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Plum Genotypes and Their Improvement in Yugoslavia

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Abstract

This paper describes the plum and prune cultivars and species, their genetic potential, production and utilization in Yugoslavia. It describes the major attributes and problems of the plum cultivars, as well as the major rootstocks. Special attention is paid to genetic resources of local and other plum cultivars and to what is needed to assure plum production in the future.

Introduction

There are a total of 250,629 ha (83,543,000 trees) of plums in Yugoslavia, of which 220,014 ha (73,338,000 trees) (38) are fruiting. Yugoslavia produces an average of 826,000 metric tons (MT) of plums, yearly. In the eight year period from 1977-1984, production ranged from a low of 517,000 MT in 1979 to a high of 1,028,000 MT in 1982. Plum production accounts for about 39% of the total fruit production (2,122,860 MT) in Yugoslavia which includes olives, figs and citrus. That does not include small fruits and the wild uncultivated fruits, which by estimations, amount to 250,000 MT. Yugoslavia plum production accounts for 28.7% of European plum production (2,870,000 MT) and 15.9% of the World's production (5,210,000 MT) (2).

According to statistical data (38), plum production per hectare is not high because it includes the trees which are beginning to bear, those in full production as well as the neglected and very old trees. The average yield for a commercial orchard is 15,000 to 22,000 kg. Yields have been recorded up to 30,000 kg/ha (18).

Plum production is located in the Socialist Republic of Serbia (66.2%), Socialist Republic of Bosnia and Hercegovian (19.0%), Socialist Republic of Croatia (10.3%), Socialist Republic of Macedonia (2.7%), Socialist Republic on Monte Negro (0.9%) and Socialist Republic of Slovenia (0.9%). In the Socialist Republic of Serbia, plum production is located mostly in the Socialist Autonomous Provinces (60.4%), the Socialist Autonomous Province Vojvodina (4.5%) and Socialist Autonomous Province Kosovo (1.7%).

The plum and prune domestic processing industry in 1983 produced mostly drying prunes (29,107 MT), jam (14,624 MT), and distilling plum brandy (sljivovica: 75,038,000 liters of 25 proof and 26,664,000 liters of 40-45 proof). Other products such as frozen halves, compote, juice, candies, cocktail with other fruits, and Serbian "slatko" are also produced. Plum fruits are also used in the bakery and cake industry, Plum brandy and the dried prunes are used in the liqueur industry.

The major plum cultivars grown in Yugoslavia

In Yugoslavia the main cultivars are 'Pozegaca' standard (syn.: Hungarian prune, Hauszwetsche), its clones and variants which make up about 40% of the production. About 3.5% of production is from 'Stanley.' In addition to these, 'Buhler Fruhzwetsche' and 'Zimmer's Fruhzwetsche' are grown on a wide scale. 'Ruth Gerstetter,' 'California Blue' and selected clones of 'Italian Prune' have been in commercial production since 1958, and the new plum cultivars 'Cacak's Early,' 'Cacak's

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Table 1. Plum species, distribution and their propagation in Yugoslavia (31, 37).

Species	Vegetative propatation cultured (cvs)	Generative propagation non-culture (cvs)	Wild self propagated	Area of distribution
Prunus domestica L.	+	+		In all Yugoslavia
P. insititia L.	+	+	+	In Serbia, Bosnia, Croatia, Monte Negro, Macedonia
P. salicina L	+			Dalmacia, Hercegovina, part of Monte Negro, Macedonia
P. cerasifera Ehrh.		+	+	In all Yugoslavia
P. spinosae L.		+	+	In all Yugoslavia
P. cocomilia T.			+	Macedonia, Serbia
P. prostrata Labill			+	Macedonia

Beauty,' 'Cacak's Fruitful' and 'Cacak's Sugar' have been grown since 1974 (23, 24, 25, 26, 27, 28, 29, 31). All of these make up about 1.5% of the plum production.

Other cultivars grown on a small scale are the 'Reine Claudes,' 'Mirabelle de Nancy,' 'Imperial,' 'Agen 707,' 'Julka,' 'Konigsbaher Fruhzwetsche' and 'Bluefree,' and the Japanese plum cultivars 'Red Beaut,' 'Frontier,' 'Santa Rosa,' 'Desertnaja,' 'Ozark Premier,' and 'Starking Delicious.'

