

Results of New Cultivar Selection Trials for Lemon in Arizona – 2005-06¹

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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. These trial results are presented here.

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Materials and Methods

1995 Lemon Cultivar Selection Trial. This trial, at first comprising 10 cultivar selections was established in March 1995 in Block 17 (Foundation Block) of the Yuma Mesa Agricultural Center, near Yuma, Arizona. An additional cultivar selection was planted in 1997. As it exists within the citrus variety collection, it is not a large trial, nor is it replicated. The experimental area was laser leveled and fumigated prior to planting. Trees were planted on a 10-m x 10-m spacing. Three to five trees of each cultivar selection were planted. This trial contains the following selections, all on *C. volkameriana* rootstock:

- ‘Allen Eureka’ – The most common and popular ‘Eureka’ selection planted in Arizona. Originated in Santa Paula, CA
- ‘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.
- ‘Frost Nucellar Lisbon’ – Vigorous nucellar selection derived by Dr. H.B. Frost of the Citrus Research Station, Riverside, CA
- ‘Limoneira 8A Lisbon’ – A vigorous selection originating from the Limoneira Ranch, Ventura County, CA. The most popular lemon planted in Arizona today.
- ‘Prior Lisbon’ – A selection from California. Originated at the Rancho Sespe, near Fillmore, CA. Has a reputation for lateness.
- ‘Rosenberger Lisbon’ – Although considered a ‘Lisbon’, possibly a hybrid of ‘Lisbon’ and ‘Villafranca’. Vigorous and productive. Originated in Upland, CA.
- ‘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.
- ‘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.
- ‘Walker Lisbon’ – A vigorous selection from California.

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 ‘Allen’, ‘Cavers’, ‘Cascade’, ‘Cook’, ‘Limoneira 8A’, ‘Limonero Fino 49’, ‘Villafranca’ as well as the following selections:

- ‘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.
- ‘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.
- ‘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.

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’ and ‘Walker 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, and 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.

Yield data is collected during the fall and winter. Trees picked as noted below. For 2005-06, trees in the 1995 trial were picked on 12-16-05, trees in the 1997 trial were picked on 11-29-05, and for the 1998 trial, trees were picked on 12-1-05. For each harvest date, a portion of 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.

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

Results and Discussion

1995 Lemon Selection Trial. Yields of the original ten selections in this trial, since its inception, are found in Figure 1. For 2005-06, yields of all the selections increased compared with the previous season. It is likely that this was due to the low crop the previous year. However, most selections did not return to the yields of the 2003-04 season. ‘Cascade Eureka’ was superior to all the others for the first time.

Yields for the 2005-06 year are shown in Figure 2. In addition to ‘Cascade’, ‘Cavers Lisbon’, ‘Frost Nucellar Lisbon’, and ‘Rosenberger Lisbon’ performed well. ‘Allen Eureka’ ‘Walker Lisbon’ and ‘Cook Eureka’ had the least yield for the year.

Packout for this trial is shown in Figure 3. ‘Walker Lisbon’ and ‘Cascade Eureka’ had the largest fruit size, followed by ‘Cavers Lisbon’. ‘Walker’, in particular, had extremely large fruit size. ‘Rosenberger Lisbon’ and ‘Prior Lisbon’ had the smallest fruit size, but ‘Rosenberger’ was noticeably smaller than the others.

There was no effect of selection upon fruit color or exterior quality. Significant differences in fruit shape were found. ‘Villafranca’ and ‘Cavers Lisbon’ had fruit that was rounder, while ‘Rosenberger’ fruit was the most elongated.

1997 Lemon Selection Trial. Yields of this trial, since its inception, are found in Figure 4. 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’ and ‘Villafranca’. ‘Femminello’ has performed well in the past, but fell off considerably this year. Yield of ‘Limonero Fino 49’ also fell by about 25% this year, and yield of ‘Villafranca’ was flat. Yields of the other selections increased in 2005-06 in response to a smaller crop in 2003-04.

Yield for the 2005-06 season is shown in Figure 5. Although ‘Limoneira 8A Lisbon’ had the greatest yield, most of the other selections were not statistically different. Only ‘Allen Eureka’, ‘Corpaci’ and ‘Femminello’ performed poorly, with yields as much as 75% less than ‘Limoneira 8A’.

Packout for the 11-29-05 harvest is shown in Figure 6. Fruit size was quite large, a result of the rather late harvest date. While most of these had similar size, ‘Arancino’ and ‘Berna’ had slightly larger fruit, while ‘Santa Teresa’ and ‘Limoneira 8A’ had smaller fruit. ‘Since the yields of ‘Arancino’ and ‘Berna’ 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.

