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BARD

FINAL REPORT

PROJECT NO. US-436-81

**Response of Peach and Nectarine Germplasm to
an Annual Top Removal Pruning System**

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Final Progress Report

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Abstract - BARD US-436-81

Clonal evaluations were made in Florida and Israel for determining adaptation to high density. In Florida, Flordagold, Fla. 9-9, Fla. 9-14, and Fla. 9-15N had significant yield on high density (1x3m), 16-month-old trees while the same clones at standard orchard spacing (4.5x6m) had no yield. Fruit size and soluble solids were slightly reduced on these trees at the high density as compared to the standard orchard spacing in the second fruiting at 28 months from planting (yields not comparable due to frost damage).

In Israel, rooting capacity of 10 clones showed high variability for % rooted and survival. Self rooting would be more desirable as tree density greatly increases. Chilling was investigated in 9 clones and results were similar to that in Florida with 2 exceptions. A quadratic function seemed to link flower and vegetative bud break. Flower bud set of 10 clones in a high density planting was evaluated in the 2nd growing season and most clones produced high bud set, but 4 were especially prolific. Among 10 clones tested 9-7N, 9-15N, and 83-4 were the most promising for high density with annual top removal.

Approximately 225,000 hand pollinations during the 4 year grant period resulted in about 18,000 hybrid seedlings from which selections for early ripening, high fruit quality will be made. During the grant period some 78 new clonal selections were made which are propagated and being field tested. The significant clones from this field test will be distributed to Israel for variety evaluation. Clones from previous cultivar tests are now propagated in Israel and 3 will be proposed for release in 1987-88 (Fla. 8-1, Fla. 82-9W, and Fla. 82-19). Others will be considered after further tests.

Improvements in the breeding procedure have been realized from effectiveness of preselection (selection in 18 month old seedlings). A 10-year analysis of the fruiting nursery indicated that selection was effective for chilling requirement, fruit development period, size, color, shape, and firmness. However, preselection for seedling chilling requirement based on seed chilling requirement was not effective in the chill range desired. Clones with a high flower bud set tended to produce precocious seedlings ($H=0.55$). A high degree of flower bud set in parents was a good indication that their progeny would have a high flower bud set. Chilling requirement was highly heritable ($H=0.93$). There was a positive relationship between earliness of autumn growth cessation and increased chilling requirement of the clone.

Attempts were made to increase the earliness and % success in germination of reseeded peach embryos in order to increase the hybrid population size of earlier ripening seedlings for clonal selection. Media, tetcyclazide, paclobutrazol, gibberellin, hydrogen cyanamide, seed peeling, light vs dark during germination, and temperature were investigated in seed germination. Both media explored were about equal in effect. There were indications that tetcyclazide combined with GA_3 substantially increased seed germination in vitro. Paclobutrazol applied to trees and hydrogen cyanamide applied to seed had no highly beneficial effects on germination. GA_3 in media improved germination in nearly every experiment. Some beneficial effect of culturing the embryos in darkness was noted. Culturing seed with a late chilling ($5^{\circ}C$) period increased % of large plantlets.

Research Objectives

1. Response of regrowth in high density with annual top removal and in standard orchard spacing.

1984

Flordagold, Sungem (Fla. 7-4N), and 5 clones from advanced selections (Fla. 8-2N, Fla. 8-6, Fla. 9-9N, Fla. 9-15N, and Fla. 9-14) were propagated on Nemaguard rootstock and planted in January 1984 to a high density (5 replications of 6 trees each spaced 1 x 3 meters) and a standard orchard spacing (5 replications of 1 tree each spaced 6 x 4.5 meters). The 7 clones were chosen for this experiment from a preliminary screening of advanced selections and cultivars for adaptation to the annual top removal system. Comparisons of crop load (yield), fruit size, and soluble solids are being made in the 2 spacing systems.

1985

First yield on the high density was in May and early June 1985 (Table 1), but no yield occurred in the standard spaced orchard system because of pruning required to train the tree. Flordagold, Fla. 9-9N, Fla. 9-14, and Fla. 9-15N had significant commercial yield on the second leaf trees (16 months old). Fla. 8-2N, Fla. 8-6, and Sungem had yields that were not considered commercially significant. Top removal to 60cm was done in early June in the high density system for regrowth of 1986 crop.

