

# Results of New Cultivar Selection Trials for Lemon in Arizona – 2004-05<sup>1</sup>

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## Abstract

*Three lemon cultivar selection trials are being conducted at the Yuma Mesa Agriculture Center in Somerton, AZ. Data from these trials suggest that 'Limonero Fino 49' selections may be a suitable alternative for the varieties most commonly planted in Southwest Arizona today. 'Femminello' and 'Villafranca' might also be planted on an experimental basis*

## Introduction

The Arizona lemon industry has historically relied on a small number of lemon cultivar selections. In the 1950's, the industry was established with 'Desert Lisbon', however within a few years, 'Desert Lisbon' was eclipsed in popularity by 'Frost Nucellar Lisbon' the only nucellar clonal selection of the 'Lisbon' cultivar. Other minor selections of 'Lisbon' that were planted in Arizona from the 1960's through the 1980's included 'Monroe', 'Prior', and 'Rosenberger'. Beginning in the late 1980's, new plantings were established using 'Limoneira 8A Lisbon'. More recently, 'Corona Foothills Lisbon' is increasingly popular. 'Allen Eureka' has also been occasionally planted in Arizona.

All of these represent clonal selections of outstanding trees that were then propagated. Typically, they are identified by their originator or place of origin, and are valuable to Arizona growers because of their high vigor, high productivity, precocity (trees bear at an early age), earliness (a high percentage of the fruit can be harvested before 1 November), short thorns and good fruit quality. When a commonly grown lemon cultivar selection is gradually replaced in the industry, the new selection typically is improved in one of these characteristics. Sometimes a cultivar selection may be replaced because of a negative characteristic. Such was the case with 'Frost Nucellar Lisbon' which appears to be susceptible to brown heartwood rot.

From the late 1980's, to the early 1990's, Arizona lemon growers have received their information about new cultivar selections through word of mouth or from nursery sources, since there were no trials planted in the state. With this in mind, we have planted three new lemon cultivar selection trials in 1995, 1997 and 1998, all located at the Yuma Mesa Agricultural Center. The 1997 and 1998 trial results are presented here.

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## Materials and Methods

1997 Lemon Cultivar Selection Trial. This trial, comprising 13 cultivar selections, was established in March 1997 in Block 22 of the Yuma Mesa Agricultural Center, near Yuma, Arizona. The land was laser leveled and fumigated prior to planting. Trees were planted on an 8-m x 8-m spacing. Fifteen trees of each selection were planted. This trial includes the following selections:

- ‘Allen Eureka’ – The most common and popular ‘Eureka’ selection planted in Arizona. Originated in Santa Paula, CA
- ‘Arancino’ – A minor Italian cultivar, with rounded fruit, a short nipple and thick rind. Fruit is seedy.
- ‘Berna’ (‘Verna’) – The common summer lemon of Spain. Thornless tree produces medium to large fruit with few seeds.
- ‘Cavers Lisbon’ – A vigorous ‘Lisbon’ selection originating in Upland, CA.
- ‘Cascade Eureka’ – Another, less-commonly planted, vigorous selection that originated in San Diego County, CA.
- ‘Cook Eureka’ – A selection from Limoneira Del Mar Ranch, Ventura County, California.
- ‘Corpaci’ – A minor Italian cultivar from Sicily. Vigorous, thorny trees are reportedly productive. Fruit matures early and has few seeds.
- ‘Femminello Comune’ – Italian, everbearing cultivar.
- ‘Limoneira 8A Lisbon’ – A vigorous selection originating from the Limoneira Ranch, Ventura County, CA. The most popular lemon planted in Arizona today.
- ‘Limonero Fino 49’ – The chief winter lemon of Spain. Reportedly vigorous, thorny and highly productive. Early producer with uniform yield. Fruit is spherical to oval, with a smooth rind and a relatively short nipple. Relative high acid and about five seeds per fruit.
- ‘Primofiori’ – Originated in Spain. Similar to the ‘Limonero Fino 49’ described above.
- ‘Santa Teresa’ (Femminello Santa Teresa) – Similar to ‘Femminello Comune’, but resistant to the Mal Secco disease prevalent in Italy.
- ‘Villafranca’ – Said to be of Sicilian origin, introduced into Florida in 1875. Formerly planted in California, but of little importance there today. Fruit and tree characteristics similar to ‘Eureka’, but produces mainly a winter crop.