1998 Lemon Cultivar Selection Trial. 2001 to 2005 yields from this trial are found in Figure 7. Although the 'Limoneira 8A' was originally the best performer of this trial; 2005-06 is the second year that any other selection has surpassed it in total yield since 2001-02. 'Lapithiotiki' and 'Dr. Strong' Lisbon had yields that equaled or surpassed the yield of 'Limoneira 8A Lisbon' (Figure 8). Meanwhile, 'Genoa', 'Taylor Eureka', Walker Lisbon' and 'Monroe Lisbon' had yields only slightly less than 'Limoneira 8A'. After consistently producing low yields, we were surprised to see 'Lapithiotiki' vault into the second-highest place in 2005-06.

Fruit size for the 2005-06 harvest of this trial is shown in Figure 9. The 'Lapithiotiki' has outstanding size, coupled with its high yields. The size of the 'Genoa' fruit is consistent with what we have seen in previous years. The other selections tested have similar-sized fruit.

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'. Furthermore, 'Femminello' performed poorly in 2005-06. 'Santa Teresa' had excellent yield in 2002-03, but stumbled for the last three years, and is hobbled by its lateness. None of the other selections in the 1995 and 1997 trial have been consistently better than 'Limoneira 8A Lisbon'.

In the 1998 trial, no selection has proved to be consistently better than 'Limoneira 8A', but 'Walker', 'Monroe' and particularly 'Dr. Strong' may be contenders. 'Lapithiotiki' has large fruit, and high yields for the first time this year. 'Eureka' lemons have typically performed poorly in comparison to the 'Lisbons', and should not yet be considered as a replacement for any of the high-yielding 'Lisbon' selections, although the best candidate is 'Cascade'.

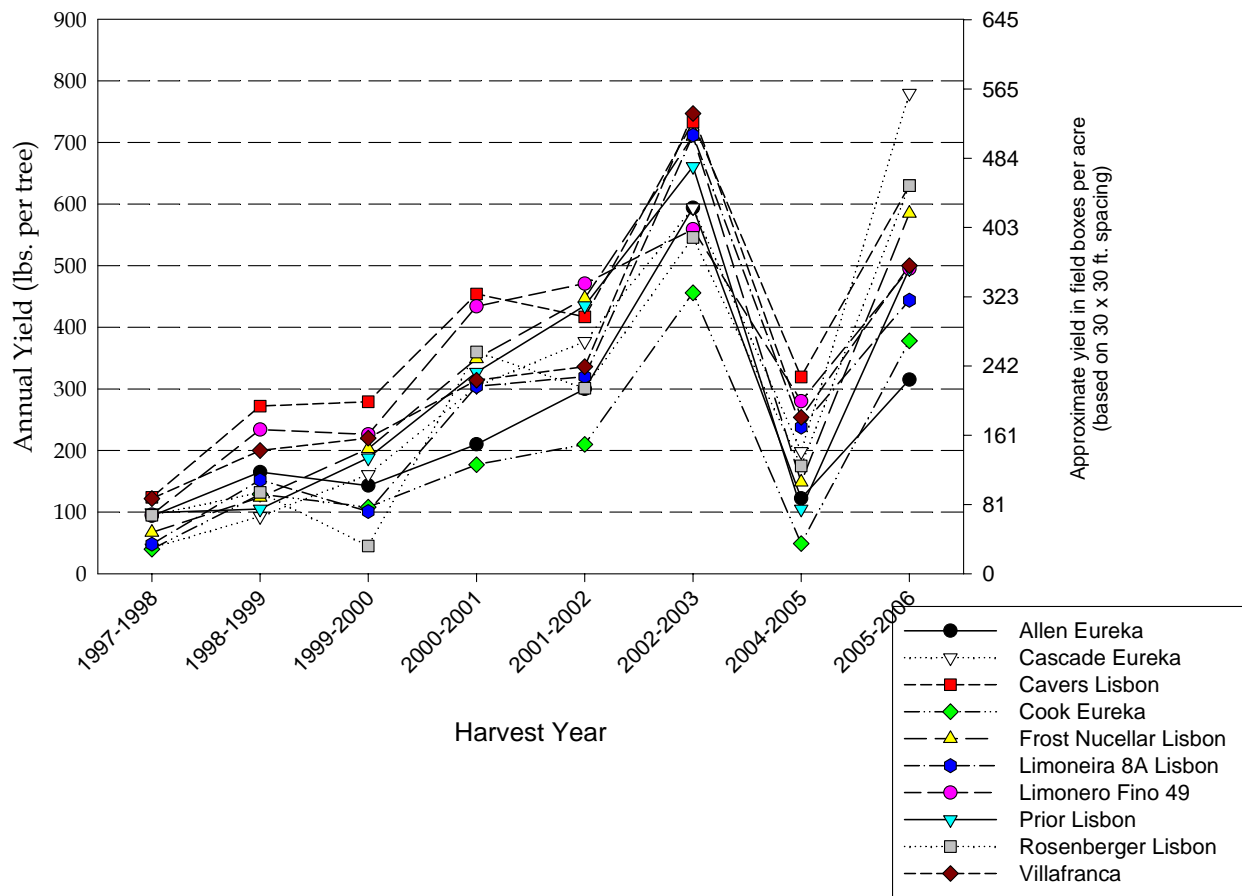


Figure 1. 1997-2005 yield of ten lemon selections budded to *C. volkameriana* rootstock.

