

Established ‘Lisbon’ Lemon Trials in Arizona – 2001-02¹

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Abstract

Four ‘Lisbon’ lemon selections, ‘Frost Nucellar’, ‘Corona Foothills’, ‘Limoneira 8A’ and ‘Prior’ were selected for evaluation on Citrus volkameriana rootstock. 1994-2002 results indicate that the ‘Limoneira 8A Lisbon’ and ‘Corona Foothills Lisbon’ are superior in yield and fruit earliness

Introduction

There is no disputing the importance of citrus scion cultivars to desert citrus production. A successful citrus cultivar must be adaptable to the harsh climate, (where average high temperatures are often greater than 40°C), must be vigorous and must produce high yields of good quality fruit of marketable size.

Lemons are the most important and profitable citrus cultivar grown in Arizona today. Today, lemons comprise 45% of all harvested citrus acreage in the state. When the lemon industry was established in the 1950’s the principal variety was the ‘Desert Lisbon’. No records exist as to the characteristics of this variety. Within a few years however, ‘Desert Lisbon’ was eclipsed in popularity by ‘Frost Nucellar Lisbon’ the only nucellar clonal selection of the ‘Lisbon’ variety. Other popular clonal selections of ‘Lisbon’ that have been planted in Arizona include ‘Monroe’, ‘Limoneira 8A’, ‘Corona Foothills (Foothills)’, ‘Prior’, and ‘Rosenberger’. All of these represent selections of outstanding trees that were then propagated. All are identified by their originator or place of origin, and are characterized by 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. However, there is a certain amount of variability among ‘Lisbon’ clonal selections.

As the Arizona lemon industry has found itself a marketing niche for the late summer and early fall harvest, high productivity, good fruit quality and earliness have become increasingly important. Selections that have not met these standards have been superseded by selections that have these characteristics. Consequently, by 1992, the most popular clonal lemon selection grown in Arizona was the ‘Limoneira 8A Lisbon’. This selection originated in Santa Paula, CA, exhibits high productivity, precocity, earliness, and has adequate fruit quality. Other ‘Lisbon’ selections still grown in Arizona include ‘Prior’ and ‘Frost Nucellar’. ‘Corona Foothills’ is a more recent introduction that originates in Corona, CA. Not much is known about this selection, other than it has a reputation for high productivity. Therefore, we planted the first ‘Lisbon’ lemon selection trial in 1993 including ‘Limoneira 8A Lisbon’, ‘Prior Lisbon’, ‘Frost Nucellar Lisbon’, and ‘Corona Foothills Lisbon’ lemon on *C. volkameriana* as the rootstock.

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Materials and Methods

This trial was established in March 1993 in Block 26 of the Yuma Mesa Agricultural Center, near Yuma, Arizona. The land was laser leveled and fumigated prior to planting. Trees were planted on a 9.1-m x 9.1-m (30 ft x 30 ft) spacing. Twelve replicates of each of the 4 selections were planted, for a total of 48 trees. Experimental design is randomized complete block.

Irrigation is border flood, and normal cultural practices are used. Growth data, expressed as trunk diameter, was taken annually through 1997. Measurements were taken about 4 inches above the bud union. These locations are permanently marked with paint. Trunk diameters were taken annually in March, so as to quantify any differential growth rates that might have occurred. Leaves are collected annually in August for mineral analysis; however there have been no significant differences in leaf nutrient content. Yield data is collected during the fall and winter. Trees are ring or strip-picked as noted below. Harvested fruit for each tree is collected in wooden or plastic boxes and weighed. Prior to 1999-2000, approximately 30 lbs of fruit was sub-sampled from the harvested yield of each tree for packout determination, and these were sized by hand using rings and graded by visual observation. Since 1999-2000, the entire harvest from each tree has been 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 is collected at each harvest time. These data include °brix, peel thickness, percentage juice, pH, and total soluble solids to total acid ratio. There was no effect of lemon selection on fruit quality (data not shown).

All data was analyzed using SPSS 7.0 for Windows (SPSS Inc., Chicago, Illinois).

