For practical application, subatmospheric pressure provided a better way of storage than controlled atmosphere since control of air pressure is easier and simpler than that of O_2 and CO_2 concn.

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A Comparison of Three Nucellar Selections of Red Grapefruit with Old Budline Redblush[1]

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Abstract. Virus-free nucellar budlines of red grapefruit and an old budline selection carrying exocortis and xyloporosis were grafted on sour orange rootstocks and grown under commercial conditions in the orchard. No differences were found in fruit quality. The old line trees produced the greatest tonnage of fruit for the first 7 years. By the tenth year the old budline trees were only 55-62% as large as the nucellar trees and were producing less fruit. Counting numbers of fruit above and below 96 ring size revealed no distinct differences in fruit size. This information should be vital to those concerned with early returns from citrus groves.

Attempts to use citrus cultivars other than 'Rough Lemon' and 'Sour Orange' as rootstocks in the late '40's and early '50's often failed because of viruses in many of the clones then used in the industry. As a result the planting of virus-free selections was recommended (1). Citrus viruses, with the exception of the psorosis virus, are not transmitted through the seed and many new selections were propagated from seedling trees. It soon became apparent, however, that the juvenility of nucellar selections led to excessive vegetative growth and low yields (4). This experiment was designed to determine differences in growth and fruit yield over a 10-yr period among 3 nucellar selections of red grapefruit and 'Webb' selection of old budline 'Redblush', a standard cultivar in South Texas.

Materials and Methods

The trial was located at the Texas A&M University Agricultural Research and Extension Center at Weslaco, Texas, commencing in March 1960. Three nucellar selections, 'CES #3 Redblush' and local selections of nucellar 'Redblush' and 'Ruby' were planted in randomized, complete blocks together with the old budline 'Webb' selection of 'Redblush'. The nucellar trees were virus-free, the old budline trees carried exocortis and xyloporosis. There were 10 trees of each selection, arranged in 5, 2-tree plots. All trees were on sour orange rootstock,

[1]Received for publication August 10, 1972. The research was a cooperative project of the Plant Science Research Division, Agricultural Research Service, U. S. Department of Agriculture and the Texas A&M University Agricultural Experiment Station at Weslaco.

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field-grown in a nursery. The bud sources were indexed for xyloporosis and exocortis viruses on 'Orlando' tangelo and 'Rangpur' lime rootstocks by Dr. E. O. Olson.

The 'CES #3' clone originated from seed in 1945; the local selections in 1950. Although the bud sources were bearing trees, juvenility problems were expected, particularly with the more recently selected budlines (2).

We planted the trees in Willacy fine sandy loam soil at 25 x 27.5 foot spacing in order to eliminate crowding as a factor and to render hedging unnecessary for 10 years or more. Tree ht and width were measured when the trees were 10 years old; the fruit was always harvested in December and total yields for the period 1964-70 were recorded. Over the 3-yr period 1968-70, the fruit was also sized to determine the percentage of fruit size 96 (9.52 cm diam) and larger in the total crop. Fruit quality (fruit wt, vol of juice per fruit, rind thickness, Brix, and total acid) was determined on 10-fruit samples from each budline at the 1968 and 1969 harvests.

Results

From 1960-64 fruit yield was negligible. Yield per tree, annually and cumulatively, for 1964-70 is shown in Table 1. The yields of the old budline trees in the first 3 years of production (1964-66) were significantly higher than those of nucellar trees. Records for the fourth year were lost because of the 1967 hurricane. In the fifth and sixth years there were no significant differences, while in the seventh year (tenth year of growth) the nucellar budlines outyielded old budline 'Redblush'. There were no significant differences in cumulative yield of the 6 recorded harvests. The 10-yr old budline trees, however, were only 55-62% as large as the nucellar trees, with no significant size differences among the nucellar selections (Table 1). At the last 3 harvests the fruits were sized with a size 96 (9.52 cm) ring and the percentage of fruits exceeding this size was recorded. Although in 1968 the percentage of large fruit was greater from 2 of the nucellar budlines than from old budline trees (Table 2), there were no significant differences in 1969. In 1970 the percentage of fruit larger than size 96 from old budline trees equalled that of fruit from nucellar 'Redblush' and nucellar 'Ruby' trees, while nucellar 'CES #3 Redblush' produced a much smaller crop of large fruit. Cumulatively over the 3-yr period nucellar 'Ruby' yielded the greatest percentage of large fruit, followed by nucellar 'Redblush' and 'Webb' selection of 'Redblush'. 'CES #3 nucellar Redblush' bore distinctly fewer large-size fruits.

