to project such work into the future. The subject matter is interspersed with numerous diagrams and tables that are scientifically substantiated. At the end of each of the 12 chapters there is a summary in German, English and French.

The book has been directed at beginners as well as those with advanced knowledge in the field of "Klon Zuchtung." The information relates to plant material production in all areas of the world. The authors state that the book should intensify an interest in clone development where it already exists. Where it does not exist it could provide the stimulus to get it started. It is also directed at all those in the winegrape industry, such as propagators, grafters and producers who, directly or indirectly, stand to reap the commercial benefits of the clone developers. Finally, "Klon Zuchtung" should continue to improve the economics of winegrape production and make the livelihood of winegrape producers more secure. G. A. Cahoon, G. R. Nonneke.

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Performance of Nectarine Cultivars in Northern Mississippi

FRANK B. MATTA, R. C. SLOAN, JR. AND O. P. VADHWA

Abstract

Twenty-one nectarine cultivars were evaluated for fruit characteristics (flesh color, stone freeness, and skin color), full bloom date, harvest date, and yield. All cultivars tested had yellow flesh color, except 'Redchief' and 'Lafayette,' which had white flesh. 'Harko,' 'Early Sun Grand,' and 'Nectared #4' were semi-freestone and the remaining cultivars were freestone. Skin color ranged from yellow red to bright red. Bloom period for all cultivars occurred in late February through late March, and late spring freezes greatly limited production. Harvest dates ranged from May 22 through July 23. 'Early King' was early maturing, followed by 'Durbin,' 'Stark Crimson Gold,' and 'Stark Early Bird.' Late maturing cultivars were 'Redchief,' 'Garden State,' 'Francesco,' and 'Stark Redgold.' Based on yield, the most promising cultivars for northern Mississippi were 'Harko,' 'Redgold,' 'Stark Sunglo,' 'Hardired,' and 'Mericrest.' Cultivars were not evaluated for susceptibility to disease or insects. However, disease and insect pressure did not seem to limit tree production and performance.

Introduction

Nectarine and peach trees are similar; however, nectarine fruit are usually smaller, have smooth skin, and different flavor (8). Performance of peaches in Mississippi was reported in 1966 (6) and 1986 (4), but reports documenting the performance of nectarine cultivars in Mississippi are nonexistent. Since peaches can be successfully grown in Mississippi, prospects for nectarine production appeared viable. Breeding programs at the University of Florida (7), USDA at Bryon, Georgia, Clemson University (1), and the Horticulture Research Institute of Ontario, Canada (3) are developing new nectarine cultivars for growers. With development of new, more desirable cultivars, interest in nectarine production in Mississippi has prompted growers to seek information on adapted cultivars. Inquiries concerning performance and adaptability of nectarine cultivars prompted establishment of nectarine cultivar evaluations. This research paper presents results of nectarine cultivars evaluated from 1984 through 1992.

Methods and Materials

Twenty-one nectarine cultivars were evaluated from 1984 through 1992 at the MAFES Pontotoc Ridge-Flatwoods Research and Extension Center (34° 08'N and 89°00'W), Pontotoc, MS. Trees

were spaced 4.3 by 3.7 meters in a randomized, complete block design with four single tree replications. Trees of 3/4 inch (1.9 cm) caliper were planted February 15, 1984. Nine cultivars were on 'Halford' rootstock and the remaining cultivars were on 'Lovell' rootstock (Table 1). Soil was an Atwood Silt Loam with a pH of 6.0. Trees were trained to a 8 ft. by 4 ft. (2.4 x 1.2 meters) maintained hedgerow. The sod-strip method of culture was maintained using herbicide under tree rows (1.2 meter band) with a mowed grass strip between rows.

In 1985, trees were fertilized with 50 grams of ammonium nitrate on April 15. In subsequent years (1986-1989), trees received split application of ammonium nitrate at the rate of 100 g per tree in mid March and mid June. In 1990, ammonium nitrate was applied at the rate of 1.20 kg and 0.06 kg per tree on March 19 and August 3, respectively. Current spray schedule recommendations provided by the Mississippi Cooperative Extension Service were followed for control of diseases and insects.

Fruit were thinned by hand to a distance of approximately 15 cm apart. Fruit thinning was conducted when fruit was approximately 15 mm in diameter, about 24 days after bloom. Fruit from each cultivar were harvested when maturity was indicated by changes in skin color. Therefore, a given tree was harvested more than once when the fruit were fully matured. Harvest date was defined as the number of days required to harvest all fruit from a given tree. In order to avoid picking of soft fruit, fruit were not allowed to become over-ripe. Yields of cultivars were subjected to analysis of variance; yield means were separated by Duncan's Multiple Range Test. Other fruit characteristics documented were flesh color, skin color, and stone freeness. Full bloom and harvest dates were recorded yearly. Trees were considered in full bloom

Table 1. Fruit characteristics of nectarine cultivars grown at the Pontotoc Ridge-Flatwood Research and Extension Center, 1984-1992.