Results and Discussion

For ease of viewing, annual yields for the four scions tested can be seen graphically in Figure 1.

There were no yield differences among the scions tested during the 1994-95-harvest season (Table 1). Yields across the entire experiment in 1995-96 and 1996-97 were light, but 'Limoneira 8A Lisbon' trees had 2 to 2.5 times the yield of the other scion cultivars. For 1997-98, the yield of 'Limoneira 8A' was 2 to 3.7 times higher than the other cultivars tested. For 1998, 'Limoneira 8A Lisbon' was again superior, but to a lesser degree than in previous years. Yield of 'Limoneira 8A' was from 1.2 to 1.7 times greater than the other selections, and 'Corona Foothills Lisbon' was the second best selection. From 1994-95 through 1998-99, there was no difference in fruit packout among the selections tested.

For the 1999-2000 harvest, 'Corona Foothills Lisbon' had the most fruit harvested in the first ring pick harvest, about 24% more than 'Limoneira 8A Lisbon' (Table 2). 'Prior' and 'Frost Nucellar' lagged behind for the first pick. For the second pick, the yield of 'Limoneira 8A' was 35% to 50% more than that of any other of the scions tested. For the third pick, 'Corona Foothills' had the greatest yield, although not significantly greater than the others. There was no significant difference between the scions in the total yield, or in the percent of fruit harvested before 1 November. 1999-2000 was the second year that 'Corona Foothills' performed as well as 'Limoneira 8A', and the first year that 'Frost Nucellar' and 'Prior' performed as well as 'Limoneira 8A'.

For 1999-2000, packout data for the first harvest was lost, and packout data for the third harvest was not collected, but packout for the second harvest is shown in Figure 2. For the harvest on 11/18/99, 'Prior' had the greatest percentage of fruit size 95, but significantly less fruit of size 115 and 200. Although 'Corona Foothills' had less fruit of size 95 than did 'Prior', there was no significant difference between the two selections, and 'Corona Foothills' had the greatest percentage of fruit size 115, and the least of fruit size 200. 'Frost Nucellar' had significantly less fruit of size 95, compared to 'Prior' and significantly less fruit of size 115 compared to 'Corona Foothills'. 'Limoneira 8A' had the least fruit of size 95, a smaller amount of fruit size 115, although not significantly different than that of 'Prior' and the greatest amount of fruit size 200. In general, and for this harvest only, 'Corona Foothills' had the greatest amount of the larger size fruit, while 'Limoneira 8A' had the smallest.

For the 2000-01 harvest year, total yields were 2 to 2.5 times those of 1999-2000 (Table 3). 'Limoneira 8A' trees reclaimed the top yielding spot for the first harvest although not significantly different than 'Corona Foothills' or 'Prior', while 'Frost Nucellar' lagged. For the second harvest, there was no significant difference between the scions tested, nor were there any significant differences in total yield. For 2000-01, there was very little effect of scion upon packout.

For 2001-02, there was no effect of 'Lisbon' lemon selection on yield or percent early fruit (Table 4). Packout for the 2000-01 harvest season is shown in Figures 3 and 4. For the 9/27/01 harvest trees on all four scions had fruit that peaked on size 140. 'Corona Foothills' had the greatest amount of fruit of size 195 and 115. Similar results occurred for the 11/28/2001 harvest, where 'Corona Foothills' and 'Prior' trees had somewhat more 95 and 115 size fruit than did the others tested, while 'Frost Nucellar' and 'Limoneira 8A' trees had more size 200 and 235 size fruit. There was no effect of scions on fruit grade (data not shown).

Conclusions

For the scions, both 'Limoneira 8A' and 'Corona Foothills' appear to be superior to the others at this point. 'Limoneira 8A' has been consistent for the last six years. Whether it will remain superior will not be known for several years. 'Corona Foothills' has equaled 'Limoneira' for the third year in a row, and when there is a difference, fruit size seems to be superior to all others. 'Prior' also performed well for the second time. 'Frost Nucellar Lisbon' continues to be only average.

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Table 1. 1994-98 yields of four 'Lisbon' lemon cultivars budded to *C. volkameriana* rootstock.