1986

First yield following top removal the previous June in the high density system was in 1986. Fruit yield, size (diameter), and soluble solids were compared from the high density (Table 2) and standard orchard (Table 3) spacing systems. Fruit yield was reduced in both systems due to a late spring frost of -2°C on March 23. Damage was visually estimated to be more severe in

the standard orchard system because trees were more compact and thus foliage more dense in the high density system thereby preventing heat loss. Only in marginal freeze conditions in very late March such as we experienced would be expected to result in yield differences between the 2 systems. Thus yield data between the 2 systems is not comparable for 1986. However, clones Fla. 9-9, Fla. 9-14, Fla. 9-15M and Flordagold were severely damaged in both systems. Fruit size and fruit soluble solids as measured by diameter and hand refractometer were smaller for all cultivars in the high density as compared to the standard orchard system.

Table 1. Yield and fruit size of 18-month-old peach trees in high density, 1985.

Clone	Harvest date	1		2		3		4		5		Clonal mean	
		Fruit weight ^z kg	Fruit size g	Fruit weight ^z kg	Fruit size g	Fruit weight ^z kg	Fruit size g	Fruit weight ^z kg	Fruit size g	Fruit weight ^z kg	Fruit size g	Fruit weight ^z kg	Fruit size g
Sungem Nect. (Fla. 7-4N)	4/30	1.07	63	.15	50	.21	70	.30	50	.84	70	--	--
	5/6	2.88	60	3.78	60	3.42	57	.15	50	1.48	57	--	--
Total/Avg.		3.95	62	3.93	55	3.63	64	.45	50	2.32	63	2.86	59
Fla. 8-2N	5/6	Very few fruit - not enough for records											
Fla. 8-6	5/14	1.92	80	2.28	91	4.15	83	1.62	90	7.43	94	3.48	88
Total/Avg.													
Fla. 9-15N	5/14	1.39	82	.26	65	1.19	70	1.88	75	2.33	75	--	--
	5/21	15.88	85	15.88	70	22.68	75	3.63	75	2.27	80	--	--
Total/Avg.		17.27	84	16.14	67	23.87	73	5.51	75	4.60	77	13.48	75
Fla. 9-9N	5/21	1.05	75	1.80	75	3.45	75	Missing data					
	5/24	5.44	70	19.50	75	9.53	75	Missing data					
Total/Avg.		6.49	73	21.30	75	12.98	75	--	--	--	--	13.59	74
Flordagold	5/21	4.37	115	3.89	105	6.75	95	4.37	95	4.14	115	--	--
	5/24	2.25	90	2.16	90	3.83	85	.51	85	.36	90	--	--
	5/28	1.62	90	1.35	90	2.16	90	.45	90	Missing data			
Total/Avg.		8.24	98	7.40	95	12.74	90	5.33	90	--	--	8.43	93
Fla. 9-14	6/7	7.65	85	4.48	80	5.67	90	Missing data					
	6/11	12.70	85	4.54	80	7.28	75	Missing data					
	6/17	7.28	85	9.07	85	12.70	80	Missing data					
Total/Avg.		17.63	85	18.09	82	15.65	82	--	--	--	--	17.12	83

^zYield per 6 trees 1 x 3 meters

Table 2. Yield, fruit size and soluble solids of 28 month-old peach trees in high density, 1986.

Clone	Rep. 1 ²										Rep. 2					Rep. 3					Rep. 4					Rep. 5					Clonal mean																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Table 3. Yield, fruit size and soluble solids of 28 month-old peach trees in standard orchard spacing, 1986.