Cultivar	Flesh color[x]	Stone freeness[x]	Skin color
Harko/L[x]	Y	SF	Red
Redgold/L	Y	F	Red over yellow
Mericrest/L	Y	F	Bright Red
Nectared #6/H	Y	F	Full Red over yellow
Stark Redgold/L	Y	F	Yellow Red
Hardired/H	Y	F	Red
Francesco/H	Y	F	Red
Stark Sunglo/L	Y	F	Vivid Red
Stark Crimson Gold	Y	F	Bright Red
Garden State/H	Y	F	Orange-yellow undercolor overspread with red
Fantasia/L	Y	F	Bright Red with yellow around color
Early Sun Grand/H	Y	SF	Red/Yellow
Redchief/L	W	F	Red
Nectared #4/H	Y	SF	Red
Tiger/H	O	F	Yellow spots on red skin
Durbin/L	Y	F	Red
Early King/L	—	F	Red
Firebright/L	Y	F	Red
Lafayette/H	W	F	Red
Flavortop/H	Y	F	Blush Red
Stark Early Bird	Y	F	Red

[x]L = Lovell rootstock, H = Halford rootstock, X = Yellow, W = White, SF = Semi-freestone, F = Freestone.

Table 2. Full bloom date of nectarine cultivars grown at the Pontotoc Ridge-Flatwood Research and Extension Center, 1990-1992.

Cultivars	Full bloom date		
	1990	1991	1992
Harko	March 4	March 21	March 15
Redgold	February 28	March 19	March 7
Mericrest	March 3	March 19	March 10
Nectared #6	March 4	March 19	March 12
Stark Redgold	February 28	March 17	March 10
Hardired	March 9	March 21	March 13
Francesco	February 28	March 17	March 10
Stark Sunglo	February 28	March 17	March 10
Stark Crimson Gold	February 28	March 21	March 10
Garden State	March 4	March 17	March 10
Fantasia	March 4	March 19	March 10
Early Sun Grand	March 5	March 22	March 10
Redchief	March 4	March 21	March 10
Nectared #4	March 9	March 24	March 15
Tiger	February 26	March 17	March 10
Durbin	March 4	March 21	March 10
Early King	February 26	March 15	March 5
Firebright	March 4	March 18	March 10
Lafayette	March 10	March 24	March 20
Flavortop/H	February 26	March 19	March 7
Stark Early Bird	March 9	March 19	March 10

when 90 percent of the flowers were fully opened.

Results

Flesh color was yellow, except 'Redchief' and 'Lafayette,' which had white flesh (Table 1). Skin color ranged from yellow red for 'Stark Redgold' to vivid red for 'Stark Sunglo.' All cultivars had freestone fruit with the exception of 'Harko,' 'Early Sun Grant,' and 'Nectared,' which had semi-clingstone fruit.

Full bloom generally occurred from late February through late March, depending on cultivars and year (Table 2). 'Redgold' and 'Flavortop/H' bloomed earlier than the other cultivars. 'Lafayette' and 'Nectared #4' were late blooming.

The first production year was 1987 (all trees flowered profusely). However, on March 31, 1987, the temperature in the orchard dropped to 24°F (-4.5°C) and destroyed a potential commercial crop of all cultivars which were post-bloom. On April 10, 1989, the temperature in the orchard dropped to 24°F (-4.5°C), and again a potential commercial crop of all cultivars was destroyed. Fruit was harvested in 1988, 1990, 1991, and 1992 when no major freeze damage occurred. Harvest period ranged between May 22 through July 23, depending on cultivar and year (Table 3). 'Early King' was the earliest maturing cultivar, followed by 'Durbin,' 'Stark Crimson Gold,' and 'Stark Early Bird,' which matured in late May to early June and mid-June. Late maturing cultivars were 'Redchief, 'Garden State,' 'Francesco', and 'Stark Redgold,' which matured in mid to late July.

Fruit yield varied depending on year and cultivar (Table 4). 'Harko,' 'Redgold,' 'Stark Sunglo,' and 'Hardired' yielded over 200 pounds (90.0 kg) per tree cumulative yield and were con-

Table 3. Harvest date of nectarine cultivars grown at the Pontotoc Ridge-Flatwood Research and Extension Center, 1990-1992.

Cultivars	Harvest date		
	1990	1991	1992
Harko	June 26-July 5	July 12-26	June 23-24
Redgold	July 10-25	July 12-26	July 9-14
Mericrest	July 9-23	July 12-26	July 14
Nectared #6	July 13-16	July 2-26	July 14
Stark Redgold	July 16-25	July 18-29	July 21-23
Hardired	June 26-July 16	July 2-12	June 23-24
Francesco	July 16-25	July 18-29	July 14-21
Stark Sunglo	June 26-July 9	July 2-12	July 19
Stark Crimson Gold	June 11	June 11-25	June 15
Garden State	July 16-25	July 18-26	July 14-21
Fantasia	July 13-20	June 25-July 16	July 14-21
Early Sun Grand	July 20-30	June 25-July 26	June 23-24
Redchief	July 23-30	July 26-29	July 23
Nectared #4	June 26-July 5	July 12-26	June 23-July 19
Tiger	July 16	July 18	-----
Durbin	June 11-20	June 11-25	June 15-24
Early King	May 22-29	May 24-31	May 23-30
Firebright	-----	-----	-----
Lafayette	-----	July 18-29	July 21
Flavortop/H	July 5-10	July 12-26	July 23
Stark Early Bird	June 11	June 11-25	June 15-24

Note: Broken lines denote missing data.