The means of fruit quality analyses of fruit harvested in 1968 and 1969 (Table 3) are not significantly different.

Discussion and Conclusions

The 'Webb' selection of 'Redblush' came into production earlier than the nucellar lines. This is important in areas, such as south Texas, where frequent freezes emphasize the need for trees to yield heavily at an early age.

The smaller size of the old budline trees is of distinct advantage from the standpoint of ease of harvest, either manually or mechanically. On small trees hedging operations would also be minimized. The fact that a nucellar grapefruit budline is virus free does not mean that it will produce more fruit than a virus infected old budline of red grapefruit. Only after the nucellar trees reached sizes considerably larger than the

Table 1. Total fruit yields, cumulative yield (kg/tree) 1964-1970 and test tree volume in cubic dm (1970).[z]

Cultivar	1964	1965	1966	1968	1969	1970	Cumulative yield	Mean volume[y] for 10 trees
Nucellar Redblush	.91 b[x]	7.26 B	39.46 C	153.77	353.81	254.02 A	809.22	40125.19 A
Nucellar Ruby	.32 b	14.06 B	44.45 C	187.79	327.95	215.91 C	792.44	35339.62 A
CES #3 Nucellar	.32 b	22.23 B	73.48 B	184.16	287.58	223.17 B	793.80	38596.62 A
Old Budline Redblush (Webb)	21.32 a	45.81 A	108.86 D	179.62	281.23	185.52 D	822.38	22030.63 B

[z]1967 fruit crop was destroyed by a hurricane

[y]Volume formula: $\frac{\text{width}^2 \times \text{ht}}{4}$

[x]Mean separation, within columns, by Duncan's multiple range test; lower case, 5% level; capitals, 1% level; differences not significant in columns lacking such letters.

Table 2. Percent of fruit harvested larger than size 96 (9.52 cm) 1968-1970 seasons.

Cultivar	1968	1969	1970	Cumulative yield mean % for 3 years
Nucellar Redblush	70A[z]	27	63A	46ab
Nucellar Ruby	63A	28	63A	48a
CES #3 Nucellar	34B	22	39B	31c
Old Budline Redblush (Webb)	40B	30	62A	42b

[z]Mean separation, within columns, by Duncan's multiple range test; lower case, 5% level; capitals, 1% levels; no letters, differences not significant.

Table 3. Nucellar and old line red grapefruit fruit quality (means of 1968 and 1969 seasons).[z]

Cultivar	Fruit wt (g)	Juice per fruit (ml)	Rind thickness (mm)	Brix (%)	Total acids (%)	Brix/acid ratio (%)
Nucellar Redblush	487.5	252	5.6	11.05	1.32	8.42
Nucellar Ruby	474.8	244	5.5	10.75	1.30	8.30
CES #3 Nucellar	474.2	250	5.4	10.71	1.30	8.23
Old Budline Redblush (Webb)	472.6	249	4.9	10.33	1.27	8.16

[z]No significant differences were found in any column.

old budline counterparts did their yield surpass that of old budline trees. Although the oldest nucellar line originated in 1945; juvenility still limited production in early years of the trees (3).

Because fruit quality is not affected and early yields are greater, it seems advantageous to the grower interested in early returns to plant old budline red grapefruit on sour orange rootstock in areas where tristeza is not a problem. The saving in labor and materials resulting from use of smaller trees is also worthy of consideration.

