Subtropical Plant Science. 47: 30-33.1995

Performance of Low-Chill Japanese Plums in Subtropical Texas

Kimberly J. Strong and David H. Byrne[1]

Technician I, Texas Agricultural Research and Extension Center, 2415 East Highway 83, Weslaco, TX 78596, USA
[1]Associate Professor, Department of Horticulture Sciences, Texas A&M University, College Station, TX 77843-2133, USA

Additional index words. Prunus salicina, low-chilling

ABSTRACT

Low-chilling, subtropical Japanese-type plums (*Prunus salicina* Lindl. and hybrids) from the Fruit Crops Department of the Gainesville Breeding Program in Florida were evaluated for fruit and tree characteristics at Weslaco, Texas, in 1991 though 1993. Information is provided on chilling unit (CU) requirement, ripening date, fruit development period (FDP), fruit size, and fruit quality traits. Estimated chilling requirement of the selections ranged from 125 to more than 350 CU. Six numbered selections and the cultivars 'Gulfruby' and 'Gulfgold' warrant further evaluation in the development of commercially acceptable plum cultivars for low-chilling subtropical areas.

RESUMEN

Entre 1991 y 1993 se evaluaron en Weslaco, Texas, las características de los árboles y los frutos de ciruelos subtropicales tipo japonés (*Prunus salicina* Lindl. e híbridos) con bajo requerimiento de frío provenientes del Programa de Mejoramiento de Gainesville, Florida. La información proporcionada consiste en los requerimientos de unidades de frío (CU), la fecha de maduración, el período de desarrollo del fruto (FDP), el tamaño del fruto y las características de la calidad del fruto. Los requerimientos de frío estimados para las selecciones variaron de 125 a más de 350 CU. Seis selecciones numeradas y los cultivares "Gulfruby" and "Gulfgold" son prometedoras y se justifica su evaluación adicional para el desarrollo de cultivares de ciruelos comercialmente aceptables para las áreas subtropicales donde se presenta poco frío.

Growing low-chill, high quality Japanese-type plums (*Prunus salicina* Lindl. and hybrids) in the Lower Rio Grande Valley (LRGV) of Texas is appealing economically because the fruit would ripen before the earliest high-chill plum available and therefore could command high prices. The Low-Chilling Stone Fruit Breeding Program at the Weslaco Agricultural Research and Extension Center has evaluated 3 plum cultivars and 27 numbered selections obtained from the University of Florida Fruit Crops Department. 'Gulfgold' and 'Gulfruby' were developed at the University of Florida by Dr. Wayne Sherman. At present, these cultivars are recommended for home gardens of central Florida (Sherman and Lyrene, 1985). A third cultivar, 'Hypoluxo', is an open pollinated seedling of 'Gulfruby' which was named and patented by Steve Farnsworth of Miami (personal communication).

Since fruit characteristics vary according to environment, the fruit must be tested in new locations before recommendations can be made (Topp and Sherman, 1989). In addition, disease pressures that occur in some low-chilling areas may differ at other sites. At the start of the Weslaco Breeding Program, plum budwood was obtained for evaluation in the subtropical LRGV. These selections arose from a Japanese-type plum improvement program begun in 1966 at the University of Florida, Gainesville (Sherman and Lyrene, 1985). At present, we are selecting plum cultivars that ripen in April and early May to coincide with the commercial peach harvest in the LRGV of Texas. This paper reports on the performance of these plum selections at the Texas Agricultural Experiment Station (TAES) in Weslaco, and their potential as commercial cultivars for low-chill, subtropical areas.

MATERIALS AND METHODS

The selections were budded onto native peach seedling rootstocks and planted in March, 1989, at TAES in Weslaco, Texas. Tree spacing was 3.7 by 6.7 meters (12 by 22 ft.) with 2 replications of each selection. Fertilization, herbicide, and pest control measures were similar to those recommended for low-chill peaches in the LRGV (Lyons, 1988; Lyons, et al., 1989). Irrigation was by microsprayer emitters as needed.

Evaluations were made in 1991 (3rd leaf), 1992 (4th leaf) and a final evaluation in 1993 (5th leaf). Evaluations in 1992 and 1993 involved trees that had been pruned and fruit thinned. The fruit was harvested when blush color turned red or purple and firmness indicated commercially acceptable ripeness. Evaluations were made on a scale of 0 (unacceptable) to 9 (excellent) for taste, firmness at picking stage, shape, appearance, and blush (percent red overcolor). Skin color and flesh color were also noted, with a bright skin color and pleasant flesh color being most desirable. In the field, diameter of the fruit was measured on 5 fruit with a scale of 0 (less than 2.5 cm) to 9 (greater than 7.0 cm (2.75 inches)) at 0.64 cm (0.25-inch) intervals. For the more promising selections, average weight was determined from a representative

fruit sample. The tree shape was classified for each selection by noting the percentage of spurs and long shoots, and also the position of scaffold limbs.