#6,' and 'Durbin' yielded 191.5 (87.0 kg), 190.8 (86.7 kg), and 182.5 (82.9 kg) pounds cumulative yield, respectively. 'Early Sun Grand,' 'Stark Early Bird,' 'Lafayette,' and 'Early King' were extremely low producers with cumulative yield between 10.9 pounds (4.9 kg) to 86.2 pounds (39.2 kg).

Nectarine yields in Alabama ranged from a low of 10 pounds (4.5 kg) per tree to a high of 105.5 pounds (48.0 kg) per tree based on a four-year average (2). In this study the lowest four-year average was 10.9 pounds (4.9 kg) per tree for 'Early King' and a high of 99.5 pounds (45.2 kg) per tree for 'Harko.' In Alabama, 'Stark Crimson Gold,' 'Stark Redgold,' 'Stark Sunglo' and 'Flavortop' yielded 69.9 (31.7 kg), 66.1 (30.0 kg), 32.4 (14.7 kg), 29.9 pounds (13.6 kg) per tree (5), respectively. In Mississippi, 'Flavortop' outyielded 'Flavortop' in Alabama by nine pounds (4.1 kg) per tree, 'Stark Sunglo' outyielded 'Stark Sunglo' in Alabama by 23 pounds (10.5 kg) per tree. However' 'Stark Crimson Gold' and 'Stark Red Gold' in Alabama outyielded 'Stark Crimson Gold' and 'Stark Red Gold' in Mississippi by 46 (20.9 kg) to 29 pounds (13.7 kg) per tree, respectively. Yields in Alabama tended to be slightly higher for all cultivars over a four-year period and averaged 49 pounds (22.3 kg) compared to 42 pounds (19.1 kg) per tree, in Mississippi. Comparing nectarine yields to peach yields in Mississippi, peaches averaged 18.5 pounds (8.4 kg) per tree per year (4) and nectarines averaged 10.5 pounds (4.8 kg) per tree per year. Thus, peaches were almost twice as productive as nectarines.

In this study, current spray schedule recommendations for peaches provided by the Mississippi Cooperative Exten-

Table 4. Yield of nectarine cultivars grown at the Pontotoc Ridge-Flatwood Research and Extension Center, 1984-1992.

Cultivars	Year				Cumulative yield	4 year Avg.
	1988	1990	1991	1992		
	Yield (kg/tree)					
Fantasia	36.2b*	15.8d-f	13.7a	6.6d-f	72.4	18.1
Nectared #4	30.1b	11.1ef	12.5ac	18.0c-f	71.9	18.1
Firebright	38.8b	4.1f	9.9ac	25.9b-d	78.8	19.6
Francesco	19.8b	27.2b-e	13.7a	12.2d-f	73.0	18.2
Redgold	47.0a	45.2ab	13.8a	11.5d-f	117.6	29.2
Harko	52.1a	58.2a*	8.0ac	62.4a	180.8	45.2
Stark Sunglo	51.3a	26.0b-e	11.0ac	12.1d-f	100.6	25.0
Early Sun Grand	----	15.3d-f	6.7bc	4.0f	26.1	8.6
Stark Crimson Gold	27.1b	25.2b-e	7.5abc	0.9f	60.9	15.2
Flavortop/H	43.0a	3.4f	15.7a	8.9d-f	71.1	17.7
Durbin	21.7b	15.0d-f	8.0ac	38.0b	82.9	20.9
Stark Early Bird	18.5b	3.09f	7.6abc	9.9d-f	39.2	10.0
Mericrest	20.2b	37.1bc	10.2ac	19.4b-f	87.0	21.7
Stark Redgold	30.8b	28.0b-e	6.2bc	5.0e-f	70.1	17.5
Redchief	30.4b	13.9d-f	7.1bc	4.63f	56.2	14.0
Hardired	25.5b	27.9b-e	5.8bc	36.9b-c	96.1*	24.0
Nectarine #6	23.9b	31.7bcd	5.6bc	25.4b-d	86.7	21.5
Lafayette	28.6b	-0-f	5.3bc	3.4f	37.4	12.4
Garden State	24.8b	21.0b-e	4.2c	24.6b-c	74.7	18.6
Tiger	12.1b	6.9f	4.3c	0.0f		
Early King	----	4.9f	0d	0.0f	4.9	4.9

*Means separated by Duncan's Multiple Range Test 5% level.
Means with the same letter do not differ.

sion Service were followed for disease and insect control. Neither disease nor insect susceptibility were monitored or quantified. It is reported that lack of pubescence predisposes the nectarine fruit to be more susceptible to brown rot disease and insect attack and severely limits production areas (9). However, disease or insect pressure did not seem any greater for nectarines than for peaches grown in an adjacent orchard.

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