Scion ^z	Yield per tree (lb.).				
	1994-95	1995-96	1996-97	1997-98	1998-99
'Corona Foothills Lisbon'	0.13 a ^y	4.98 b	11.33 b	18.43 b	281.13 b
'Frost Nucellar Lisbon'	0.07 a	3.97 b	14.48 b	26.61 b	204.96 c
'Limoneira 8A Lisbon'	0.13 a	10.56 a	27.71 a	69.07 a	343.34 a
'Prior Lisbon'	0.00 a	3.90 b	15.19 b	34.92 b	202.10 c

^z Values are the means of 12 trees.^y Means separation in columns by Duncan's Multiple Range Test, 5% level.Table 2. 1999-2000 yields of four 'Lisbon' lemon cultivars budded to *C. volkameriana* rootstock.

Scion ^z	Yield per tree (lb.).				Percent Early Fruit ^x
	9/22/99	11/18/99	2/3/00	Total Yield	
'Corona Foothills Lisbon'	65.26 a	76.94 ab	45.19 a	187.39 a	34.8 a
'Frost Nucellar Lisbon'	44.31 b	68.78 ab	37.70 ab	150.79 a	29.4 a
'Limoneira 8A Lisbon'	52.47 ab	105.38 a	33.51 ab	191.36 a	27.4 a
'Prior Lisbon'	50.71 b	57.54 b	26.23 b	134.48 a	37.7 a

^z Values are the means of 12 trees.^y Means separation in columns by Duncan's Multiple Range Test, 5% level.^x Percentage of fruit harvested prior to 1 November.Table 3. 2000-2001 yields of four 'Lisbon' lemon cultivars budded to *C. volkameriana* rootstock.

Scion ^z	Yield per tree (lb.).			Percent Early Fruit ^x
	9/28/00	12/4/00	Total Yield	
'Corona Foothills Lisbon'	140.21 ab	228.18 a	368.39 a	38.0 a
'Frost Nucellar Lisbon'	113.76 b	174.38 a	288.14 a	43.8 a
'Limoneira 8A Lisbon'	174.60 a	197.75 a	372.36 a	47.2 a
'Prior Lisbon'	153.22 ab	208.11 a	361.33 a	44.0 a

^z Values are the means of 12 trees.^y Means separation in columns by Duncan's Multiple Range Test, 5% level.^x Percentage of fruit harvested prior to 1 November.Table 4. 2001-2002 yields of four 'Lisbon' lemon cultivars budded to *C. volkameriana* rootstock.

Scion ^z	Yield per tree (lb.).			Percent Early Fruit ^x
	9/27/01	11/28/01	Total Yield	
'Corona Foothills Lisbon'	69.02 a	365.34 a	434.36 a	14.8 a
'Frost Nucellar Lisbon'	43.94 a	340.74 a	384.68 a	12.1 a
'Limoneira 8A Lisbon'	62.93 a	345.57 a	408.50 a	16.0 a
'Prior Lisbon'	45.94 a	345.21 a	391.16 a	11.7 a

^z Values are the means of 12 trees.^y Means separation in columns by Duncan's Multiple Range Test, 5% level.^x Percentage of fruit harvested prior to 1 November.