1998 Lemon Cultivar Selection Trial. This trial, comprising 7 cultivar selections, was established in late September 1998 in Block 14 of the Yuma Mesa Agricultural Center, near Yuma, Arizona. The land was laser leveled and fumigated prior to planting. Trees were planted on an 8-m x 8-m spacing. Fifteen trees of each selection were planted. This trial includes the ‘Limoneira 8A Lisbon’ described above as well as the following additional cultivar selections:

- ‘Dr. Strong Lisbon’ – Originated at the Glen Good ranch, Santa Paula, CA. Large fruit, but tree is reportedly precocious.
- ‘Genoa’ – Similar to the ‘Villafranca’, imported from Italy to the U.S. in 1881.
- ‘Lapithotiki’ – Originated in Cyprus. Reportedly harvested from September until March. Fruit is tapered at both ends.
- ‘Monroe Lisbon’ – Vigorous selection. Reportedly bears early, but fruit is small and coarse.
- ‘Taylor Eureka’ – A nucellar selection, originating in Australia. Reportedly produces late.
- ‘Walker Lisbon’ – Vigorous selection from California.

Yield data is collected during the fall and winter. Trees were ring or strip-picked as noted below. For 2004-05, trees in the 1997 trial were strip picked on 12-7-04. Trees in the 1998 trial were ring picked on 10-7-04 and strip picked on 1-19-05. For each harvest date, the entire quantity of harvested fruit from each tree was passed through an automated electronic eye sorter (Autoline, Inc., Reedley, CA), which provides weight, color, exterior quality and size data for each fruit. Fruit packout data is reported on a percentage basis. Fruit quality data, including °brix, peel thickness, percentage juice, pH, and the total soluble solids to total acid ratio was collected for the 1998 trial.

All data was analyzed using SPSS 11.0 for Windows (SPSS Inc., Chicago, Illinois).

## Results and Discussion

1997 Lemon Selection Trial. Yields of this trial, since its inception, are found in Figure 1. Because of the large number of selections in this trial, the graph has been split for ease of viewing. Selections that have had superior yields since the beginning, include 'Cascade Eureka', 'Cook' Eureka, 'Limoneira 8A Lisbon', 'Limonero Fino 49', 'Primofiori', 'Femminello Comune' and 'Villafranca'. Yields of most of the selections declined in 2004-05 due to flower and fruitlet loss during untimely heat in the Spring and the influence of a large crop in 2003-04. All the Eureka selections fell more than 50%, including 'Allen', 'Cascade' and 'Cook'. 'Villafranca', 'Femminello Comune' and 'Limoneira 8A' had slight decreases in yield, while 'Limonero Fino 49' was the only selection that had an increased yield versus 2003-04.

Yield for the 2004-05 season is shown in Figure 2. 'Limonero Fino 49' had the greatest yield, and 'Femminello Comune', 'Villafranca' and 'Limoneira 8A' were lower, but still statistically the same. 'Primofiori' and 'Santa Teresa' performed the poorest of those selections that typically have the greatest yield. Most of the others performed poorly, with yields of less than 150 lbs. per tree.

Packout for the 12-7-04 harvest, of seven of the most promising selections is shown in Figure 3. Fruit size was quite large, a result of the unusually late harvest date. While most of these had similar size, 'Cavers', 'Primofiori', and 'Limonero Fino 49' had slightly larger fruit, while 'Santa Teresa' and 'Limoneira 8A' had smaller fruit. 'Since the yields of 'Cavers' and Primofiori are so low, it is doubtful that the larger fruit for this cultivar is of any real advantage. 'Limonero Fino 49' has had larger fruit for several of the past few seasons.

Selected fruit quality parameters from the cultivars are shown in Table 1. While there were many similarities between the selections, a few stand out. 'Santa Teresa' was characterized by a low juice pH and a thin peel. 'Limonero Fino 49' had a high level of acids and a thin peel.