Clone	Harvest date	Rep. 1 ²		Rep. 2			Rep. 3			Rep. 4			Rep. 5			Clonal mean		
		Fruit yield (kg.)	Fruit diameter (cm.)	Soluble solids (%)	FY ¹	PD ^x	SS ^y	FY ¹	PD ^x	SS ^y	FY ¹	PD ^x	FY ¹	PD ^x	SS ^y	FY ¹	PD ^x	SS ^y
Fla. 8-2	5/14	1.50	5.02	14.34	3.20	4.95	14.08	0.66	4.80	12.60	1.32	4.78	15.54	2.68	4.78	14.48	--	--
	5/16	1.13	4.72	14.52	0.91	4.64	14.20	0.23	4.84	12.95	0.64	4.49	14.24	--	--	--	--	--
	Total/Avg.	2.63	4.87	14.43	4.11	4.80	14.14	0.86	4.82	12.78	1.95	4.64	14.89	2.68	4.78	14.48	2.45	4.78
Fla. 9-9	6/6	0.41	4.71	14.10	0.18	4.97	14.60	1.54	5.29	13.38	1.41	5.42	13.52	2.36	5.12	12.72	1.18	5.10
	Total/Avg.	2.54	5.28	13.20	2.77	5.03	11.54	1.18	5.28	13.37	0.86	5.70	14.00	1.50	5.17	14.50	1.80	5.19
Fla. 9-15	5/26	0.91	5.40	13.44	0.36	5.14	12.90	0.23	5.08	--	0.45	4.76	12.80	0.73	5.05	15.12	--	--
	5/31	1.45	5.30	13.48	--	--	--	0.32	5.24	13.27	1.18	4.81	14.00	0.09	5.72	15.60	--	--
	Total/Avg.	2.36	5.35	13.46	0.36	5.14	12.90	0.55	5.16	13.27	1.63	4.79	13.40	0.82	5.39	15.36	1.15	5.17
Lungem Nect	5/14	1.04	5.13	10.58	--	--	--	0.27	5.72	13.90	0.91	4.66	12.14	1.90	4.95	14.28	--	--
	5/20	1.09	--	14.42	0.09	4.76	--	--	5.50	--	--	--	19.00	1.09	5.19	13.56	--	--
	5/22	2.18	5.42	12.60	0.23	5.40	10.50	0.68	5.00	14.20	0.64	5.16	14.64	--	--	--	--	--
Total/Avg.	4.31	5.28	5.28	12.53	0.32	5.08	10.50	0.95	5.41	14.05	1.55	4.91	15.26	2.99	5.07	13.92	0.85	5.15
Floridagold	5/20	0.36	5.48	12.36	--	--	--	0.68	5.53	12.20	--	--	12.82	0.32	5.72	12.55	--	--
	5/26	1.13	5.42	13.08	--	--	--	0.77	5.02	12.00	0.23	4.87	13.67	0.59	5.40	12.88	--	--
	5/31	--	--	--	--	--	--	0.18	5.40	10.60	--	4.76	14.20	--	--	--	--	--
Total/Avg.	1.50	5.45	12.72	--	--	--	--	1.63	5.32	11.60	0.23	4.82	13.56	0.91	5.56	12.72	0.85	5.29
Fla. 9-14	6/11	0.64	5.46	11.20	0.91	5.50	11.33	0.27	4.52	11.80	0.23	5.72	--	0.91	5.08	12.12	--	--
	6/16	2.72	5.31	10.44	0.45	5.08	10.20	1.59	4.62	11.44	0.91	5.72	10.90	0.34	5.08	11.00	--	--
	Total/Avg.	3.36	5.39	10.82	1.36	5.29	10.77	1.86	4.57	11.62	1.14	5.72	10.90	1.25	5.08	11.56	1.80	5.21

¹Based on 1 tree per rep-tree spacing 6.0 x 4.5 meters.
²Soluble solids (%)
³Fruit diameter (cm)
⁴Fruit yield (kg.)

2. Clonal selection

Progress in low-chill peach and nectarine breeding was reported (Proc. Fla. State Hort. Soc. 97:320-322). Twenty advanced selections of peach and nectarine clones were compared with 7 cultivars. These selections and cultivars were characterized for chill requirement, days from bloom to maturity, and fruit quality. Two of these, Fla. 5-12 and Fla. 7-4N, have been released by the University of Florida as 'TropicSweet' and 'Sungem', respectively. Since the time of this publication some advanced selections have been deleted while additional advanced selections have been added for comparison (Table 4). From results of recent evaluation trials, some of these selections are expected to be named within 2 to 5 years. Clones Fla. 8-1, Fla. 82-9W, Fla. 82-19, Fla. 9-6N, Fla. 9-11N, and Fla. 9-15N currently appear to be the best candidates for naming.

Table 4. Characteristics of some promising peach and nectarine clones, Gainesville, Florida 19 82-86.

