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Japanese Plum Cultivar Evaluations in Northern and Southern Mississippi

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Introduction

Disease has been a major factor limiting the production of plums in the southeastern United States (3). However, cultivars and hybrids of Japanese plum (*Prunus salicina*) are better adapted than European plum (*P. domestica*) and have extended the commercial season in many of the southern states (10).

Japanese plum probably originated in China. In 1870, 'Kelsey' was the first cultivar brought to the United States from Japan. Cultivars and hybrids of Japanese plums were introduced by Luther Burbank (15). Today, 'Santa Rosa' is one of the leading cultivars in California.

In 1947, horticulturists at the Mississippi Agricultural and Forestry Experiment Station recommended plum cultivars that could be successfully grown in Mississippi (12). There are now many new, better-adapted, disease-resistant, high-yielding cultivars. Plum production for the fresh market has increased in Alabama and the Southeastern United States, with extensive plantings of 'AU Producer' (7), 'Crimson,' 'Purple' (10), and limited plantings of other selections (5, 9, 2).

In addition, breeding programs in Georgia and Alabama are developing new plum cultivars for growers (11). The development of new, more desirable cultivars has prompted growers in Mississippi to seek information on adaptation of such cultivars. Plum cultivar performance results during initial tree establishment were reported in 1989 (4).

This bulletin presents results of Japanese plum cultivars evaluated from 1985 through 1991 in northern Mississippi and from 1986 through 1995 in southern Mississippi. Results are reported for each location. No

attempt is made to compare locations.

Materials and Methods

Pontotoc (North Mississippi)

Eleven plum cultivars on Lovell rootstock were evaluated from 1985 through 1991 at the MAFES Pontotoc Ridge-Flatwoods Branch Experiment Station (34°08'N and 89°00'W) south of Pontotoc, MS. Trees were spaced 14 feet by 20 feet in a randomized complete block design with four replications and single tree plots. Trees of 3/4-inch trunk caliper were planted February 22, 1985. Trees were trained to the modified central leader system and pruned annually. The sod-strip culture method was maintained using herbicides in a 4-foot (1.2-meter) band under tree rows and a mowed grass strip between rows.

In 1986 and 1987, trees were broadcast fertilized with 300 pounds per acre (336 kg/ha) of 13-13-13 (N-P-K). In 1988, 1989, and 1990, the trees received 3.5 oz/tree (100 g/tree) of 13-13-13 at pre-bloom, post-bloom, and June 15 for a total of 10.5 oz/tree (300 g/tree). In 1991, the trees were fertilized with ammonium nitrate at the rate of 7.88 lb/tree (225 g/tree).

Current spray schedule recommendations provided by the Mississippi Cooperative Extension Service were followed for control of insects and diseases.

Fruit was hand thinned to a spacing of 6 inches on fruiting limbs. Fruit thinning began soon after blossoming and was completed shortly after "June drop."

Fruit from each cultivar was harvested when maturity was indicated by changes in peel ground color. Therefore, a given tree was harvested more than once when the fruit was fully matured. Cultivar yields were subjected to analysis of variance and yield means were separated by the Duncan's Multiple Range Test. Fruit quality was determined by measuring soluble solids concentration (Abbe hand refractometer 20C) and juice pH (Accumet 925 pH meter) of five fruit/tree. The diameter of 10 fruit/tree and weights of 5 fruit/tree were determined. Fruits were sampled each year at first harvest (Table 3). The fruit flesh color, peel color, and stone freeness were determined. Bloom and harvest dates were recorded annually.

Alcorn (South Mississippi)

Ten plum cultivars on Lovell rootstock were evaluated from 1985 through 1991 at Alcorn State University, Lorman, Mississipi (32°00'N and 91°00'W). Trees were spaced 14 feet by 20 feet in a randomized complete block design with four single tree replications. Trees of 3/4-inch trunk caliper were planted March 5, 1985. Tree training system and cultural practices, which included fertilization, irrigation, weed control, fruit thinning, and insect control, were identical to those at Pontotoc. The soil, however, was a Memphis silt loam with a pH of 6.5.