1998 Lemon Cultivar Selection Trial. 2001-02 to 2004-05 yields from this trial are found in Figure 4. Although the 'Limoneira 8A' is still the class of this trial; 2004-05 is the first year that any other selection has surpassed it in total yield since 2001-02. 'Monroe', 'Walker' and 'Dr. Strong' Lisbon had yields that equaled or surpassed the yield of 'Limoneira 8A Lisbon' (Figure 5). Meanwhile, 'Genoa', 'Taylor Eureka' and 'Lapithiotiki' had yields 40 to 70% less than the others. All the higher yielding selections had similar quantities of fruit picked in the first harvest, while the three selections that are lagging had less fruit picked early.

Fruit size for the 10-17-04 harvest of this trial is shown in Figure 6. The 'Lapithiotiki' has outstanding size, but it is an elongated lemon, and is probably unsuitable for the US market. Some of this size may be due to its low yield. The size of the 'Genoa' fruit may also be due to its low yield. Of the others, 'Dr. Strong' appears to have the best size at this time, while 'Taylor' Eureka has the smallest fruit. For the second harvest, Lapithiotiki again has the largest fruit (Figure 7), while the others are similar.

## Conclusions

One new lemon cultivar selection appears promising for Arizona. This is 'Limonero Fino 49' lemon, because its yields are similar to that of 'Limoneira 8A' and it has larger fruit size. 'Femminello Comune' and 'Villafranca' may also be suitable, but neither consistently equals or surpasses 'Limoneira 8A Lisbon' lemon in terms of overall yield and/or earliness as often as does 'Limonero Fino 49'. 'Santa Teresa' had excellent yield in 2002-03, but stumbled for the last two years, and is hobbled by its lateness. In the 1998 trial, no selection has proved to be better than 'Limoneira 8A', but 'Walker', 'Monroe' and 'Dr. Strong' may be contenders. No other new selections stand out at this time; however this may change as more data is collected. 'Lapithiotiki' has large fruit, but low yields. 'Eureka'

lemons have typically performed poorly in comparison to the 'Lisbons', and should not be considered as a replacement for any of the high-yielding 'Lisbon' selections.