About 55% of the production is from the local indigenous cultivars, old cultivars and primitive cultivated landraces or wild forms of *P. domestica, P. insititia,* and *P. cerasifera.* The following cultivars are from this group: 'Crvena Ranka,' 'Metlas,' 'Piskavac Cerovacki,' various types of 'Belosljiva,' 'Crnosljiva,' 'Moravka,' 'Crnica,' 'Sarica,' 'Velinka,' 'Hodzicka,' 'Dobojska rana,' 'Niskovacka rana,' 'Ruzica,' 'Slatkulja,' 'Komoricanka,' 'Moticanka,' 'Magareska,' 'Mednica,' 'Turgulja,' and 'Brkinska' (21, 31). Paunovic et al. (33, 37) stated that in Yugoslavia there are about 65 local-indigenous old cultivars and primitive plum cultivars of *P. domestica* and *P. insititia* being grown on a wide scale.

The major attributes of the plum cultivars

'Pozegaca' is a very old cultivar and of multipurpose use. It ripens the end of August to the middle of September. According to international classification (4), the fruit are extremely small (about 17 g), dark blue, elliptic, with firm flesh that is yellow-green, sweet-acid, and of excellent quality. Fruits are sweet and its compote does not need sugar. It is used fresh, for drying (the dried fruit is of first class-Class I), jam, compote, Serbian "slatko" (confection), juice, baking, brandy and the liqueur industry. The tree is vigorous, beginning to bear late but is very fruitful (37% self-fruitful), and regular cropping with an index of alternation[I] of 11.47 and fluctuation of yield[II] of 20.6% (34). It is sensitive to *Polystigma rubum* (red leafblotch), *Tranzschelia pruni spinose* (plum rust) and very sensitive to Sharka. It is resistant to low winter temperatures and late spring frost.

Clones of 'Pozegaca': Cacak B-1/56 (19), clone No. 10, 11, 30, 33, clone APS (18), 'Korajka' and 'Bsanka' (5) are all the same as 'Pozegaca standard' except they have larger fruit that averages 25-28 g.

[I]Index of alternation = $100 \times \frac{\text{Yield in year of harvest - Yield in years of crop failure}}{\text{Yield in year of harvest + Yield in years of crop failure}}$

[II]Index of fluctuation yields = $100 \times \frac{\text{Yield in year of harvest - Yield in years of crop failure}}{\text{Yield in years of harvest}}$

Table 2. Plum rootstock cultivars recommended for the major scion cultivars grown in Yugoslavia.

Plum cultivars	Rootstocks	
	Currently used	Recommended for use
Pozegaca	Suckers of Pozegaca, Seedling of different types of *Prunus cerasifera*	*P. cerasifera* clone No. 9, No. IV/10/4 (11), *P. domestica* cv. Crnosljiva, Piskavac Cerovacki, Crvena Ranka (30), St. Julien A, Belosljiva clone of *Prunus spinosae* L. (15)
Stanley	Seedling of different types of *Prunus cerasifera*	Belosljiva, Myrobalan, St. Julien A, Stanley seedlings (15)
Ruth Gerstetter	" "	Myrobalan Welk, St. Julien A (16)
California Blue	" "	St. Julien A,, Myrobalan B (16)
Zimmer's Fruh.	" "	St. Julien A, Myrobalan Inhib. (16)
Ersinger Fruh.	" "	Myrobalan B (16)

'Stanley' is a relatively new cultivar in Yugoslavia. It was introduced into commercial production in 1955. It ripens the second half of August. The fruit are very small (36 g), dark blue and ovate. The flesh is firm, green-yellow, sweet and of medium quality. It is used fresh, for brandy and for drying although the dried fruit is second or third class (Class II, III). As a compote, the 'Stanley' fruits are acid and need sugar. Trees of 'Stanley' have medium vigor, begin bearing early, are fruitful (7.4% self-fruitful), and relative regular cropping with an index of alternation of 33.61 and fluctuation of yield of 50.3% It is relatively resistant to *Polystigma rubrum, P. pruni spinosae* and more or less tolerant to Sharka. Depending on the strain of Sharka and the ecological conditions, 'Stanley' can be very tolerant or sensitive. The flowers are sensitive to cool and damp weather and very sensitive to *Monilinia fructigena.*