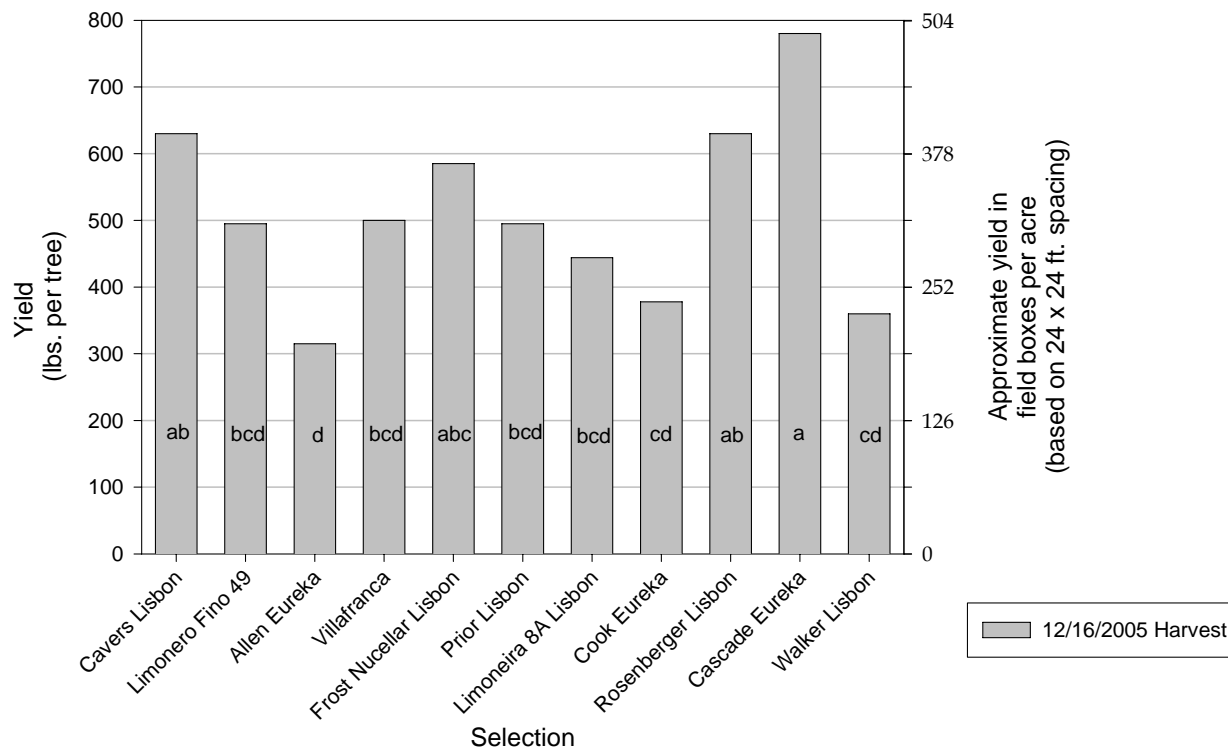
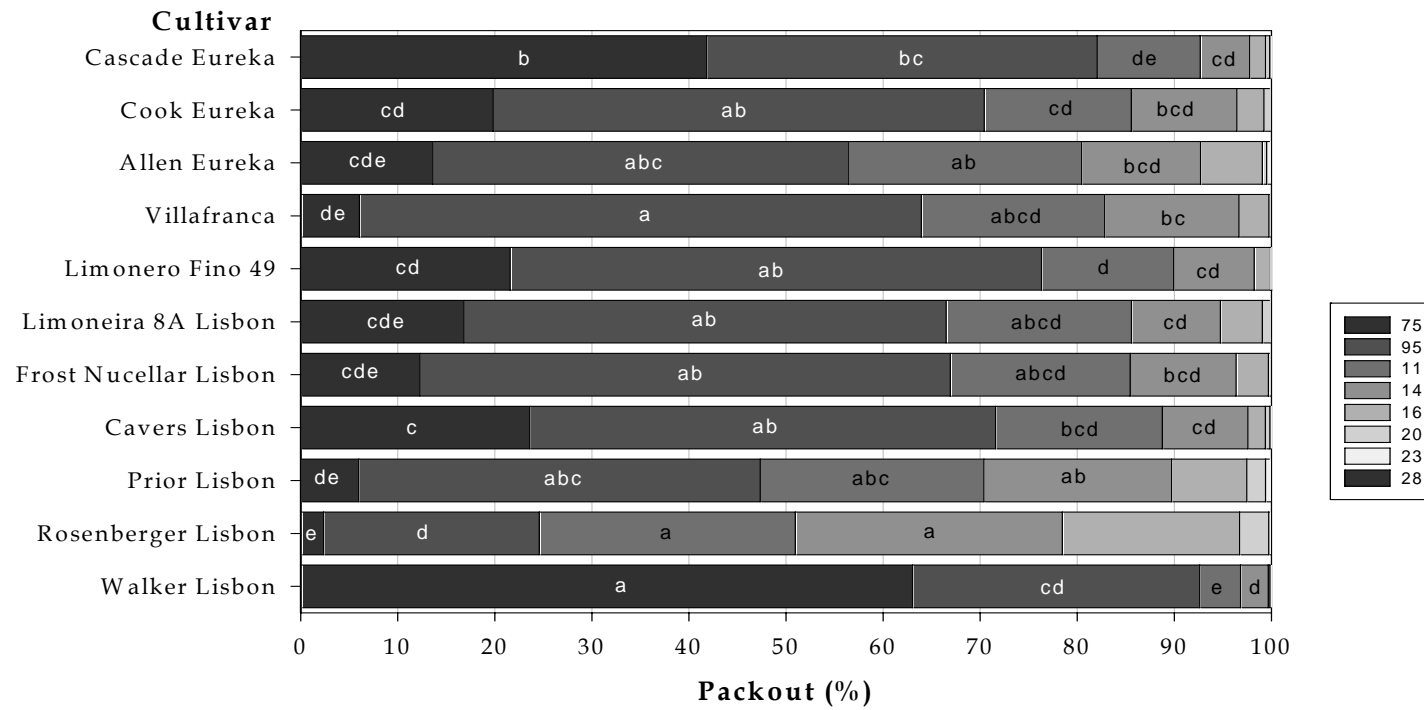