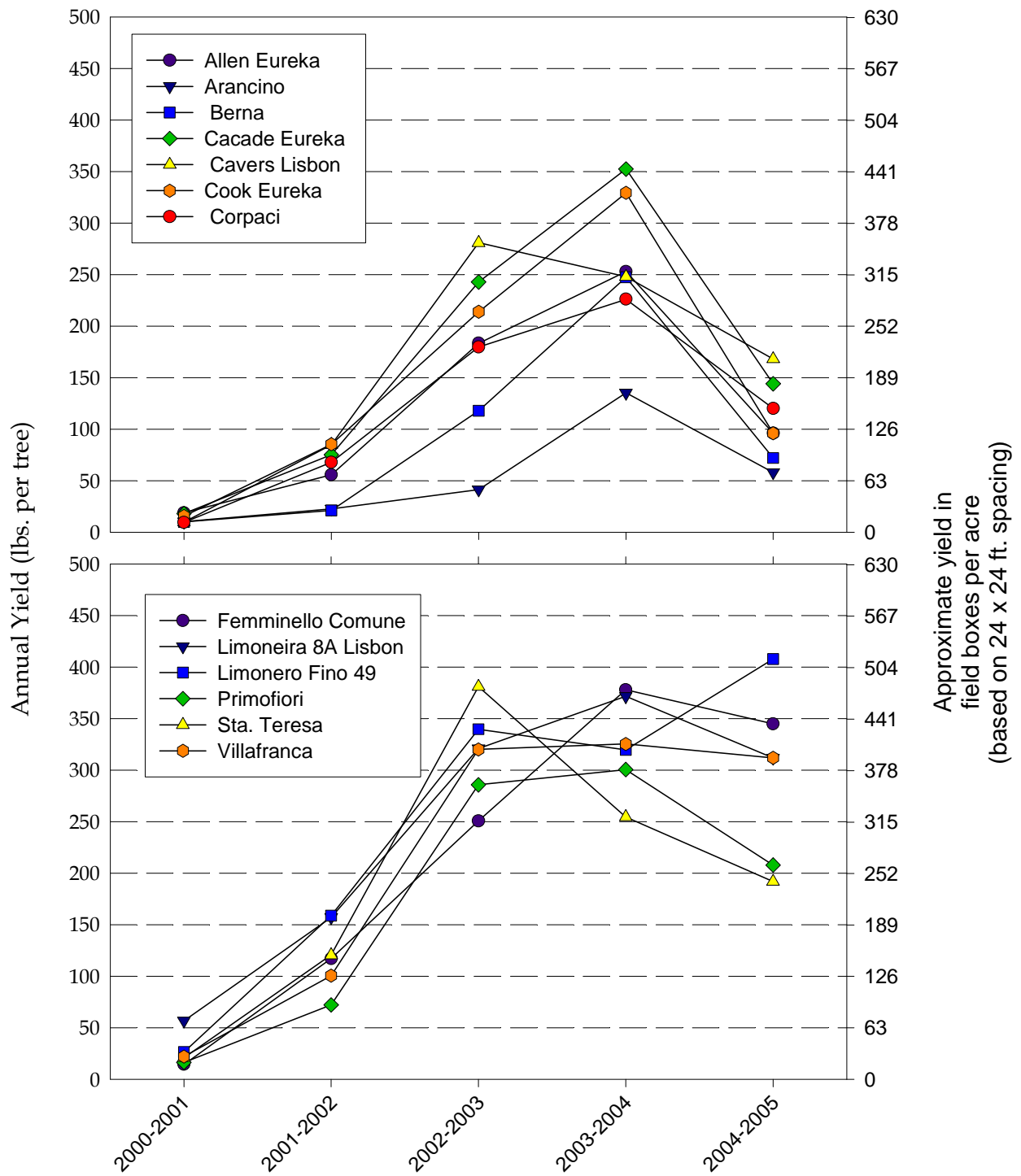


Figure 1. 2000-2005 yield of thirteen lemon selections budded to *C. macrophylla* rootstock.