RESULTS AND DISCUSSION

In South Texas, many of the Florida selections showed extended bloom, ranging from 10 days to 38 days of flowering. Fla.86-8, Fla.32-23, Fla.34-12, Fla.86-2, and Fla.31-75 bloomed as long as 5 weeks. A variation was also seen in date of full bloom (Table 1). These selections were made at Gainesville, Florida, (29°38'N, 82°21'W) where 200 to 450 CU normally accumulate (Topp and Sherman, 1990). Weslaco, Texas, (26°09'N, 97°58'W) receives about 200 CU and the extended bloom shown by some selections indicates a lack of required chilling. When peach and plum cultivars are grown in areas where their chilling requirement is not met, their bloom period can become as long as 2 to 5 weeks (Sherman and Rodriquez-Alcazar, 1987) and fruit set will be low (Rouse, 1985). Chilling requirement was determined by comparing the mean bloom date to those of known peach cultivars, i.e. 'TropicBeauty' (150 CU), 'TropicSweet' (175 CU), and 'EarliGrande' (250 CU), and noting the fruit set. The estimated chill units ranged from 125 to more than 350 CU (Table 1). Fla.86-8, Fla.87-3, Fla.87-4, Fla.87-6, and Fla.87-8 had very low fruit set in the LRGV but set would probably increase in areas of higher chilling. For example, Fla.86-8 was overcropped in Gainesville in 1990 (Topp and Sherman, 1990).

Firmness of the fruit is an important characteristic for fruit that will be packed and shipped. Our evaluations were made when the blush color, size, and firmness indicated the fruit could be handled at the packing shed. This commercially harvestable stage was designated as harvest date. Fla.30-43, Fla.8-1, and 'Hypoluxo' had a poor firmness rating at a very small size and therefore would not be considered to have potential marketability (Table 2). A high firmness rating (7,8,9) indicates a firm fruit that could be shipped to soften after reaching the consumer.

Because the fruit was picked prior to attainment of tree-ripening, the flavor of some selections was noted to be less than desirable because of skin acidity or tartness (Table 2). The percent color change is one indicator of readiness for commercial harvest and early coloration could explain the bitterness and tartness of the skin (Topp and Sherman, 1989). At high firmness and purple blush, Fla.87-10 and Fla.86-3 had only mildly tart skin that was offset by their flesh sweetness. 'Gulfgold' also had high firmness and flesh sweetness at harvest but the blush rating was low because it is a gold-skinned cultivar. At full maturity, the above fruits were juicy, with good flavor. Fla.32-23, Fla.85-2, and Fla.30-43 did not develop a pleasing taste.

A heavy crop or yield of fruit is commercially advantageous for growers and provides a margin of safety in the event of late spring freezes. At Weslaco, the probability of critically low temperatures occurring after bloom (February 12) is 30% (Orton et al., 1967). In the commercial peach production area of LRGV at Linn, Texas, the probability would be slightly higher so the fruit set and final crop ratings become very important. A few of the selections, Fla.32-23 and Fla.30-37 with a crop rating of 0 to 3 had heavy flowering and fruit set but the fruit dropped readily in high winds or rainy conditions (Table 2). A crop rating of 5 to 6 is most desirable. Fla.31-75 with a crop rating of 7 was overcropped and the fruit size was smaller than would be anticipated if the fruit were further thinned.

Most of the selections had an average fruit size of 3.8 cm (1.5 in) or less which is marginal for commercial use (Table 2). All selections which ripen just before or immediately after 'Gulfruby', except Fla.87-4, produced small fruit. 'Gulfgold' had a consistent diameter of 5.0 cm (2.0 inches), the preferred minimum commercial size. Several selections (Fla.87-4, Fla.87-6, Fla.86-1, Fla.86-7, Fla.87-10), 'Gulfruby', and 'Hypoluxo', approach this diameter. With more intense orchard management (higher levels of fertilization, better irrigation scheduling, girdling) the size of these selections may be increased.

Attractiveness is a combined subjective assessment of the fruit's external appearance. Attractiveness was based on shape, blush, size, scarring and brightness of the skin. The selections that rated low in attractiveness (0 to 5) were smaller fruit with more green ground color, causing the fruit to appear unripe when picked at marketable firmness. The most attractive fruit (7 to 9) had good shape, high percent blush (except 'Gulfgold'), good shape, no scarring, and bright color.

A widely-distributed fruit disease of peaches and plums, bacterial leaf spot [*Xanthomonas campestris* pv. *pruni* (Smith)Dye], causes fruit loss and shortened tree life. It has not been identified as a serious problem in the LRGV possibly because of a drier climate (Rouse, 1986). Evaluations in Florida indicate that Fla.8-1, Fla.86-5, Fla.87-3, and Fla.87-8 are highly susceptible to the disease and are likely to experience problems if planted in areas predisposed to the disease.