Procedures for harvesting and data analyses were identical to those at Pontotoc. Data collected included yield per tree, fruit flesh color, peel color, and stone freeness. Bloom and harvest dates were also recorded.

Results and Discussion

Pontotoc and Alcorn

Flesh color of plums ranged from yellowish red for 'Six Weeks' to blue-black for 'Frontier' (Table 1). Skin color ranged from light red for 'Morris' to dark-red-purple for 'Methley.' All cultivars had cling stone fruit with the exception of 'Au Roadside' and 'Ozark Premier,' which had semi-cling stone fruit. 'Segundo' and 'AU Roadside' were not evaluated at Alcorn.

Pontotoc

In general, full bloom dates of the plum cultivars at Pontotoc occurred from March 9 through March 20 (Table 2). Also, full bloom dates varied from year to year. This is expected because of environmental conditions.

The first potential production year was 1987 (all trees flowered profusely). A freeze of 24°F (-4.5°C) on March 31, 1987 destroyed the potential commercial crop of all cultivars. All trees were at post-bloom stage. 'Segundo,' 'Robusto,' and 'Bruce' produced some fruit, perhaps indicating some degree of hardiness to the freeze or a heavy production of blossoms, in which case some ovaries survived.

Rieger, et al. (13) reported that 'Bruce' and 'Santa Rosa' were hardy and 'Ozark Premier' the least tolerant in a freeze that occurred during bloom. On March 16, 1988, a freeze with a minimum temperature in the orchard of 23°F (-5°C), caused major crop damage to most cultivars (Table 4). However, the fruit of 'Robusto,' 'Morris,' and 'Segundo' had to be thinned to ensure fruit sizing. As indicated by average first harvest date, 'Robusto,' 'Methley,' and 'Six Weeks' were the highest producers with cumulative yield of 156.7 pounds (71.2 kg), 127.2 pounds (57.8 kg), and 117.8 pounds (53.5 kg) per tree, respectively (Table 4).

Plum yields in Alabama have ranged from 39 to 149 pounds (17.7 to 67.7 kg) per tree depending on cultivar (6). The low cumulative yields for most cultivars reported in this publication (Table 4) were primarily caused by the March 16, 1988 freeze. It is interesting to note that 'Robusto' and 'Segundo' produced both years (measurable yields in 1987 and a commercial crop in 1988).

On March 18, 1989, a minimum temperature of 23°F (-5°C) was recorded and resulted in a crop loss of 'Explorer,' 'AU Roadside,' and 'Frontier.' All trees were in full bloom. The remaining cultivars did not apparently suffer damage. The temperature in the orchard dropped to 24°F (-4.5°C) on April 10 when fruits were 5-12 mm in diameter, resulting in complete crop loss. A crop load rating was taken after the damage, indicating that all cultivars except 'Explorer,' 'AU Roadside,' and 'Frontier' would have produced an adequate crop if the April 10 freeze had not occurred (Table 2).

It is evident that late spring freezes severely limit plum production in this climate since the bloom period for all cultivars occurred in early to mid-March. Results indicate and are in agreement with Rieger, et al. (13) that certain cultivars are hardier or produce an abundance of blossoms and, therefore, are able to produce a crop consistently.

In 1990, yields ranged from 6.5 pounds (3.0 kg) per tree for 'AU Roadside' to 41.4 pounds (18.8 kg) per tree for 'Methley.' 'Methley,' 'Frontier,' and 'Morris' were the highest producers followed by 'Robusto' and the remaining cultivars. In 1991, 'Methley' and 'Morris' were again the highest producers followed by 'AU Producer.' 'Frontier,' a high producer in 1990, did not produce a crop in 1991. Greater cumulative yield with time is a good indicator of consistency in production. 'Robusto,' 'Morris,' 'Segundo,' and 'Methley' had greater cumulative yields indicating that these cultivars were more consistent producers (Table 3).