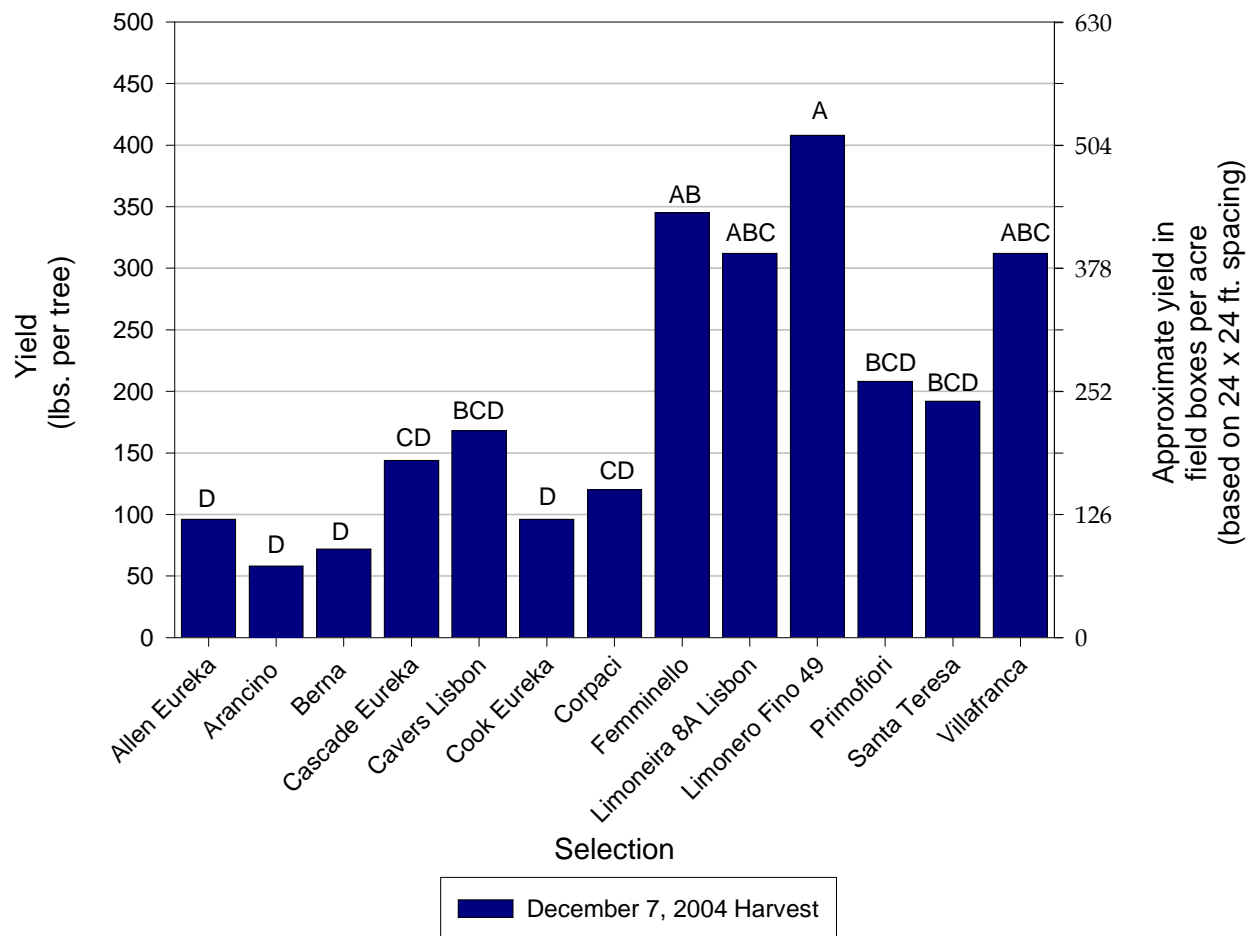


Figure 2. 2004-05 Yield of thirteen lemon selections budded to *C. macrophylla* rootstock, separated by harvest time. Bars are significantly different if the lowercase letters above them are different.

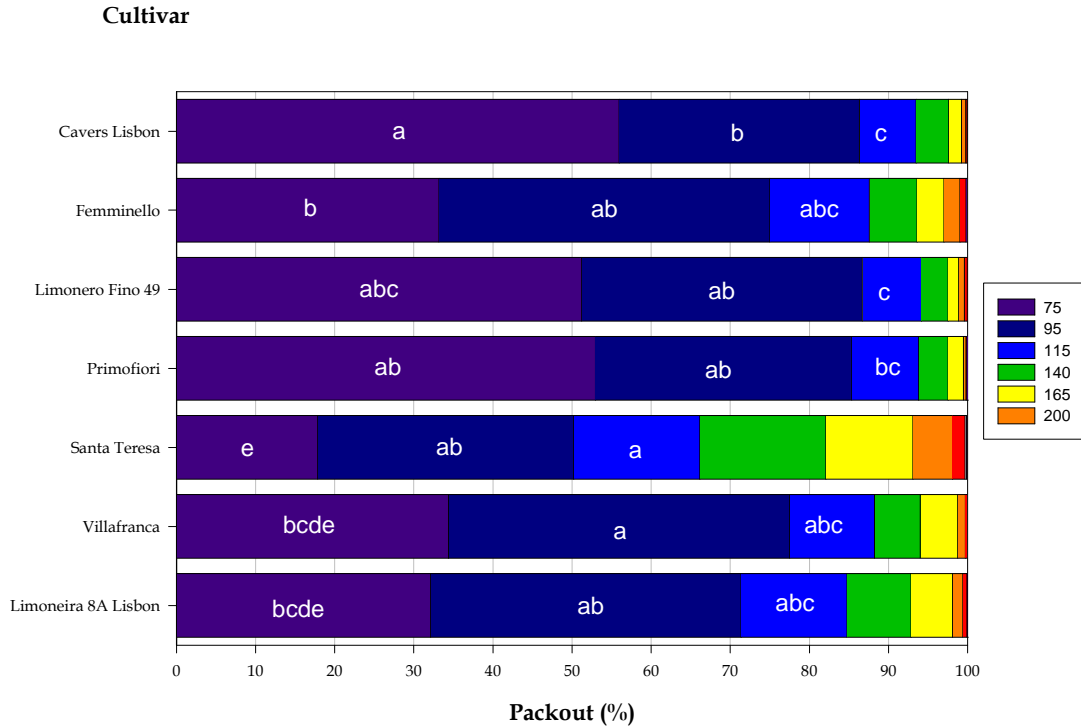


Figure 3. Packout of 13 lemon selections on *C. macrophylla* rootstock for the 12-7-04 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

Table 1. Selected interior fruit quality parameters for 13 lemon selections on *C. macrophylla* rootstock.