Another disease in areas where low-chill plums can be grown is plum leaf scald (*Xyllela fastidiosa* Wells et al.). This disease, caused by a rickettsia-like bacteria, causes marginal leaf necrosis and eventual tree death. Plum leaf scald is not seen in the LRGV as of yet, possibly because of a lack of a natural reservoir of the bacteria. Observations of the selections in Florida suggested that all the low-chill plum selections have some susceptibility to the disease, with the most significant being Fla. 87-6 and 'Gulfgold'.

As a final consideration, the long growing season in the LRGV makes heavy pruning (both summer and dormant) necessary to maintain optimum fruit production and tree shape. Because pruning is labor intensive, an upright tree type with more spurs than long shoots would require less pruning and therefore reduce labor costs. Fla.86-4, Fla.87-6, Fla.87-7 and others (Table 2) display the upright form. A selection with intermediate type shape, having equal numbers of spurs and long shoots is also acceptable. The weeping plums (Fla.79-3 and Fla.86-1), with an overabundance of long downward-growing shoots, are difficult to train.

The best low-chill selections should combine good adapt-

ability, fruit attractiveness, size, firmness, cropping ability, tree form, and resistance to wind scarring. The most promising of the selections tested at the Texas Agricultural Experiment Station are Fla.3-5, Fla.87-6, Fla.86-7, Fla.86-4, Fla.87-7, Fla.87-10, and 'Gulfruby' and 'Gulfgold'. These selections have good size, appearance and firmness, and warrant further evaluation and use in the development of commercially acceptable plum cultivars for the early market. As of the final evaluation done in 1993, Fla.30-37, Fla.30-43, Fla.30-47, Fla.32-23, Fla.34-12, Fla.8-1, Fla.85-2, Fla.85-3, Fla. 86-6, Fla.87-1, Fla.87-2, and Fla.87-3 were eliminated from further consideration.

Table 1. Bloom date, fruit development period (FDP), and estimated chill units for plum selections grown at TAES (1991-1993).

Selection	Bloom period		Harvest	FDP	Estimated chill
	Begin	Full	date		units[z]
Fla. 3-5	20 Feb	25 Feb	14 May	84	300
Fla. 30-37	29 Jan	8 Feb	14 May	96	150
Fla. 30-43	5 Feb	12 Feb	13 Apr	60	200
Fla. 30-47	3 Feb	8 Feb	13 Apr	64	175
Fla. 31-75	29 Jan	13 Feb	14 May	91	200
Fla. 32-23	3 Feb	12 Feb	7 May	85	300
Fla. 34-12	8 Feb	17 Feb	7 May	80	250
Fla. 79-3	9 Feb	17 Feb	5 May	78	250
Fla. 8-1	29 Jan	3 Feb	28 Apr	85	125
Fla. 85-1	9 Feb	13 Feb	27 Apr	74	200
Fla. 85-2	9 Feb	9 Feb	20 Apr	71	175
Fla. 85-3	9 Feb	12 Feb	13 Apr	61	200
Fla. 86-1	3 Feb	9 Feb	22 May	103	175
Fla. 86-2	4 Feb	13 Feb	11 May	88	250
Fla. 86-3	9 Feb	12 Feb	11 May	89	200
Fla. 86-4	29 Jan	5 Feb	7 May	92	175
Fla. 86-5	11 Feb	15 Feb	10 May	85	300
Fla. 86-7	29 Jan	8 Feb	22 May	105	175
Fla. 86-8	3 Feb	12 Feb	—	—	—
Fla. 87-1	10 Feb	11 Feb	27 Apr	76	200
Fla. 87-2	3 Feb	11 Feb	16 Apr	65	250
Fla. 87-3	9 Feb	12 Feb	20 Apr	68	350
Fla. 87-4	9 Feb	15 Feb	29 Apr	75	350
Fla. 87-6	17 Feb	20 Feb	10 May	81	350
Fla. 87-7	9 Feb	12 Feb	11 May	90	250
Fla. 87-8	17 Feb	21 Feb	11 May	80	350
Fla. 87-10	10 Feb	16 Feb	3 June	108	250
Gulfgold	13 Feb	20 Feb	2 June	104	300
Gulfruby	10 Feb	18 Feb	30 Apr	72	250
Hypoluxo	3 Feb	12 Feb	7 May	85	200

[z]Estimated from bloom date (see text).

Table 2. Fruiting characteristics of plum selections tested at TAES, Weslaco, Texas (1991-1993).