Figure 2. 2005-06 Yield of eleven lemon selections budded to *C. volkameriana* rootstock. Yields are significantly different if the lowercase letters within the respective bars are different.



Letters indicate significant differences, within fruit sizes, between cultivars tested.

Figure 3. Packout of 10 lemon selections on *C volkameriana* rootstock for the 12-16-05 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

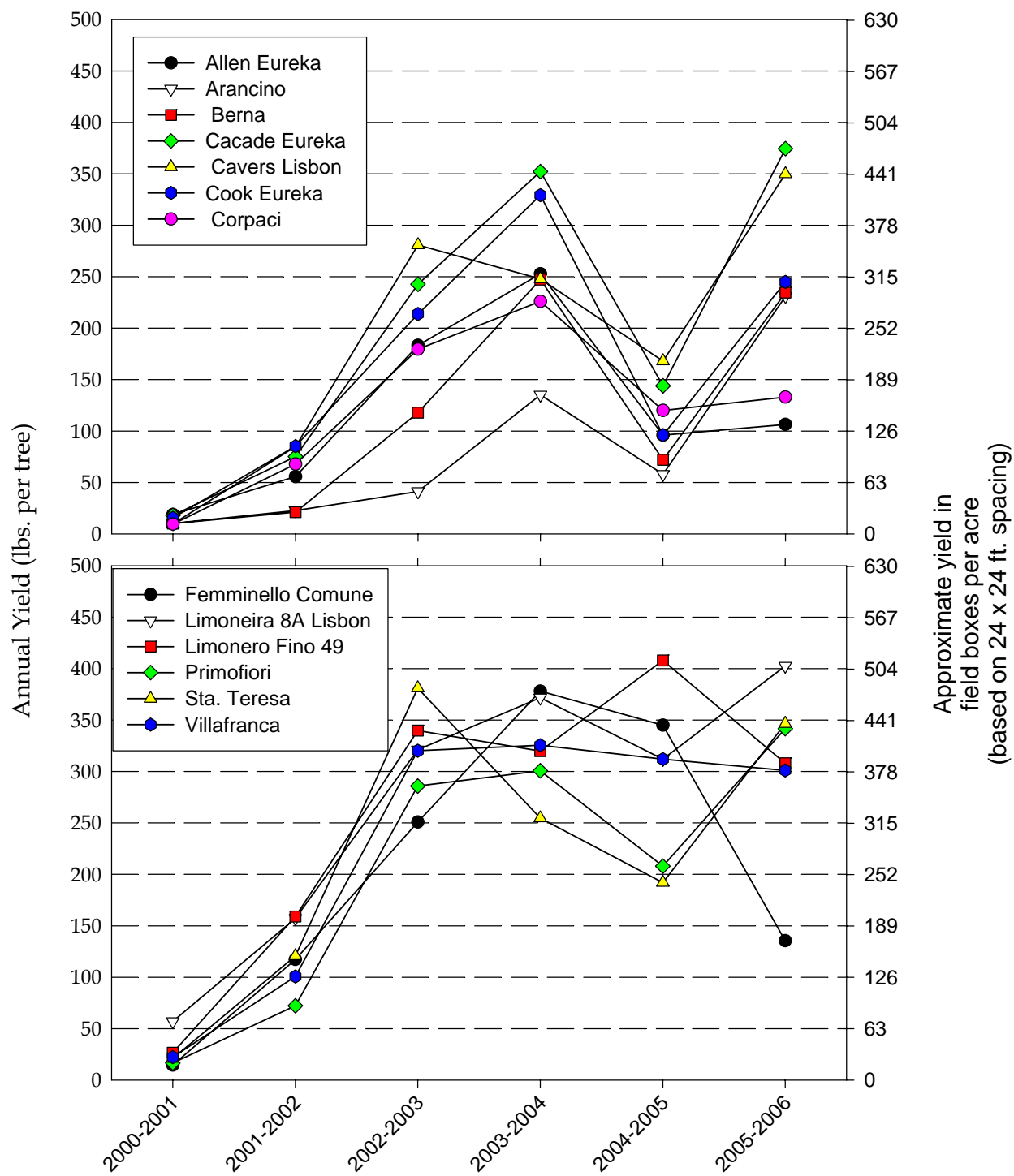


Figure 4. 2000-2005 yield of thirteen lemon selections budded to *C. macrophylla* rootstock.

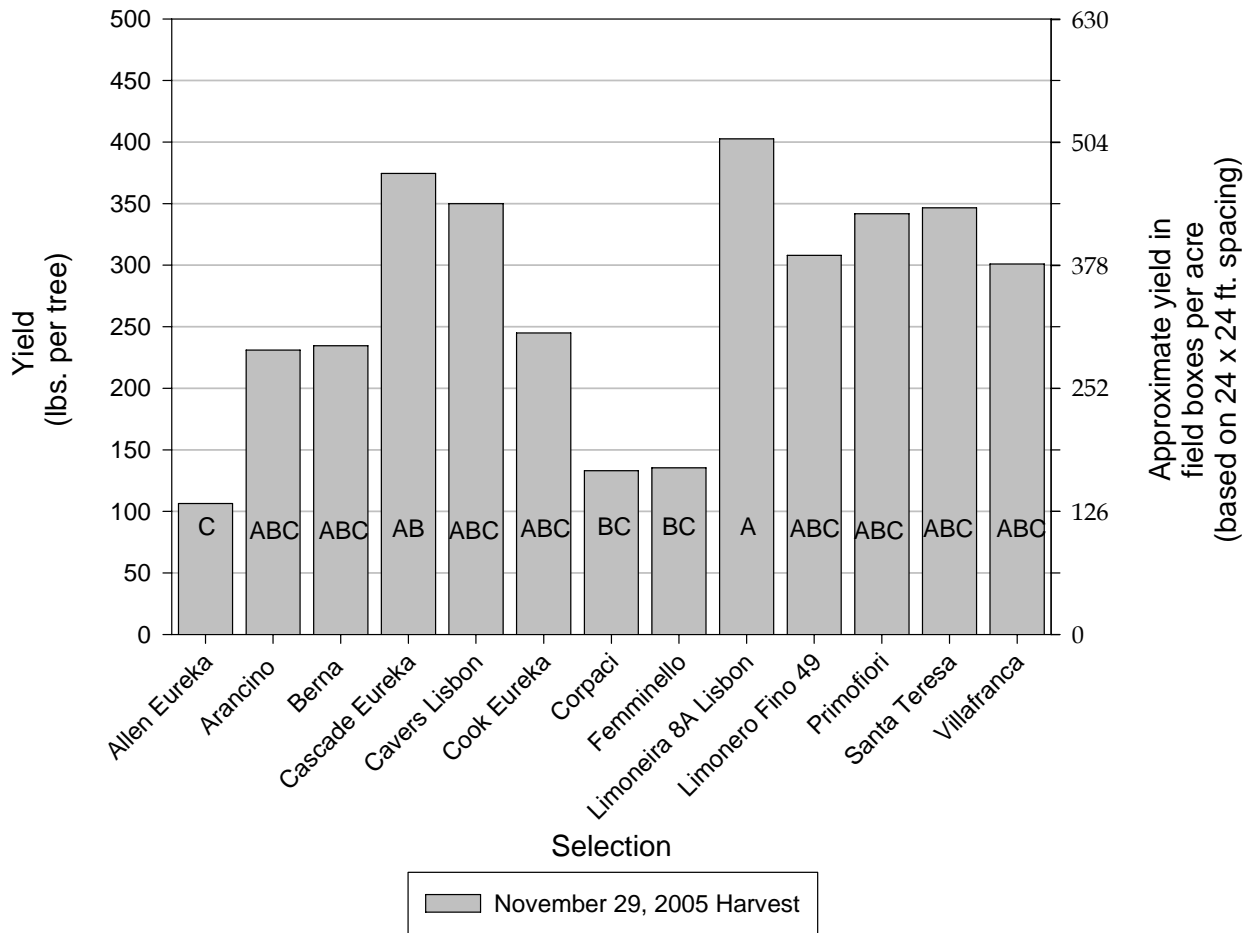


Figure 5. 2005-06 yield of thirteen lemon selections budded to *C. macrophylla* rootstock. Yields are significantly different if the letters within them are different.