Selection	Juice pH	Total Acids (%)	TSS:TA	Peel thickness (mm)
Allen Eureka	2.83 abc <sup>z</sup>	4.74 bcd	1.58 ab	3.92
Arancino	2.85 abc	4.73 cd	1.56 ab	5.24
Berna	2.82 abc	4.90 abcd	1.60 a	4.69
Cascade Eureka	2.93 ab	4.82 abcd	1.57 ab	4.62
Cavers Lisbon	2.77 abc	5.05 abcd	1.44 ab	5.00
Cook Eureka	2.71 bc	4.60 d	1.60 a	4.04
Corpaci	2.85 abc	5.07 abcd	1.50 ab	4.08
Femminello	2.75 abc	5.26 ab	1.46 ab	4.48
Limoneira 8A Lisbon	2.73 bc	5.23 abc	1.41 b	4.00
Limonero Fino 49	2.80 abc	5.27 a	1.44 ab	3.61
Primofiori	2.86 abc	4.90 abcd	1.56 ab	5.02
Santa Teresa	2.67 c	5.09 abcd	1.48 ab	3.64
Villafranca	2.97 a	4.79 abcd	1.58 ab	4.51

<sup>z</sup> Means separation in columns by Duncan's Multiple Range Test, 5% level.

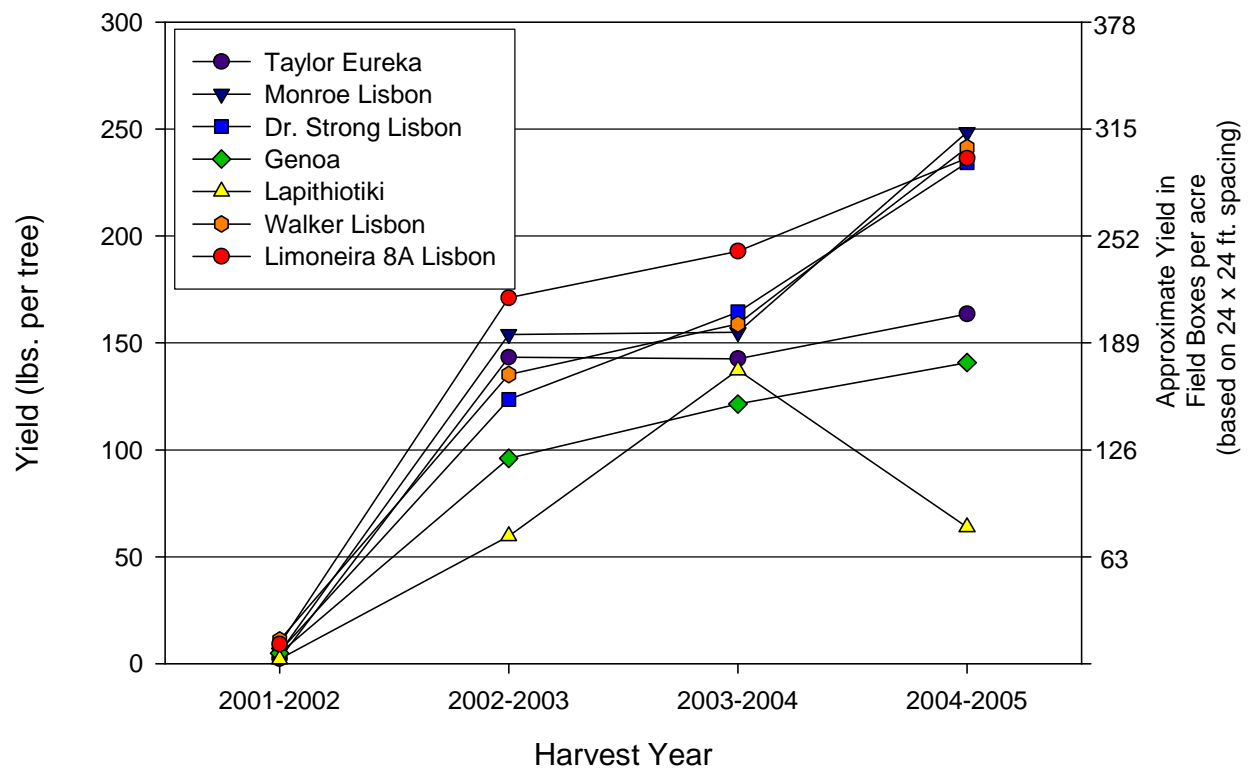


Figure 4. 2001-02 through 2004-05 yield of seven lemon selections budded to *C. macrophylla* rootstock.