Clone	Estimated chill units	Fruit							Bacterial ^x Spot resistance	
		FDP ^z (days)	Size (g)	Stone ^y freeness	Red overcolor (%)	Shape ^x	Firm ^x	Taste ^x		Flesh ^x browning
Peach										
FloridaGrande	75	104	98	SF	60	8	7	7	10	10
Flordaprince	150	78	88	SC	80	9	8	7	8	4
Flordagold	325	88	89	SC	60	7	10	9	9	5
FlordaKing	400	68	92	SC	50	7	7	7	9	9
Desertred	175	89	101	SF	90	9	8	8	8	5
Fla. 1-8	350	97	115	SF	80	9	9	8	10	9
Fla. 8-1	200	69	72	SC	70	8	8	6	8	10
Fla. 81-12	300	79	130	SC	20	8	7	7	9	10
Fla. 82-3	275	71	75	SC	80	9	10	7	10	10
Fla. 82-7	200	80	100	SC	90	8	9	7	8	6
Fla. 82-9W	150	86	110	SC	80	9	9	9	9	8
Fla. 82-10	200	91	90	SC	70	10	8	8	8	8
Fla. 82-19	350	76	105	SC	60	8	10	8	10	9
Fla. 82-24W	150	96	112	F	50	8	8	8	9	10
Nectarine										
Sungem	425	70	82	SC	90	9	8	8	10	10
Fla. 8-2N	425	70	79	SC	70	9	8	8	9	10
Fla. 9-6N	225	89	87	SC	100	9	9	8	8	9
Fla. 9-11N	200	95	92	SC	100	9	9	8	8	9
Fla. 9-15N	275	88	97	SF	100	9	8	8	9	10
Fla. 81-6N	300	81	81	SC	100	8	8	8	9	10
Fla. 81-17N	200	79	76	SC	90	8	7	8	10	10
Fla. 82-23N	200	101	113	F	100	8	9	9	10	10

^zFDP=Fruit development period.

^ySC=Semifree, SF=semifree, and F=Free. All genetic freestone classes.

^xRating of 1=poorest or least desirable to 10=best or most desirable.

3. Improvements in the breeding procedure.

- A. The genetics and methodology of the peach and nectarine breeding program were examined in order to improve the efficiency of producing high fruit quality, early ripening, low-chill cultivars. The effectiveness of preselection for chilling requirement, precociousness, fruit development period, fruit qualities, cold hardiness, and vigor were studied (Rodriquez, PhD dissertation and Mowrey, MS thesis).
- B. Attempts to select for flower bud chilling requirement (CR) at the seed stage were made in 58 families obtained from crosses and open-pollination of low chill selections and cultivars of peach and nectarine from the Florida breeding program. A nonsignificant correlation ($r=0.08$) between midparent bud CR and family seed CR was obtained. A low significant correlation ($r=0.21^{**}$) was obtained between individual seed CR and the CR of the resultant seedling. Seed coat removal had no effect on these correlations. Narrow sense heritability for bud CR as determined by parent-offspring regression was 0.50 ± 0.06 . The small range in CR of the seed and pollen parents, 300 to 450 and 200 to 400 chill units, respectively, may explain the low correlation values obtained. The data suggest that it is impractical to screen for seedling CR based on seed CR where the CR for climatic adaptability must be held within a range of less than 300 chill units (J. Amer. Soc. Hort. Sci. 110(5):627-630).
- C. Flower bud set was evaluated in 18-month old peach and nectarine seedlings growing in a high density nursery system. Nonsignificant correlations between trunk diameter and flower bud set (-0.3) and between trunk diameter and percent fruiting plants (0.03) were found

among 36 families from crosses or open pollination. Crosses with 'EarliGrande' (a light flower bud setter) consistently produced progeny with low bud set, as compared to crosses with Fla. 7-3 (a heavy flower bud setter). The percent of fruiting plants was high in families having Fla. 7-3 as a parent and in families derived from seed parents having a heavy flower bud set. These results indicate that clones with high flower bud set as mature trees tend to produce precocious seedlings. The estimate of narrow sense heritability by midparent-offspring regression for flower bud set in 18-month-old seedlings was 0.55 (Fruit Var. J. 40(1):8-12).

- D. A 10-year analysis of the high-density nursery (HDN) in the breeding of low-chilling peach and nectarine cultivars indicated selection was effective during the first cropping year for chilling requirement, fruit development period, size, color, shape and firmness but not for crop load, which needs to be evaluated at normal spacing over several years. The HDN system effectively has advanced the breeding program by promoting short generation time, reducing labor and space, and allowing for rating of some characters within 2 years from seed (J. Amer. Soc. HortSci. 111(2):311-315).
- E. A study was made on the feasibility of selection for cold hardiness, plant vigor, and flower bud set in young hybrid peach seedlings from a low chill breeding population. Variability occurred among families, pollen parents, and seed parents for cold hardiness, based on plant survival, among 4-month-old seedlings exposed to -10°C . The relationship between cold hardiness in juvenile and adult plants is not known. Variability was also found among 18-month-old seedlings for plant vigor and the red leaf allele was associated with reduced

vigor compared to green leaf seedlings of similar genetic background.