Fruit juice pH, based on a 4-year average, ranged from 3.7 for 'AU Producer' to 3.1 for 'Segundo' (Table 5). The remaining cultivars had an average pH of 3.4 to 3.2 except for 'Morris,' which had a pH of 3.6. Soluble solids ranged from a 14.2 for 'Robusto' to 10.9 for 'Segundo.' Fruit diameter varied from 1.9 inches (4.9 cm) for 'Methley' and 'Ozark Premier' to 1.44 inches (3.7 cm) for Morris. Fruit weight (five fruit/tree) did not differ among cultivars and ranged from 1.2 pounds (500.8 g) for 'Methley' to 0.42 pound (192.1 g) for 'AU Producer.'

The climate in Mississippi is characterized by long, hot, humid summers, mild winters, periods of heavy rainfall, and late spring freezes (Wax et al., 1987). 'Robusto,' 'Morris,' 'Segundo,' and 'Methley' were the best adapted cultivars as indicated by yield. Resistance or tolerance of the various cultivars to black knot, bacterial canker, bacterial fruit spot, and plum leaf scald was not monitored. However, disease pressure seemed to be minimal in this orchard, perhaps attesting to the disease resistance developed in these cultivars.

Alcorn

In general, full bloom dates of the plum cultivars occurred from February 25 through March 7 (Table 6). Full bloom date varied from year to year and was expected because of environmental conditions. Bloom period was approximately 2 weeks earlier at Alcorn than at Pontotoc. The first potential production year was 1987 (all trees flowered profusely). However, as in Pontotoc, late spring freezes in March of 1987, 1988, 1989 destroyed the crop. In addition to the freezes that occurred in northern Mississippi, two additional freezes occurred at Alcorn in 1990 and 1991, which also destroyed the plum crop. Therefore, the first production year at Alcorn was 1992.

Harvest date ranged from May 27 through June 28 (Table 7) depending on cultivar and year. As indicated by harvest date, 'May Ripe,' 'Methley,' and 'Six Weeks' were early producers. 'Morris,' 'Frontier,' and 'Explorer' were late producers (Table 2). 'AU Producer,' 'Methley,' and 'May Ripe' were the highest producers with cumulative yields of 178.7, 138.9, and 95.8 lb/tree (81, 63, and 43.5 kg/tree), respectively (Table 8). The remaining cultivars produced between 73.2 pounds (33.2 kg) per tree and 30.0 pounds (13.6 kg) per tree. 'Ozark Premier' was the lowest producer with 16.3 pounds (7.4 kg) per tree.

Plum cultivar yields in northern Mississippi ranged from 8.4 pounds (3.8 kg) per tree to 52.2 pounds (23.7 kg) per tree based on a 3-year average. At Lorman, yield ranged from 4.1 to 44.6 pounds (1.8 to 20.2 kg) per tree based on a 4-year average. The 3-year average yield per tree for all cultivars at Pontotoc was 24.9 pounds (11.6 kg). At Lorman, the 4-year average yield per tree for all cultivars was 19.3 pounds (8.75 kg). Results indicate that, in general, the cultivars were equally productive at both growing sites. However, some cultivars performed better in northern Mississippi and others in southern Mississippi.

Conclusion

Results illustrate yield of Japanese Plums in northern and southern Mississippi. Based on cumulative yield, 'Robusto,' 'Morris,' 'Sunglo,' and 'Methley' are recommended for northern Mississippi. 'AU Producer,' 'Methley,' and 'May Ripe' are recommended for southern Mississippi.

Japanese Plums, as indicated by bloom period, were very susceptible to late spring freezes. Bloom period at Alcorn was approximately 2 weeks earlier than at Pontotoc and perhaps rendered buds more susceptible to freeze injury. 'Segundo,' 'Robusto,' and 'Bruce' indicated some degree of hardiness to late spring freezes or perhaps a heavy production of blossoms in northern Mississippi resulting in yield. As would be expected, because of higher day/night temperatures and earlier bloom, cultivars matured earlier in southern Mississippi (Lorman).

On the basis of yield date and other performance characteristics presented in this bulletin, the production of Japanese plum in northern and southern Mississippi is possible. However, spring freezes during Japanese plum tree bloom severely limit plum yields and annual production in Mississippi.