Cultivar

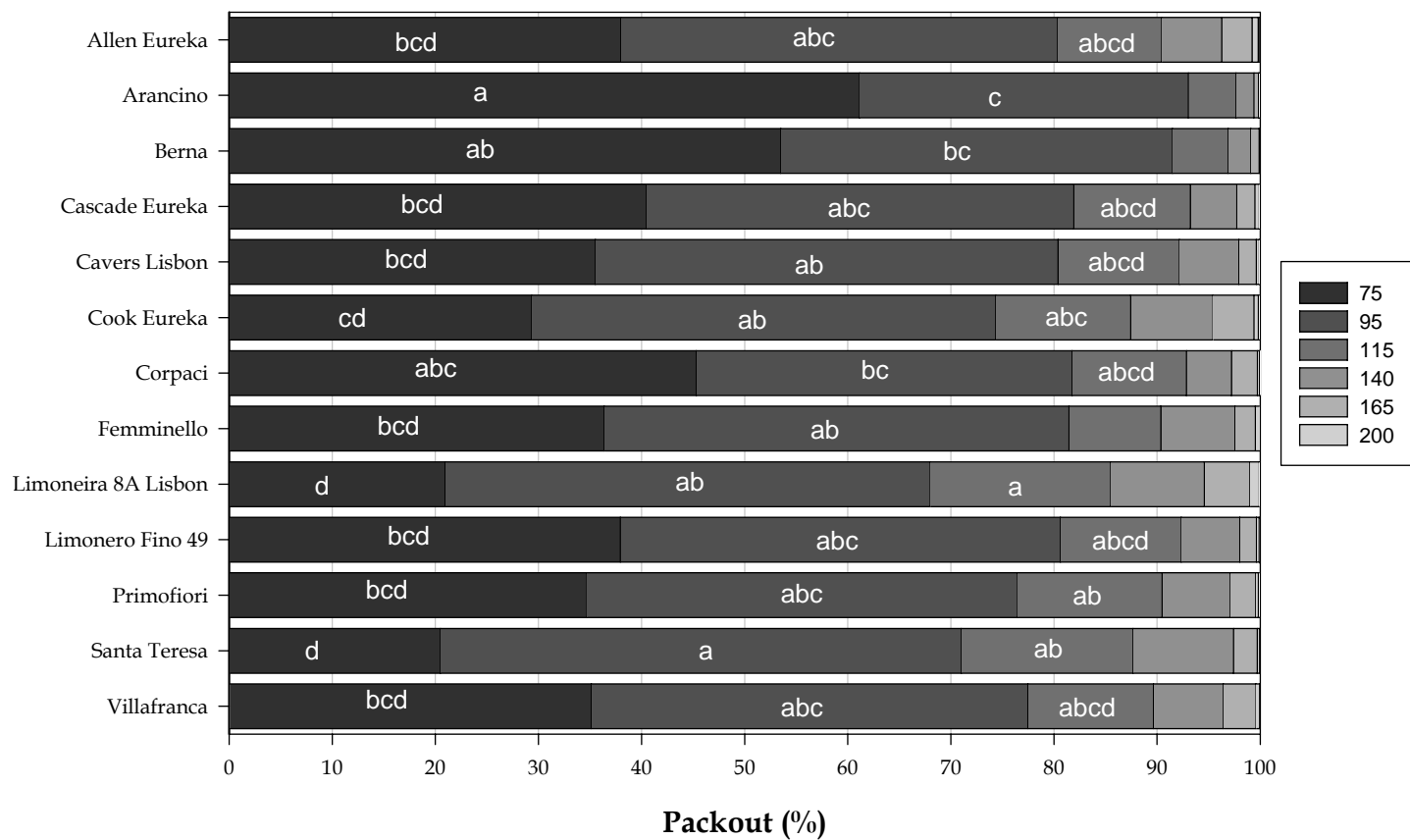


Figure 6. 2005-06 packout of 13 lemon selections on *C. macrophylla* rootstock for the 11-29-05 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