Block 14 Lemons 2004-05 Yield

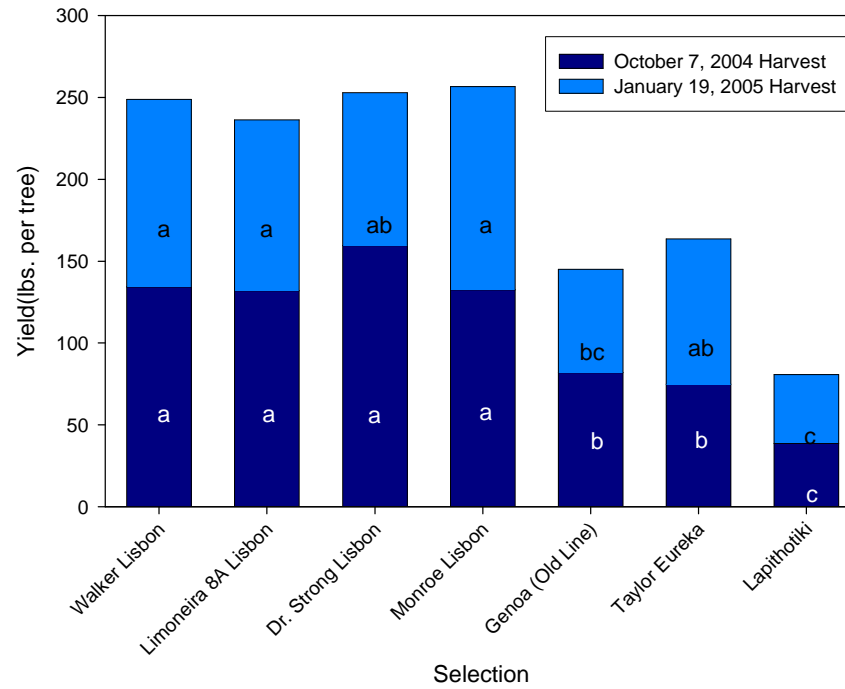


Figure 5. 2004-05 yield of seven lemon selections budded to *C. macrophylla* rootstock.