Fig. 1. 1994 -2002 Established 'Lisbon' Lemon Selection Yields

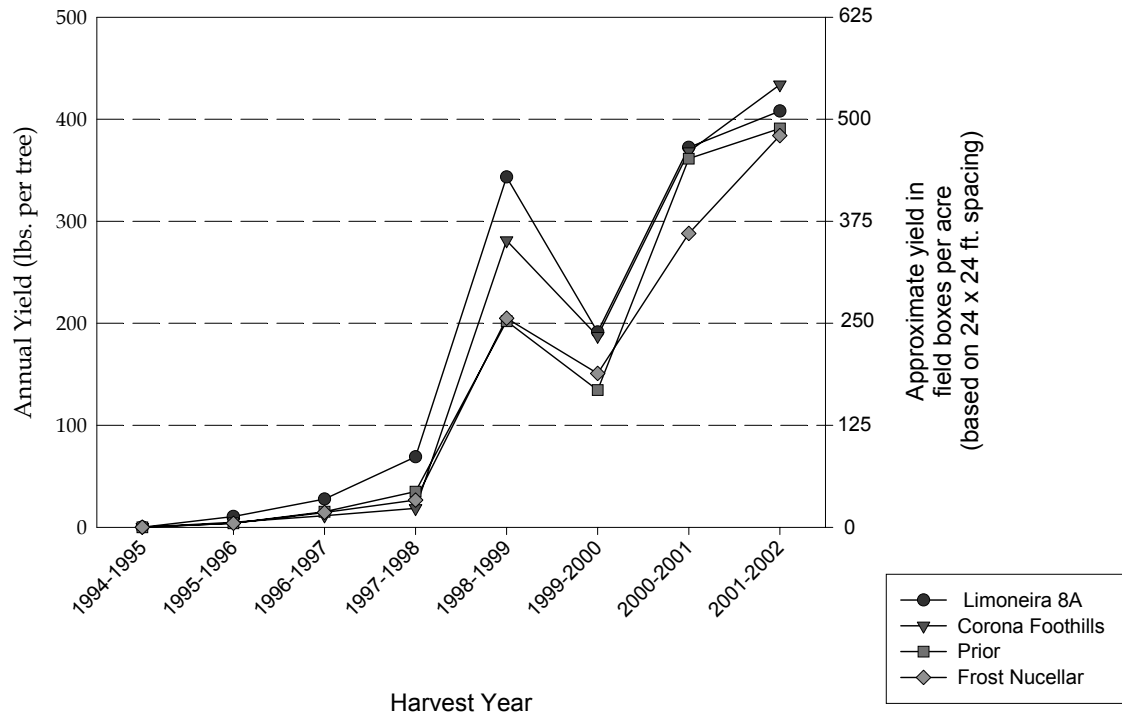


Fig. 2. 1999-2000 Established 'Lisbon' Lemon Selection Packout - 11/18/99 Harvest

