

Performance of Japanese Plum Cultivars in Northern Mississippi*

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Abstract

Eleven Japanese plum cultivars were evaluated for seven years. Parameters considered were fruit characteristics (flesh color, skin color and freeness of stone), quality indices (pH, soluble solids concentration, fruit size and weight), bloom dates, and yield. All cultivars were clingstone except 'AU Roadside' and 'Ozark Premier.' Full bloom dates for all cultivars occurred between March 9 and March 20. Late spring freezes greatly limited plum yields due to their bloom time. 'Robusto,' 'Morris,' 'Segundo' and 'Methley' had the highest cumulative yields over four production years. 'Ozark Premier' and 'Robusto' had the highest soluble solids concentration. 'AU Producer' produced the smallest fruit and the highest juice pH.

Introduction

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

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 the new, more

desirable cultivars, has prompted growers in Mississippi to seek information on adaptation of such cultivars. Plum cultivars performance results during initial tree establishment were reported in 1989 (4). This paper presents results of plum cultivars evaluated from 1985 through 1991.

Methods and Materials

Eleven plum cultivars on Lovell rootstock were evaluated from 1985 through 1991 at the MAFES Pontotoc Ridge-Flatwoods Research and Extension Center (34°08'N and 89°00'W), Pontotoc, MS. Trees were spaced 14 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 under tree rows (1.2 m band) and a mowed grass strip between rows.

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

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

*Contribution from the Mississippi Agricultural and Forestry Experiment Station, Journal Series No. J-8290.

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Table 1. Fruit characteristics of eleven plum cultivars grown at Pontotoc Ridge-Flatwoods Research & Extension Center, Pontotoc, MS, 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

Fruit were 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 were 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. Fruit 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.

Results

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.

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

The first potential production year was 1987 (all trees flowered profusely). A freeze of 24°F (-4.5 C) on 31 March 1987 destroyed the potential commercial crop of all cultivars. All trees were at the 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.

Table 2. Full bloom dates of plum cultivars grown at Pontotoc Ridge-Flatwoods Research & Extension Center, Pontotoc, MS, 1988-1991.

Cultivar	Year			
	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 Research & Extension Center, Pontotoc, MS, 1988-1991.

Cultivar	Year			Average First Harvest
	1988	1990	1991	
	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

(13) reported that 'Bruce' and 'Santa Rosa' were hardy and 'Ozark Premier' the least tolerant in a freeze that occurred during bloom. On 16 March 1989, 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 early producers. 'Explorer', 'Frontier', and 'Ozark Premier' were late producers (Table 3). 'Robusto', 'Morris', and 'Segundo' were the highest producers with cumulative yield of 156.7 (71.2kg), 127.2 (57.8kg), and 117.8 pounds (53.5kg) per tree, respectively (Table 4). Plum yields in Alabama have ranged between 39 (17.7kg) to 149 pounds (67.7kg) per tree depending on cultivar (6). The low cumulative yields for most cultivars reported in this publication (Table 4) were primarily due to 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 18 March 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 10 April when fruit 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 pro-

Table 4. Yield of plum cultivars grown at Pontotoc Ridge-Flatwoods Research & Extension Center, Pontotoc, MS, 1988-1991.

Cultivar	Year				Cumulative ^z Yield
	1988	1989	1990	1991	
	Yield (lb/tree)				
AU Producer	30.7c ^y	5.0 ^z	16.1bcd	34.0a	80.0c
AU Roadside	13.8d	0	6.5cd	5.1c	25.4d
Bruce	16.2d	3.3	9.7bcd	19.6b	45.5d
Explorer	14.8d	0	13.6bcd	1.2c	29.7d
Frontier	18.3d	0	34.3a	----	52.6cd
Methley	17.3d	4.0	41.4a	45.4a	104.1b
Morris	57.4b	2.8	31.0ab	38.8a	127.2ab
Ozark Premier	27.0c	5.0	9.3cd	12.7c	49.0cd
Robusto	115.4a	5.0	24.5abc	16.8c	156.7a
Segundo	74.5b	2.0	16.1bcd	27.2b	117.8ab
Six Weeks	26.0c	5.0	13.7bcd	7.0c	46.7d

^yCrop 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.