'Buhler' and 'Zimmer's Fruhzwetsche' ripen the beginning of August. The fruit are extremely small (about 20 g), dark blue and ovate. The flesh is firm, green-yellow, sweet-acid and of very good quality. The fruit is used fresh. The tree is vigorous, not precocious, but a heavy cropper. They are resistant to low winter temperatures but sensitive to late spring frost. It is tolerant to Sharka.

'Ruth Gerstetter' ripens the end of June or the beginning of July. The fruit are very small (31 g), blue-violet, roundish-cylindrical. The flesh is medium firm, greenish-yellow and sweet-acid. The fruit is used fresh. The tree is medium in vigor, semi-fruitful, early bearing and a good cropper. It has economical tolerance to Sharka but is sensitive to spring frost.

'California Blue' ripens the middle of July. The fruits are small to medium (51 g), roundish, blue-violet and fall off very easily when fully ripe. The flesh is medium firm, green-yellow, sweet-acid, and aromatic with good quality. The tree is medium in vigor, a little late in beginning to bear but fruitful (5.9% self-fruitful), and regular cropping with an index of alternation of 36.31 and fluctuation of yield of 53.3%. It is sensitive to Sharka and to spring frost.

'Italian Prune' ('Fellenberg') ripens the end of August or the beginning of September. The fruit is very small (34 g), dark-blue and ovate. The flesh is firm, yellowish, sweet-acid and of excellent quality. It is used fresh, for drying (Class I), jam, compote, juice, "slatko," freezing and brandy. The tree is of medium vigor, coming into bearing late but it is a good cropper. It is resistant to low winter temperatures and late spring frost. It is relatively

Table 3. Sensitivity of the local-indigenous old plum cultivars and primitive cultivated landraces in Yugoslavia to diseases, insects, frost, drought, and high lime (37) in the various plum growing regions.

	Diseases[z]						Environment[z]			
Cultivars	Sharka	M. Laxa	M. Fructigena	P. pruni spinosae	Polystigma rubrum	Pest Attack[y]	Frost	Drought	Lime	Use[x]
SR Serbia:										
Arapka	3	7	7	7	9	5	7	7	—	1 5 7
Bela Pozegaca	3	7	7	3	3	3	9	7	—	1 3 67
Belosljiva	7	7	7	5	7	3	7	7	7	1 5 7
Piskavac Cer.	9	9	9	9	5	3	7	7	—	1 5 7
Crnosljiva	7	9	9	7	9	3	5	7	—	1 5 7
Crvena Ranka "Bardaklija"	9	9	9	9	9	1	9	9	—	1 567
Crvena Ranka "Derosavka"	9	9	9	9	9	1	7	9	—	1 567
Cokesinka	7	7	7	5	5	5	7	7	—	1 7
Kapavac	3 leaf 9 fruits	9	9	7	9	3	7	7	—	1 5 7
Maricevka	7	7	7	7	5	3	7	7	7	1 5 7
Metlas	9	9	9	9	5	5	5	9	—	1 5 7
Mudara	8	7	7	9	5	3	3	5	—	1
Piskavac Obican	9	9	9	9	7	3	7	7	—	1 5 7
Petrovaca	7	7	7	5	9	3	7	7	—	1 5 7
Pozegaca c.10	3	9	9	3	3	3	7	7	—	12 67
Pozegaca c.11	3	9	9	3	3	5	9	5	5	12 67
Pozegaca c.30	3	9	7	3	5	5	7	5	—	12 67
Pozegaca c.33	5	9	9	5	5	5	7	7	7	12 67
Trnovaca	7	9	9	9	9	1	5	7	—	1 5
Turgulja	9	7	7	7	7	5	9	7	7	1 5 7
Moravka	9	3	3	9	9	1	9	7	7	1 567
Crnica	9	7	7	7	9	1	9	7	7	1 4 7
Plaovaca	3	5	5	5	5	3	7	7	—	1 567
Volujevaca	5	7	7	7	5	3	7	7	—	1 5 7
Groka Bula	7	9	9	9	3	5	7	9	5	1 5
Lednicka c.1B	7	7	7	3	3	5	7	7	7	1 5 7
Lednicka c.2C	7	7	7	9	7	5	7	7	7	1 5 7
SR Monte Negro:										
Bjelica	9	9	9	9	7	1	7	9	9	1 5
Belosljiva	9	9	9	9	7	3	9	9	9	1 5 7
Car Dusan	3	9	9	8	8	1	6	6	8	12 67
Durgulja	9	9	7	9	9	3	9	9	9	1 5 7
Mednica	7	7	7	7	7	3	9	9	9	1 5 7
Mudovalj	7	9	9	9	9	3	9	9	9	1 7
Piskavica	7	9	7	7	7	5	9	9	9	1 5 7
Sarica	9	9	9	9	7	1	9	9	9	1 5 7
Trnosljiva	9	9	9	9	8	1	9	9	9	1 5
Turgonja	9	7	7	7	9	3	7	5	7	1 567
Turgulja	7	7	7	7	7	3	9	9	9	1 5 7