There was a positive relationship between the degree for flower bud set of parents and their progeny with a high heritability estimate for flower bud set in 18-month-old seedlings (HortSci. 21(4):938).

- F. The University of Florida low chilling peach breeding program was studied for parental and progeny flower bud set and its relationship with progeny plant vigor. A significant correlation was found between parental and progeny flower bud set ($r=0.65^{**}$) and between progeny flower bud set and stem diameter ($r=0.40^{**}$). A high heritability estimate for flower bud set was obtained by regression of progeny on midparent means (Proc. Fla. State Hort. Soc. 99:in press).
- G. The relationship between growth cessation under shortening daylengths and chilling requirement was investigated in a low-chill, young peach seedling population and in 6 low-chill peach cultivars. A positive correlation ($r=0.32^{**}$) was found between growth cessation and chilling requirement in the seedling population, whereas, a negative correlation ($r=0.58^{**}$) was found for the 6 cultivars. The 6 cultivars behaved in the manner that was expected; however, growth cessation in the seedlings was confounded by juvenility and vigor. Regression of individual progeny on their midparent values revealed that chilling requirement is highly heritable ($h^2=0.93$) (Fruit Var. J. 40(1):24-28).

4. In vitro and In vivo seed germination

- A. Hydrogen cyanamide was investigated as a substitute for part or all of peach seed cold needs for germination. Peach clones used were Fla. 82-2 which ripens about 60 days from bloom and Sunlite which ripens about 90 days from bloom. Fla. 82-2 seed were harvested at fruit ripening, pits cracked for kernel removal and placed on a culture

media, and matured for 4 weeks in vitro according to standard practices for germination. They were then removed from the media treated for 1, 3 and 5 minutes at 0.025, 0.05%, and 0.1% hydrogen cyanamid and placed in either 7.5°C or 26°C (room temperature). There were 50 seed per treatment and 2 checks making 20 treatments. Sunlite nectarine seed were harvested at fruit ripening, pits cracked for kernal removal, and treated with hydrogen cyanamide at 0.05%, 0.1%, 0.25%, and 0.5% for 1, 3, and 5 minutes. Treated seed were placed in moist perlite and either refrigerated (7.5°C) or kept at room temperature (26°C). There were 50 seed per treatment plus 2 checks for a total of 34 treatments.

Treatments of hydrogen cyanamide had no measurable effects on speeding up germination, and in fact, was toxic to the seed in proportion to the hydrogen cyanamide dosage.

- B. The purpose of this research was to study the effects of embryo age, growth medium, and germination procedure on germination rates of ovule-cultured peach (Prunus persica (L.) Batsch) embryos. The effects of pollen source on embryo size were also studied.

There were no consistently significant differences in germination rates attributable to the effects of Knopos, Neal and Topoleski, or Stewart and Hsu ovule culture media. Germination rates in vitro compared to those in moist perlite were not significantly different. The embryos germinated in perlite were visibly weaker.

Interspecific crosses with almond tended to produce larger embryos than those produced by selfing, backcrossing, or outcrossing within peach. There were no consistent differences in embryo size when outcrossing was compared to inbreeding within Prunus persica.

The use of isozymes for peach X almond hybrid identification was studied and the PGM and PGD enzyme staining systems were found to verify the hybridity. (Chaparro, J. X. 1986. M.S. Thesis. Factors affecting embryo size and germination rates of ovule cultured peach embryos. Univ. of Florida.)

5. Germplasm Sent to Israel

Shipments of budwood representing promising peach and nectarine selections were made to Israel each year (Table 5). Clones not established will be reshipped as required for establishment. Clonal selections made in the last 2 grant years will be supplied to Israel as they prove worthy from Stage 2 (1st fruiting on budded trees) test.

Table 5. Clonal peach and nectarine sent to Israel from Florida through 1986.