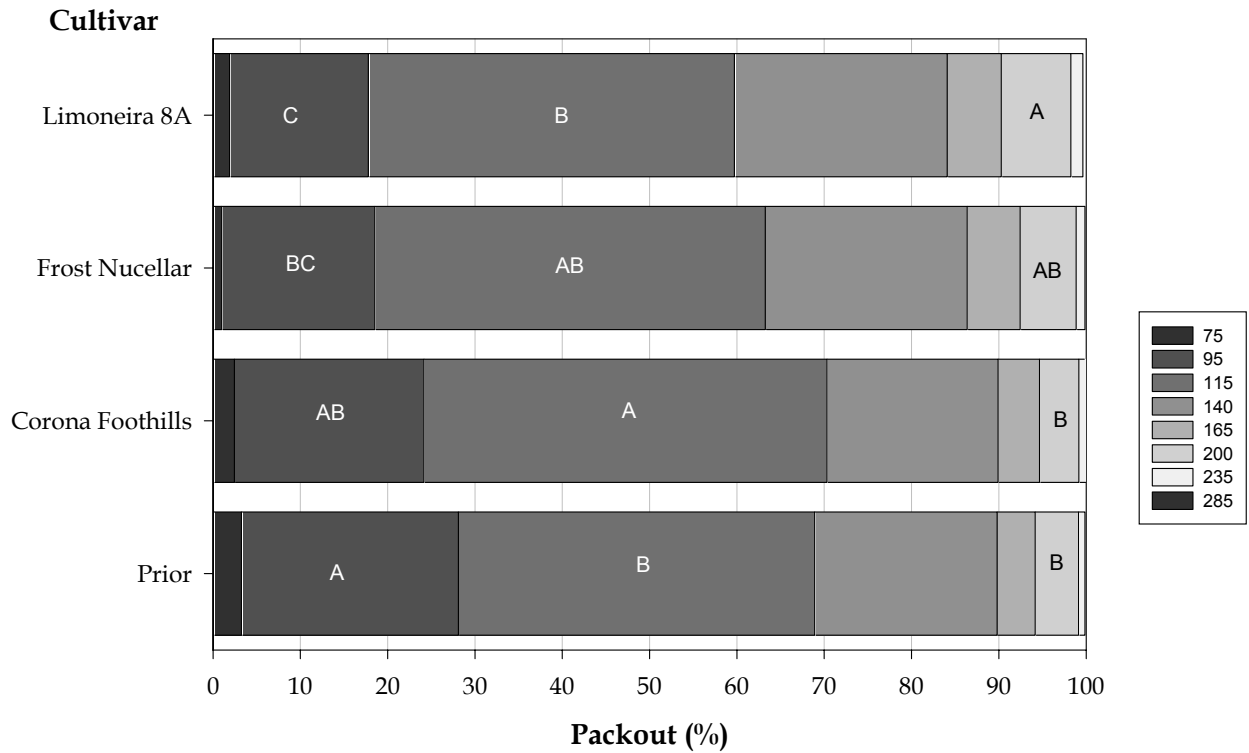


Fig. 2. 2001-02 Established 'Lisbon' Lemon Selection Packout - 9/27/01 Harvest

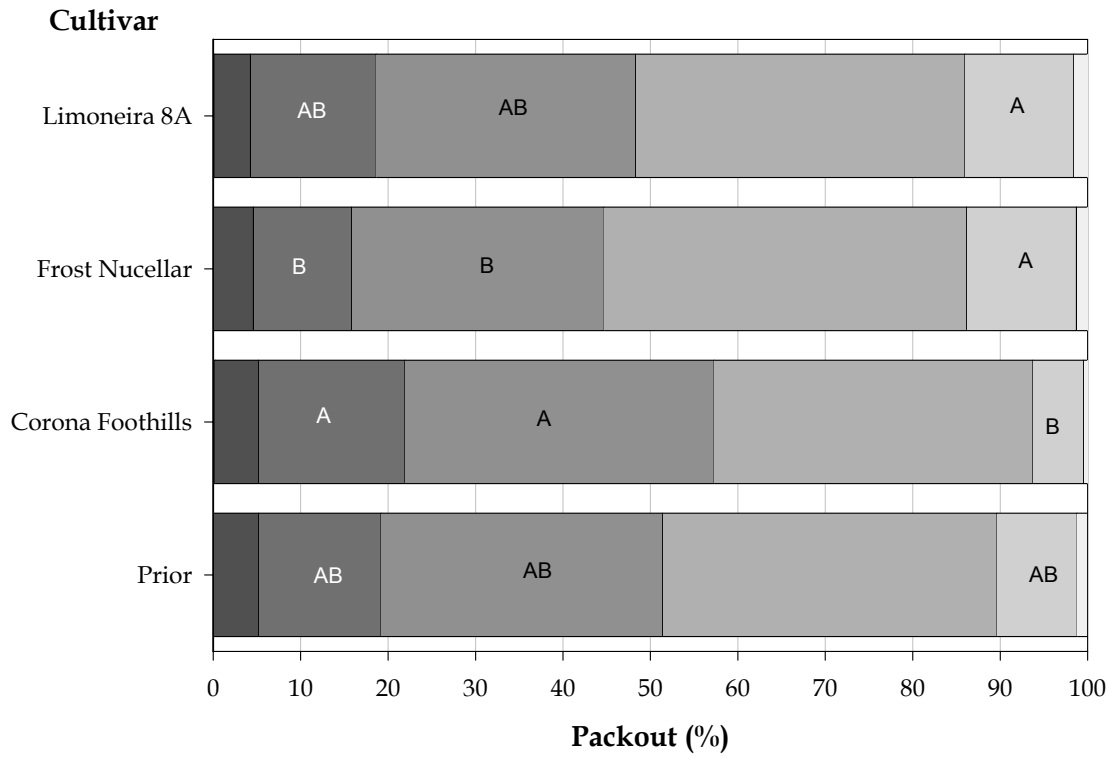


Fig. 3. 2001-02 Established 'Lisbon' Lemon Selection Packout - 11/28/01 Harvest