Table 3. Continued.

Cultivars	Diseases[z]					Pest Attack[y]	Environment[z]			Use[x]		
	Sharka	M. Laxa	M. Fructigena	P. pruni spinosae	Polystigma rubrum		Frost	Drought	Lime			
SR Macedonia:												
Magareska Crna	9	8	8	7	7	3	8	7	3	1	5	7
Belluvra	7	5	7	5	3	5	7	5	4	1	5	7
Trnosljiva	9	9	9	8	9	2	9	9	—	1	5	
Magareska	9	8	7	9	8	5	9	6	5	1	5	7
Crna Patrovka	7	7	6	8	7	3	6	5	6	1	3	6
Panadjurka	6	7	7	6	5	5	7	7	3	1		7
Zimna	5	6	5	7	6	5	7	7	5			7
Modra Sljiva	7	7	5	6	6	5	7	7	5			7
Gurgutka	5	5	7	7	5	5	7	7	5			7
Banska	4	7	7	7	6	2	7	7	5			7
SR Bosnia and Hercegovina:												
Korajka	1	7	7	3	3	5	7	5	3	2		67
Bosanka	1	7	7	3	3	5	7	5	3	2		67
Pozegaca c.P25	1	7	7	3	3	5	7	5	3	2		67
Pozeg. c.M-1A	1	7	7	3	3	5	7	5	3	2		67
Pozeg. c.M1-B	1	7	7	3	3	5	7	5	3	2		67
Pozeg. c.M-6	1	7	7	3	3	5	7	5	3	2		67
Bilska Rana	7	7	5	5	5	3	7	7	5			67
Julka	7	7	1	7	5	5	5	7	5	1	3	6
Dobojska Rana	5	7	5	5	3	5	3	7	5			67
Banjalucka-Bjelica	5	7	7	7	5	3	7	7	5	1	5	
Sitnica	3	5	7	—	3	5	7	7	—	1	4	7
Slatkulja	3	5	5	5	3	5	5	5	—	12		567
Misovacka Rana	3	5	5	3	3	5	3	5	—	1		567
Kaurka	5	5	5	5	3	5	7	7	—	1	3	67
Ruzica	3	5	3	5	3	5	5	5	—		5	7
Podsedlinka	3	9	7	5	5	5	7	5	3	1		7

[z]Scale 1-9: 1 = highly susceptible, 3 = susceptible, 5 = intermediary, 7 = resistant, 9 = highly resistant.
[y]Scale 1-9: 1 = none, 3 = weak, 5 = medium, 7 = strong.
[x]Scale 1-7: 1 = breeding, 2 = commercial growing, 3 = home gardens, 4 = landscaping, 5 = rootstocks, 6 = fresh consumption, 7 = processing.

resistant to *P. pruni spinosae*, but very sensitive to Sharka.