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15. Westwood, M. E. 1993. Temperate-zone pomology. 3rd Edition. Timber Press, Portland, Oregon. Table 1. Fruit characteristics of eleven plum cultivars grown at Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, MS, 1985-1991.

Table 1. Fruit characteristics of eleven plum cultivars grown at Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, Mississippi, 1985-1991.

Cultivar	Flesh Color	Skin Color	Stone Freeness
AU Producer	Dark Red	Dark Red	Cling
AU Roadside	Dark Red	Dark Red	Semi-Cling
Bruce	Orange-Red	Orange-Red	Cling

Explorer	Dark-Purple	Dark-Purple	Cling
Frontier	Blue-Black	Dark-Purple	Cling
Methley	Reddish-Purple	Dark-Red-Purple	Cling
Morris	Light Red	Light Red	Cling
Ozark Premier	Bright Red	Red-Purple	Semi-Cling
Robusto	Red	Bright Red	Cling
Segundo	Orange-Red	Red	Cling
Six Weeks	Yellowish-Red	Red	Cling

Table 2. Full bloom dates of plum cultivars grown at Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, Mississippi, 1988-1991.

	Year			
Cultivar	**1988**	**1989**	**1990**	**1991**
	March Full Bloom Date			
AU Producer	15	16	17	15
AU Roadside	13	10	16	13
Bruce	11	12	19	16
Explorer	13	13	20	18
Frontier	14	12	18	16
Methley	17	16	20	17
Morris	12	12	15	13
Ozark Premier	9	11	20	18
Robusto	14	12	15	14
Segundo	14	13	18	17
Six Weeks	18	17	19	18

Table 3. First harvest dates of plum cultivars grown at Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, Mississippi, 1988-1991.

	Year			Average First
Cultivar	**1988**	**1990**	**1991**	**Harvest**
	First Harvest Date (month/day)			
AU Producer	6/23	6/22	6/20	6/22
AU Roadside	6/23	6/15	6/11	6/16
Bruce	6/17	6/16	6/20	6/18
Explorer	6/27	6/22	7/7	6/29
Frontier	6/27	6/22	6/20	6/23
Methley	6/9	6/6	6/20	6/12
Morris	6/23	6/22	6/20	6/22
Ozark Premier	7/5	7/5	7/6	7/5
Robusto	6/9	6/1	6/20	6/10
Segundo	6/23	6/6	6/20	6/16

Six Weeks	6/1	5/21	6/11	6/11

Table 4. Yield of plum cultivars grown at Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, Mississippi, 1988-1991.

	Year				Cumulative[1]	4-yr
Cultivar	**1988**	**1989**	**1990**	**1991**	**Yield**	**Avg.**
	Yield (lb/tree)					
AU Producer	30.7c[2]	5.0[3]	16.1bcd	34.0a	80.0c	26.6
AU Roadside	13.8d	0	6.5cd	5.1c	25.4d	8.4
Bruce	16.2d	3.3	9.7bcd	19.6b	45.5d	11.3
Explorer	1.8d	0	13.6bcd	1.2c	29.7d	9.9
Frontier	18.3d	0	34.3a	--	52.6cd	17.5
Methley	17.3d	4.0	41.4a	45.4a	104.1b	84.7
Morris	57.4b	2.8	31.0ab	38.8a	127.2ab	42.4
Ozark Premier	27.0c	5.0	9.3cd	12.7c	49.0cd	16.3
Robusto	115.4a	5.0	24.5abc	16.8c	156.7a	52.2
Segundo	74.5b	2.0	16.1bcd	27.2b	117.8ab	39.2
Six Weeks	26.0c	5.0	13.7bcd	7.0c	46.7d	15.5

[1]Cumulative of 3 years.

[2]Means in columns separated by Duncan's Multiple Range Test with significance level 0.05.

[3]Crop load rating: 0=no commercial crop, 1=low crop, no thinning, 2=commercial crop, light thinning, 3= commercial crop moderate thinning, 4=commercial crop, heavy thinning, 5=commercial crop, very heavy thinning.

Table 5. Fruit quality characteristics of plum cultivars grown at Pontotoc Ridge-Flatwoods Research Branch Experiment Station, Pontotoc, Mississippi, 1985-1991.