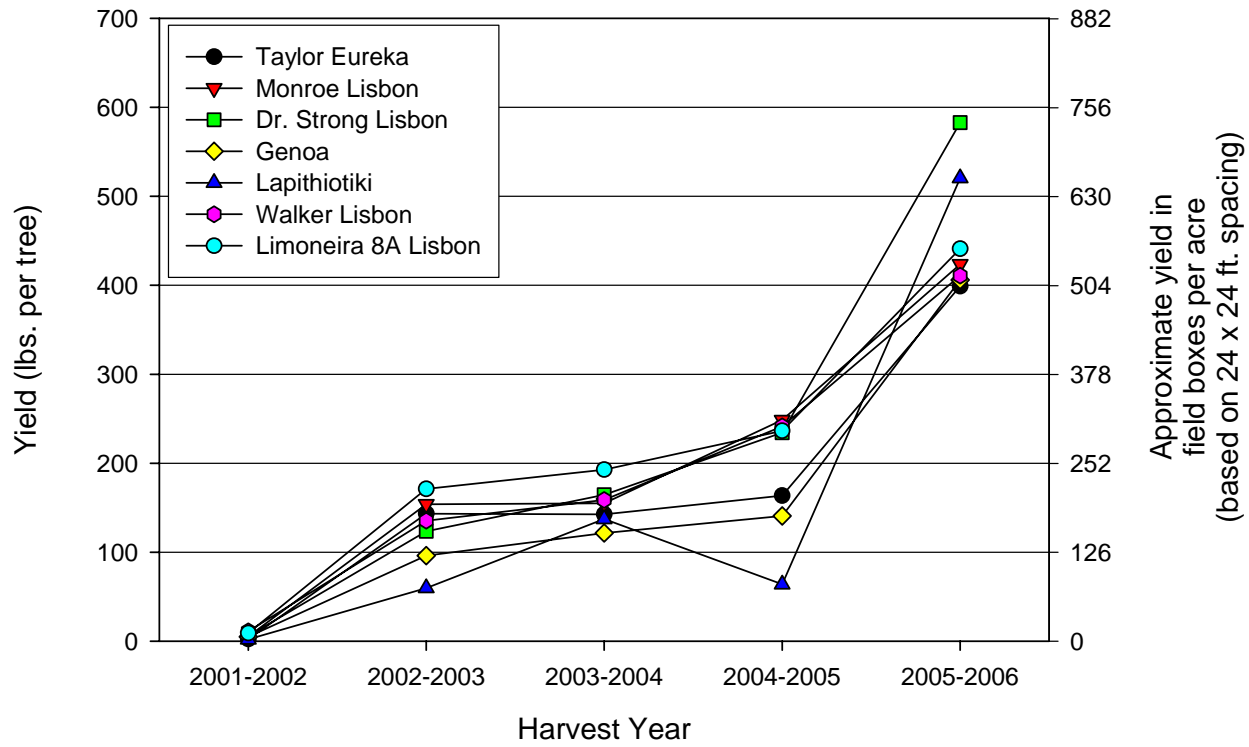


Figure 7. 2001-2005 yield of seven lemon selections budded to *C. macrophylla* rootstock.