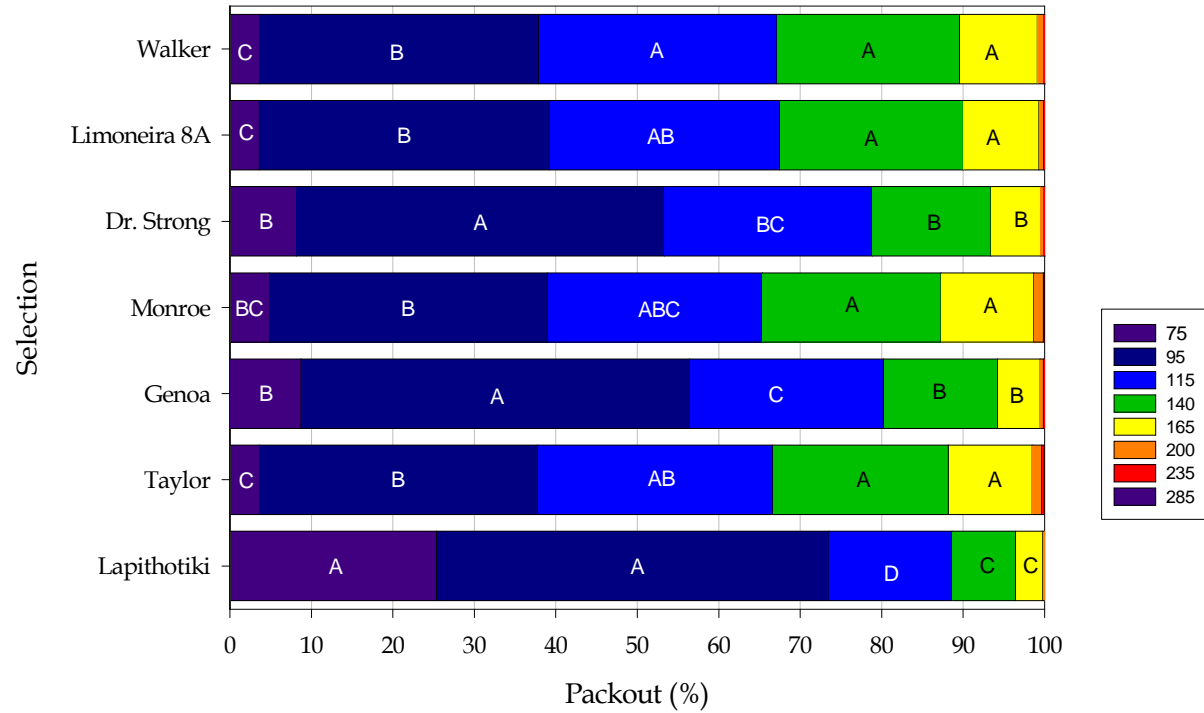


Figure 6. Packout of seven lemon selections on *C. macrophylla* rootstock for the 10-7-04 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

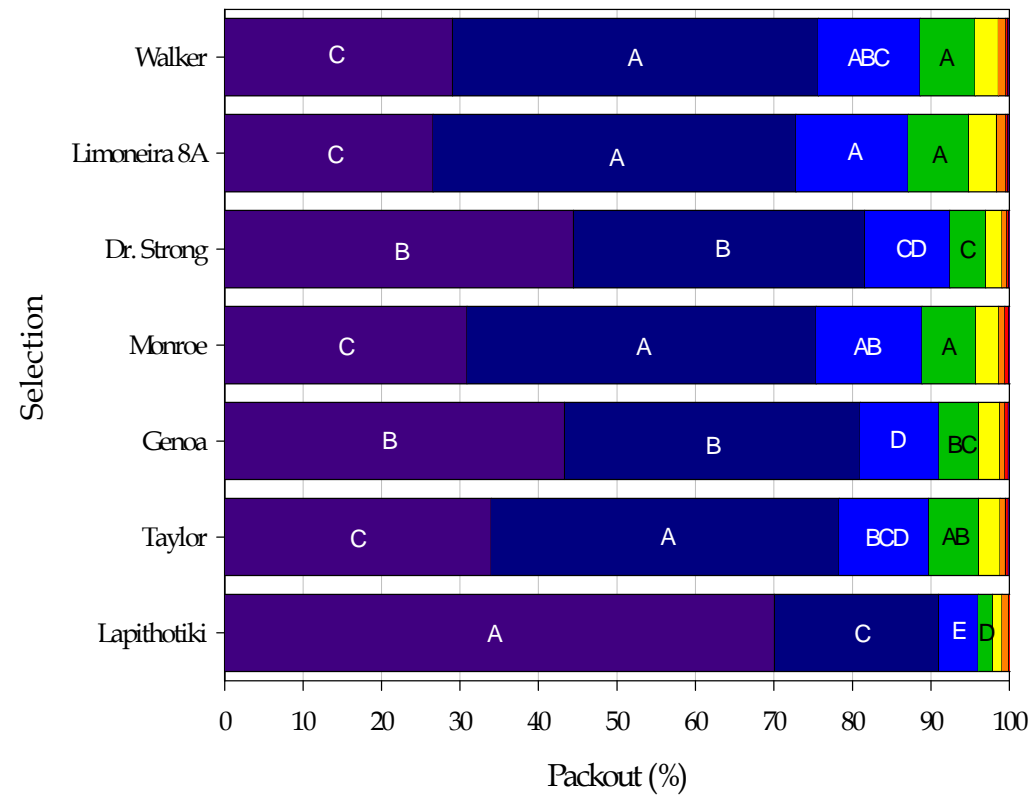


Figure 7. Packout of seven lemon selections on *C. macrophylla* rootstock for the 1-19-05 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.