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Effects of Induced Polyploidy in Cucumbers[1]

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Abstract. Autotetraploid cucumbers were induced by soaking diploid seed in solutions of colchicine. Triploids were made by reciprocal crosses between diploids and tetraploids. The fruit yield of the polyploids was approx ½ that of diploids. The fertility of the tetraploid plants as measured by viable seed was approx 1/5 that of diploids. The reduced seed yields of tetraploids appeared to be due to reduced no. of functional male gametes and genic factors. Differences in seed yields were measured among tetraploid lines. Tetraploid by diploid crosses were extremely infertile in either direction.

With the advent of once-over mechanical harvesting of pickling cucumbers, the no. of fruit a plant will set simultaneously has become of primary importance. Previous work with cucurbits has shown that polyploids of this family have reduced seed yields, with triploids having very few if any seeds (1, 3, 4, 5, 6). This study was made to determine if reduced seed yields affected the no. of fruit a plant would set simultaneously and if the polyploids have enough potential fertility for commercial production.

Materials and Methods

Tetraploid cucumber plants of several cultivars were produced by soaking diploid cucumber seed in 0.5 to 1.0% aqueous colchicine solutions for 6 to 24 hr at 21°C. Plants of the C_0[5] generation displaying morphological characteristics similar to a naturally occurring tetraploid, RT[4], were grown in the greenhouse. Pollen diam was used as the primary screening aid in the selection of tetraploids. Chromosome counts were made on some plants in order to authenticate ploidy level based on pollen sizes. The percentage of pollen stainable with 2% acetocarmine was determined for all lines used in the study. Tetraploids were selfed and crossed, and also crossed reciprocally with diploids. Resulting progenies were grown in the greenhouse and in the field. Completely random designs with 7 plants of each line in the greenhouse and 10 plants of each line in the field were used. The no. of pollinations and the no. of fruit set per plant was recorded for those plants grown in the greenhouse, and the no. of fruit set per plant for plants grown in the field. Data were collected on fruit length to diam ratio (L/D), skin toughness, and flesh firmness (measured with a USDA fruit Pressure Tester, Magness, .79 cm tip). The skin toughness was computed as the difference between 2 pressure test readings taken on each fruit - 1 on the upper 3rd of the fruit with the skin intact and the other on the lower 3rd of the fruit with the skin removed. The 2nd measurement was used as a measure of flesh firmness. Pressure test and L/D measurements were taken on immature fruit that were approx 4.5 cm in diam. The no. of full-size seed coats per fruit, the no. of full seed per fruit, and the seed size for diploid and polyploid lines of the C_0 and C_1 generations were recorded. In this study the no. of full seed per fruit was used as an estimate of female fertility and the total no. of full-size seed coats was used to estimate the no. of functional female gametes produced or potential fertility.

Results and Discussion

Pollen diam was used as the major criterion in preliminary determinations of ploidy level. The pollen from tetraploid plants was similar in size to RT, the naturally occurring polyploid, and significantly larger than pollen from diploid plants (Table 1). Distributions of diploid, triploid, and tetraploid pollen diam were plotted and there was little overlap between pollen size of diploid and tetraploid plants. The triploid pollen diam were quite irregular with the mean square

Table 1. The effect of ploidy level on cucumber pollen size and stainability of 5 cucumber cultivars.

Cultivar	Pollen diam[z,y]		Percent stainable[y]	
	2N	4N	2N	4N
Poinsett	47.1	57.6	99.0	81.0
Tablegreen 65	48.6	65.0	97.0	47.5
N. H. Tiny Dill	45.1	57.4	98.0	85.0
S. C. Gynoecious 3	50.3	63.3	96.0	81.0
MSU 713-5	49.3	60.9	96.0	80.0
RT		59.8		88.0
LSD .01	8.73		14.96	

[z] 1 unit = 1.2μ.

[y] Values are means of 10 measurements.

[1] Received for publication August 28, 1972. Paper No. 3851 of the Journal Series of the North Carolina State University Agricultural Experiment Station, Raleigh.

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[4] The authors express appreciation to J. L. Bowers, Ark. Agr. Expt. Sta., Fayetteville, Ark. for supplying this tetraploid seed.

[5] C_0 = treated generation; C_1 = progeny of treated generation.