		Soluble	Fruit	Fruit
Cultivar	**pH[1]**	**Solids[2]**	**Diameter[3]**	**Weight**
		(%)	**(cm)**	**(g/5 fruit)**
AU Producer	3.7a	11.7bc	3.9bcd	192.1a
AU Roadside	3.2d	12.5b	---	343.7a
Bruce	3.2cd	12.3b	4.5ab	438.2a
Explorer	3.2c	11.2c	4.5ab	277.4a
Frontier	3.4a-d	12.9b	4.7a	341.6a
Methley	3.2cd	11.0c	4.9a	500.8a
Morris	3.6ab	12.4b	3.7cd	263.4a
Ozark Premier	3.4a-d	13.5a	4.9a	333.8a
Robusto	3.4a-d	14.2a	---	335.6a
Segundo	3.1d	10.9c	4.3abc	307.3a

Six Weeks	3.2d	11.4c	4.6ab	421.3a

[1]Means in Columns separated by Duncan's Multiple Range Test with significance level 0.05.

[2]Mean pH values and soluble solids concentration of fruit from four replications and 4 years.

[3]Mean of 10 fruit per tree from four replications and 4 years.

Table 6. Full bloom dates of plum cultivars grown at Alcorn State University, Lorman, Mississippi, 1989-1995.

	Year			
Cultivar	**1992**	**1993**	**1994**	**1995**
AU Producer	March 2	March 4	February 28	March 2
Methley	March 5	March 7	March 4	March 5
May Ripe	March 1	March 3	February 27	March 1
Morris	February 28	March 3	March 2	February 27
Robusto	March 1	March 2	March 5	March 1
Explorer	March 2	February 28	March 1	March 3
Frontier	March 2	March 4	March 4	March 7
Six Weeks	March 5	March 7	March 3	March 4
Bruce	February 26	February 28	March 1	February 28
Ozark Premier	February 25	February 28	March 1	February 26

Table 7. First harvest dates of plum cultivars grown at Alcorn State University, Lorman, Mississippi, 1989-1995.

	Year			
Cultivar	**1992**	**1993**	**1994**	**1995**
AU Producer	May 29-June 17	June 5-25	June 8-27	May 31-June 26
Methley	May 27-June 2	June 1-14	June 3-22	May 31-June 5
May Ripe	May 27-May 29	June 1-10	May 18-23	May 31-June 5
Morris	June 5-10	June 1-14	June 8-22	May 31-June 12
Robusto	May 29-June 5	June 1-17	June 1-9	May 31-June 12
Explorer	June 23-26	June 25-July 1	June 8-22	--
Frontier	June 15-26	June 25-28	June 9-27	--
Six Weeks	May 27-June 5	June 1-7	May 18-23	May 31-June 5
Bruce	May 27-June 8	June 1-17	June 1-17	May 31-June 5
Ozark Premier	June 10-15	June 17-22	June 17-20	June 9-16

Table 8. Yield of Japanese plum cultivars grown at Alcorn State University, Lorman, Mississippi, 1989-1995.

	Year					
Cultivar	**1992**	**1993**	**1994**	**1995**	**Cumulative**	**4-yr Avg**
AU Producer	71.15a	17.15b	84.88a	5.58a	178.76a	44.6
Methley	18.68b	53.45a	66.65b	0.13a	138.91b	34.7

May Ripe	7.53c	29.9b	56.45b	2.01a	95.89c	23.9
Morris	0.5c	16.58b	54.9b	1.28a	73.26d	18.3
Robusto	29.83b	30.53b	5.0d	4.41a	69.77d	17.4
Explorer	2.4c	2.18c	55.73b	1.25a	61.56d	15.3
Frontier	10.93c	2.5c	42.03b	1.0a	56.46d	14.1
Six Weeks	2.3c	19.33b	29.4c	0.83a	151.86df	12.9
Bruce	6.33c	14.7bc	7.73d	1.3a	30.06fg	7.5
Ozark Premier	--	3.75c	12.35d	0.25a	16.35g	4.09