Selection	Diam.(cm)	Avg. Wt. (g)	Crop[z]	Firm-ness[y]	Shape[y]	Attrac-tiveness[y]	Blush (%)	Skin color[x]	Flesh color[x]	Taste[w]	Tree Type[v]
Fla.	3-5	3.8	47	5	8	8	8	80	P	R	4 U
Fla.	30-37	3.2	35	2	8	8	7	70	R	Y	— I
Fla.	30-43	2.5	32	3	4	8	4	90	R	Y	2 I
Fla.	30-47	3.2	34	3	6	8	7	90	R	G	2 I
Fla.	31-75	3.8	—	7	8	8	7	80	R	R	— U
Fla.	32-23	3.2	37	1	8	8	2	50	R	G	1 I
Fla.	34-12	—	22	1	8	8	3	70	R	Y	3 U
Fla.	79-3	3.8	—	1	8	6	6	70	R	R	4 W
Fla.	8-1	2.5	18	3	7	8	8	80	R	Y	4 I
Fla.	85-1[u]	3.2	25	1	9	8	4	60	R	Y	— I
Fla.	85-2	3.2	34	1	7	8	7	80	R	Y	2 I
Fla.	85-3	2.5	15	5	6	8	7	60	R	YG	4 I
Fla.	86-1	4.4	63	1	7	8	7	70	R	Y	4 W
Fla.	86-2	3.8	53	1	8	7	7	60	R	Y	4 I
Fla.	86-3	3.8	43	3	8	8	6	60	R	Y	5 U
Fla.	86-4	3.8	49	5	8	8	7	80	R	R	5 U
Fla.	86-5	3.8	48	1	8	8	8	90	R	Y	— U
Fla.	86-7	4.4	64	2	8	7	8	80	R	Y	4 I
Fla.	86-8	2.5	—	0	7	8	-	90	R	Y	— U
Fla.	87-1	3.2	26	1	7	8	7	80	R	Y	5 I
Fla.	87-2	2.5	25	3	-	9	7	90	R	Y	5 I
Fla.	87-3	2.5	22	1	7	8	6	70	R	YR	3 I
Fla.	87-4	4.4	49	2	7	8	8	90	R	Y	5 I
Fla.	87-6	4.4	68	3	8	8	6	80	R	Y	4 U
Fla.	87-7	3.8	37	4	8	8	8	90	R	Y	3 U
Fla.	87-8	3.2	28	0	-	-	-	-	P	Y	3 U
Fla.	87-10	4.4	—	1	8	7	7	90	P	Y	5 U
Gulfgold	5.0	70	4	7	7	7	10	Y	Y	5	I
Gulfruby	4.4	51	5	7	8	7	80	R	Y	4	I
Hypoluxo	4.4	44	4	6	8	4	50	RG	Y	2	U

[z]Rated 0-4 = 0-99%, 5 = full crop, 6-9 = overcrop.
[y]Rated 0-4 = very poor to poor, 5-6 = Marginal to good, 7-9 = Excellent for commercial use.
[x]P=purple, R=red, Y=yellow, G=green.
[w]Rated 1-2 = poor, 3-4 = marginal, 5= good.
[v]U = upright, I = intermediate, W= weeping.
[u]Data from 1990-91 seasons only.

LITERATURE CITED

Lyons, C.G., (ed). 1988. Texas Peach Handbook. Texas Agricultural Extension Service. The Texas A&M University System, College Station, Texas.

Lyons, C.G., J.A. Lipe, L.A. Stein, and J.W. Sauls. 1989. Commercial Peach Production in Texas. Texas Agricultural Extension Service Bulletin B-1546.

Orton, R., D.J. Haddock, E.G. Bice, and A.C. Webb. 1967. Climatic Guide The Lower Rio Grande Valley of Texas. Texas Agricultural Extension Service Publication. MP-841.

Rouse, R.E. 1985. Peach cultivars for the subtropical Lower Rio Grande Valley of Texas. J.Rio Grande Valley Hort. Soc. 38:31-35.

Rouse, R.E. 1986. Testing subtropical deciduous fruit clones for Texas' Lower Rio Grande Valley. J. Rio Grande Valley Hort. Soc. 39:63-67.

Sherman, W. B. and P.M. Lyrene. 1985. Progress in low-chill plum breeding. Proc. Fla. State Hort. Soc.98:164-165.

Sherman, W. B. and J. Rodriquez-Alcazar. 1987. Breeding of low-chill peach and nectarine for mild winters. HortScience 22(6):1233-1235.

Topp, B. L. and W.B. Sherman. 1989. Location influences on fruit traits of low-chill peaches in Australia. Proc. Fla. State Hort. Soc. 102:195-199.

Topp, B.L. and W.B. Sherman. 1990. Potential for low-chill Japanese plums in Florida. Proc. Fla. State Hort. Soc. 103:294-298.