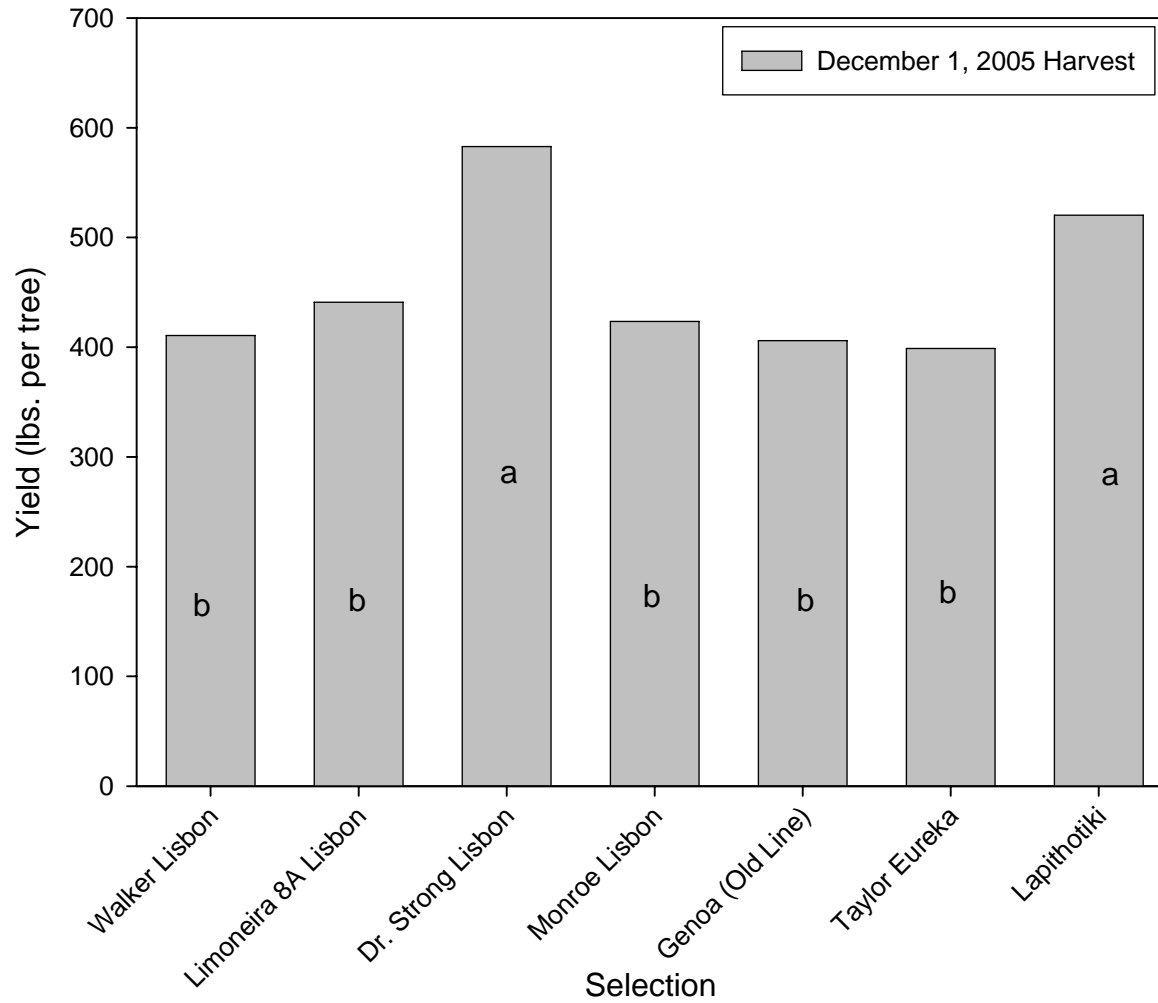


Figure 8. 2005-06 yield of seven lemon selections budded to *C. macrophylla* rootstock.

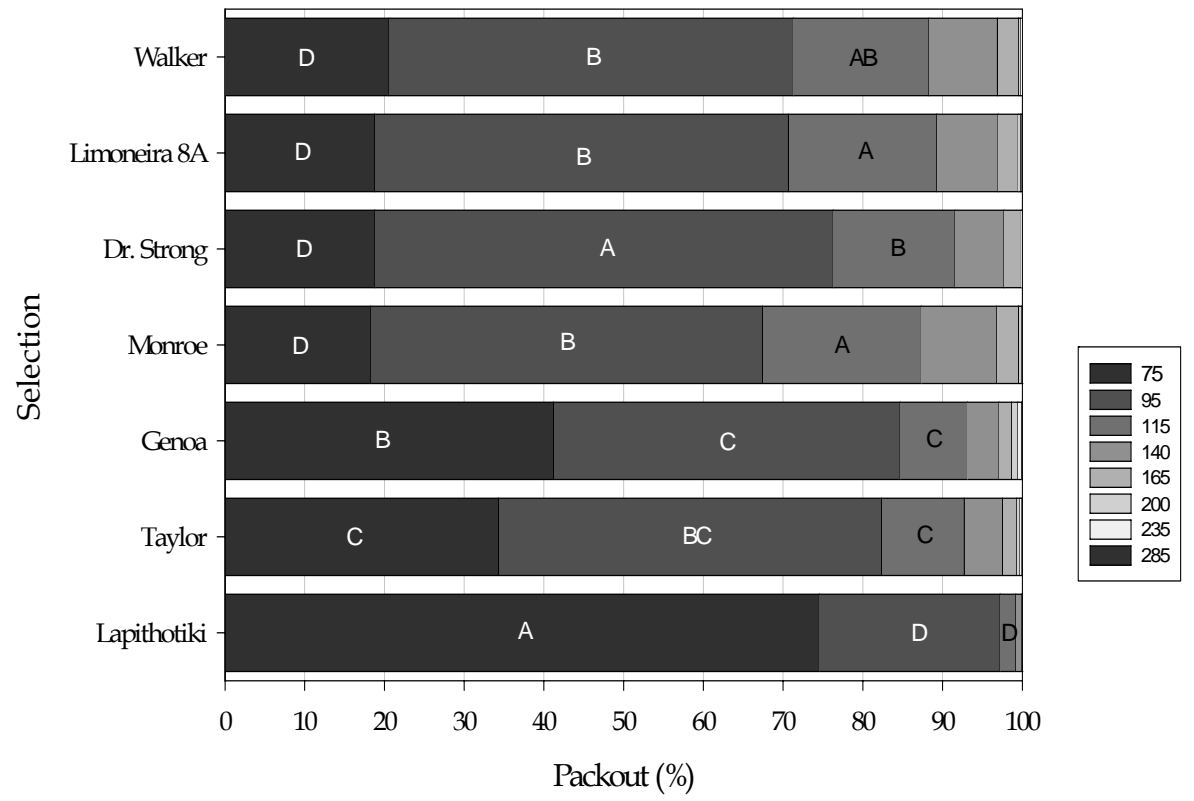


Figure 9. Packout of seven lemon selections on *C. macrophylla* rootstock for the 10-7-04 harvest. Bars of the same shade are significantly different if the lowercase letters within them are different. Bars of different shades cannot be compared.