^yMeans in columns separated by Duncan's Multiple Range Test at $p = 0.05$.

^zCumulative of 3 years.

Table 5. Fruit quality characteristics of plum cultivars grown at Pontotoc Ridge-Flatwoods Research & Extension Center, Pontotoc, MS, 1985-1991.

Cultivar	pH ²	Soluble Solids ³	Fruit ⁴ Diam.	Fruit Weight
		(%)	(cm)	(g/5 fruit)
AU Producer	3.7 a ²	11.7 bc	3.9 bcd	192.1 a
AU Roadside	3.2 d	12.5 b	---	343.7 a
Bruce	3.2 cd	12.3 b	4.5 ab	438.2 a
Explorer	3.2 c	11.2 c	4.5 ab	277.4 a
Frontier	3.4 a-d	12.9 b	4.7 a	341.6 a
Methley	3.2 cd	11.0 c	4.9 a	500.8 a
Morris	3.6 ab	12.4 b	3.7 cd	263.4 a
Ozark Premier	3.4 a-d	13.5 a	4.9 a	333.8 a
Robusto	3.4 a-d	14.2 a	---	335.6 a
Segundo	3.1 d	10.9 c	4.3 abc	307.3 a
Six Weeks	3.2 d	11.4 c	4.6 ab	421.3 a

²Means in columns separated by Duncan's Multiple Range Test at P = 0.05.

³Mean pH values and soluble solids concentration of fruit from four replications and four years.

⁴Mean of ten fruit per tree from four replications and four years.

duced an adequate crop if the 10 April 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 consistently produce a crop.

In 1990, yields ranged from 6.5 pounds (3.0kg) per tree for 'AU Roadside' to 41.4 pounds (18.8kg) 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 four 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 4.9 cm for 'Methley' and 'Ozark Premier' to 3.7 cm for Morris. Fruit weight (five fruit/tree) did not differ among cultivars and ranged from 500.8 grams for 'Methley' to 192.1 grams for 'AU Producer.'

The climate in Mississippi is characterized by long, hot, humid summers, mild winters, periods of heavy rainfall (Climatological data) 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.

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Fruit Varieties Journal 48(2):93-97 1994

Influence of Rootstock on Fruit and Tree Characteristics of 'Macspur McIntosh'¹

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Abstract

Macspur McIntosh apples grown on 4 rootstocks (M.9 EMLA, Ottawa 3, M.26 and M.4) were harvested at weekly intervals over a 5-6 week period and assessed for internal ethylene content (IEC), red skin colour, average fruit weight, flesh firmness, starch index (SI), soluble solids concentration (SSC), and titratable acidity. Data from the 4-year study showed no significant effect of rootstock on the proportion of fruit with an IEC of 1 ppm or more, a level indicative of fruit in the climacteric stage. Red skin colour, firmness, SSC, SI, and average fruit weight showed some differences in 1 or 2 years of the study but no trends were evident. Cumulative yield was not significantly different with rootstock but tree canopies on M.9 EMLA and Ottawa 3 were smaller and more yield efficient than canopies on M.26 or M.4.

Recent studies have shown an influence of rootstock on maturity of apples. Using ripening date as an index of maturity, Drake et al. (4) observed a delay in maturity for Goldspur Golden

Delicious apples on MM.111 compared to fruit on M.26 or seedling rootstock. The delay in maturity was evident in the first two harvests but not in the third one. Fallahi et al. (5) observed a delay in ripening of Starkspur Golden Delicious apples on OAR 1 compared to fruit on seedling, MM.111, MM.106, M.7 and M.26 rootstocks. Autio et al. (2) noted a tendency for M.27 to advance maturity in Starkspur Supreme Delicious and for OAR 1 to delay maturity in the cultivar. They also found a slight advancement in maturity of McIntosh on Ottawa 3 compared to M.26, EMLA 7 or M.7a (1). M.9 EMLA and other clones of M.9 are widely used in high-density orchards throughout the world as well as in British Columbia. Ottawa 3 is comparable to M.9 EMLA for tree size control but is more cold hardy (Cummins and Ald

¹Contribution Number 801 from Agriculture Canada Research Station, Summerland, British Columbia, V0H 1Z0.