Clone	Established Prior to 1983	Sent to quarantine			
		1983	1984	1985	1986
FlordaKing	x				
Sunripe	x				
Fla. 13-72 (Maravilha)	x				
Fla. 46A4	x				
Fla. K5E-15N	x				
Fla. K5E-142N	x				
Fla. 5-2 (Flordaprince)	x				
Fla. 5-5	x				
Fla. 5-14N	x				
Fla. 5-15N	x				
Fla. 6-4	x				
Fla. 6-6	x				
Fla. 7-1 (Flordagem)	x				
Fla. 7-4N (Sungem)	x				
Fla. 8-1	x				
Fla. 8-3N	x				
Fla. 8-5N	x				
Fla. 8-8N	x				
Fla. 9-1	x				
Fla. 3-2		x			
Fla. 7-11		x			
Fla. 8-2N		x			
Fla. 8-6		x			
Fla. 9-5N		x			
Fla. 9-6N		x			
Fla. 9-7N		x			
Fla. 9-8N		x			
Fla. 9-9N		x			
Fla. 9-10 (Desertred)		x			
Fla. 9-11N		x			
Fla. 9-12N		x			
Fla. 9-14		x			
Fla. 9-15N		x			
Fla. 83-4		x			
Fla. 83-5N		x			
Fla. 10-64 (FlordaGrande)		x			
Fla. 1-8		x			
Fla. 8-14		x			
Fla. 81-6N		x			
Fla. 81-12		x			
Fla. 81-27		x			

Table 5. (Continued)

<u>Clone</u>	<u>Established Prior to 1983</u>	<u>Sent to quarantine</u>			
		<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Fla. 82-7			x		
Fla. 82-8W			x		
Fla. 82-10			x		
Fla. 82-12			x		
Fla. 84-10N			x		
Fla. 84-14N			x		
Fla. M2-1			x		
Fla. M2-2			x		
Fla. M2-3			x		
Fla. M2-4N			x		
Fla. M2-7N			x		
Fla. M3-4			x		
Fla. 81-17N				x	
Fla. 82-2				x	x
Fla. 82-3				x	x
Fla. 82-9W				x	
Fla. 82-19				x	x
Fla. 82-21				x	x
Fla. 82-23N				x	x
Fla. 82-24W				x	
Fla. 9-20C					x
Fla. 82-6N					x
Fla. 84-12C					x
Fla. 86-30NC					x

Publications:

A. Thesis and Dissertations

1. Effectiveness of preselection for chilling requirement, precociousness, fruit development period, and fruit qualities in peach and nectarine (*Prunus persica* (L.) Batsch). PhD Dissertation. 1984. J. Rodriguez-Alcazar. Univ. of Fla. (Previously sent - see publications below.)
2. Preselection for precociousness, cold hardiness, chilling requirement, and vigor in peach and nectarine (*Prunus persica* (L.) Batsch). MS Thesis. 1985. B. D. Mowrey. Univ. of Fla. (Previously sent - see publications below.)
3. Factors affecting embryo size and germination rates of ovule cultured peach embryos. M.S. Thesis. 1986. J. X. Chaparro (attached).

B. Research Publications (attached).

1. Sherman, W. B., J. Rodriguez, and E. P. Miller. 1984. Progress in low-chill peaches and nectarines from Florida. Proc. Fla. State Hort. Soc. 97:320-322.
2. Rodriguez-A., J. and W. B. Sherman. 1985. Relationships between parental, seed, and seedling chilling requirement in peach and nectarine. J. Amer. Soc. Hort. Sci. 110(5):627-630.
3. Rodriguez-A., J. and W. B. Sherman. 1986. Relationship between parental flower bud set and seedling precociousness in peach and nectarine, *P. persica* (L.) Batsch. Fruit Var. J. 40(1):8-12.
4. Rodriguez-A., J., W. B. Sherman, and P. M. Lyrene. 1986. High density nursery system for breeding peach and nectarine; A 10 year analysis. J. Amer. Soc. Hort. Sci. 111(2):311-315.

5. Mowrey, B. D. and W. B. Sherman. 1986. Flower bud set and relationship to vigor in 18-month peach seedlings. Proc. Fla. State Hort. Soc. 99:(in press).
6. Mowrey, B. D. and W. B. Sherman. 1986. Relationship between autumn growth cessation and chilling requirement in peach. Fruit Var. J. 40(1):24-28.
7. Mowrey, B. D. and W. B. Sherman. 1986. Variability in cold hardiness, plant vigor and flower bud set in peach. HortScience 21(4):938. Abstr.