. The 91% congruence for replicate AFLP profiles may be compared with previous studies (Huys 1996, Winfield et al., 1998) that reported similar levels of variation for reference samples, indicating the error present is within the range commonly encountered. The presence of error, such as non-homologous AFLP products, may bias genetic distance estimates between taxa. Rieseberg (1996) suggested that RAPD homology was a function of taxonomic distance, i.e. the more closely the compared taxa are, the greater the probability that a shared co-migrating band is homologous. This may also be extended to the analysis of AFLPs. In the present study, the median similarities based on the Jaccard coefficient were generated specifically for the purpose of comparing different taxonomic levels. These showed decreasing percentage similarity from replicate selective amplifications, to cultivars of M. × soulangeana and finally samples representing different species.

M. × soulangeana cultivars grouped most closely with M. denudata, based on PCOORDA and UPGMA clustering (Figs 1 and 2). All cultivars inherited a higher
number of fragments from *M. denudata* compared with *M. liliiflora* (Fig. 3). We were able to estimate that the cultivar of unknown origin included in our study may have originated from a cross between *M. denudata* and *M. liliiflora*, because it was most closely related to the *M. × soulangeana* cultivars ‘San Jose’ and ‘Lennei’ (Figs 1 and 2) and compared with the other cultivars, contained a similar number of fragments inherited from *M. denudata* and *M. liliiflora* (Fig. 3). Unpublished flowering records of magnolias at Lincoln for three years from 1988 showed that the ‘unknown’ magnolia was more similar to *M. × soulangeana* ‘San Jose’ than *M. × soulangeana* ‘Lennei’ in terms of the spring flowering period and accumulated thermal time. But *M. ‘Unknown’* was unlike both *M. × soulangeana* ‘San Jose’ and *Magnolia × soulangeana* ‘Lennei’ in that only these two cultivars of *Magnolia × soulangeana* have a second and significant flowering period in late summer. *Magnolia × soulangeana* ‘Ruby’ has also shown some tendency to flower in late summer, but to a lesser extent. A significant period of flowering in late summer was also recorded for *Magnolia liliiflora* and *Magnolia liliiflora* ‘Nigra’ for each of the three years.

Possible explanations for the close relationship implied for *Magnolia × soulangeana* cultivars and *M. denudata* include 1) the specimens do not represent true *Magnolia × soulangeana*, and are in fact simple cultivars of *M. denudata.* 2) the specimens are *Magnolia × soulangeana*, but segregation has occurred in the F₂ and succeeding generations, and 3) the specimens are *Magnolia × soulangeana*, but backcrossing to *M. denudata* has occurred. Spongberg (1998) considered many forms of *Magnolia × soulangeana*, to approach or merge with one or other parent, possibly due to
segregation and introgression. Future investigations of *Magnolia × soulangeana* hybrid origin should include multiple representatives of each parent, particularly *M. denudata*.

AFLP variation may have potential for profiling *Magnolia* cultivars, providing evidence in addition to morphology, for registration purposes. However, it would be advantageous to apply selection criteria to fragments included for analysis, e.g., Escaravage et al. (1998), who considered only fragments of certain intensity in their analysis of clonal diversity in a *Rhododendron* population. In this way it may be possible to reduce error that might result from scoring artefact fragments due to partial digestion of the template genomic DNA, poor amplification of fragments during PCR, etc. Tignon et al. (2000) reported uniformity of AFLP profiles among representatives of most apple cultivars they tested, but one cultivar showed variability between specimens, which indicated to them, a level of genetic instability within this cultivar. This highlights the need for adequate testing of multiple representatives of each cultivar (and also from generation to generation) before the use of AFLP profiling as a tool for registration purposes. Accurate identification of cultivars would also require a database containing DNA fingerprints for all recognised cultivars for comparison.

ACKNOWLEDGEMENTS

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http://hordeum.msu.montana.edu/software/software.html.


Table 1 *Magnolia* species, cultivars and hybrids, Lincoln University living plant and herbarium (LINC) voucher numbers for samples used in this study

<table>
<thead>
<tr>
<th>Magnolia species/cultivar</th>
<th>Plant number</th>
<th>Herbarium number</th>
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<tr>
<td><em>M. campbellii</em></td>
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<td><em>M. stellata</em></td>
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<td><em>M. × soulangeana</em> ‘Lennei’</td>
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<td><em>M. × soulangeana</em> ‘Rustica Rubra’</td>
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<td><em>M. × soulangeana</em> ‘Ruby’</td>
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<td><em>M. × soulangeana</em> ‘San Jose’</td>
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<tr>
<td><em>M. × ‘unknown’</em></td>
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<td>LINC20002</td>
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Table 2 Polymorphism detected with four amplified fragment length polymorphism (AFLP) primer combinations for 13 Magnolia samples.

<table>
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<tr>
<th>AFLP Primer combination</th>
<th>No. of fragments</th>
<th>No. of polymorphic fragments</th>
<th>% polymorphism</th>
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<td>EcoR1–ACG/MseI–CAT</td>
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Fig. 1 Plot of principal coordinate 2 vs 1 for Magnolia AFLP data from 4 selective primer combinations. M. × soulangeana (a) and (b) represent different leaves from the same tree.
Fig. 2 UPGMA cluster analysis of *Magnolia* AFLP data from 4 selective primer combinations. *M. × soulangeana* (a) and (b) represent different leaves from the same tree.
Fig. 3 Number of AFLP fragments from 4 primer combinations shared between *Magnolia x soulangeana* cultivars and their parents, *M. denudata* □ and *M. liliiflora* ■