'Cacak's Early' ('Wangenheims Fruhzwetsche' x 'Pozegaca'). Introduced by Paunovic, A. S., Gavrilovic, M. and Misic, D. P. (24), ripens the first week of July. The fruit are medium-large (65-70 g), violet-blue and ovate. The flesh is medium firm, and sweet with very good quality. It is used fresh. The tree is of medium vigor, self-unfruitful, early-bearing and a good cropper. It is tolerant to *P. pruni spinosae* and *P. rubrum*.

'Cacak's Beauty' ('Wangenheims Fruhzwetsche' x 'Pozegaca'). Introduced by Paunovic, A. S., Gavrilovic, M. and Misic, D. P. (25), ripens the end of July. The fruits are very small (31-40 g), dark-blue, very attractive and oval. The flesh is greenish-yellow, firm, sweet-acid, and aromatic with excellent quality. It is used fresh. The tree is of medium vigor, very early-bearing, self-fruitful and a very good cropper. It is very tolerant to *P. rubrum* and *P. pruni spinosae*, sensitive to Sharka and resistant to *Monilinia fructigena*.

'Cacak's Best' ('Wangenheims Fruhzwetsche' x 'Pozegaca'). Introduced by Paunovic. A. S., Gavrilovic, M. and Misic, D. P. (26), dark-blue, attractive and oval. The flesh is very firm, greenish-yellow, sweet-acid and, aromatic with very good quality. It is used fresh and for drying (Class II or III). The tree is vigorous, self-unfruitful, very early bearing and a very good cropper. It is tolerant to Sharka, *Polystigma rubrum, Puccinia pruni spinosae* and resistant to *Monilinia fructigena.*

'Cacak's Fruitful' ('Stanley' x 'Pozegaca'). Introduced by Paunovic. A. S., Gavrilovic, M. and Misic, D. P. (27), ripens the second half of August. The fruit is very small to small (27.5-43.7 g), dark-blue and ovate. The flesh is greenish-yellow, firm, sweet, and aromatic with very good quality. It is used for drying (Class I) and baby food. The tree is of medium vigor, very self-fruitful (37%), early bearing and an excellent cropper. It is resistant to late frost and *Monilinia fructigena.*

'Cacak's Sugar' ('Agen 707' x 'Pacific'). Introduced by Paunovic. A. S., Gavrilovic. M., Misic, D. P. (28), ripens the end of August. The fruits are small to medium (45-55 g.), violet and ovate. The flesh is firm, yellow, sweet, aromatic and excellent quality for drying. As a dried prune, it is of extra fancy class and the best flavor of any cultivar. The stone is small. The tree is of medium vigor, self-unfruitful, early bearing and a good cropper. It is very sensitive to *Monilinia fructigena* on the fruit, especially if it is rainy about 20 days before picking.

Local-indigenous old cultivars and some of the primitive cultivated landraces of *Prunus domestica* and *Prunus insititia* are still grown commercially, mainly for plum brandy and in the last ten years for plum juice. They ripen the beginning of July to the middle of September. The fruit are extremely small to small (9 g to 50 g), of different colors, shapes and quality (from poor to excellent). The trees have different vigor and shape, but are usually very productive. Among them are those very tolerant or resistant to Sharka, *Polystigma rubrum, Puccinia pruni spinosae* and other diseases or pests.

The major problems of the plum cultivars

The four major problems for the production of plums are:

1. Sharka susceptibility.
2. *Polystigma rubrum, Puccinia pruni spinosae* or *Monilinia fructigena* susceptibility.
3. Susceptibility to late spring frost, cool and damp weather during bloom or rainy weather before picking.
4. Self incompatibility.

The indigenous old cultivars, primitive cultivated landraces and wild forms, have not been studied for their cytological characters nor have their important genes been identified, so that they can be effectively used as parents in a breeding program.

The major rootstock for plums

The major rootstocks for plums are shown in Table 2. The local-indigenous old cultivars were produced by suckers 30 years ago but are not recommended for use. The propagation of 'Pozegaca' by meristem culture has recently started.

Genetics Resources of Local Plum Cultivars

We have propagated and studied the indigenous old plum cultivars, primitive cultivated landraces, and wild forms of *P. domestica* and *P. insititia* as well as *P. cocomilia* and *P. prostrata.* Within these species and their cultivars we have studied 91 characters of the tree, flower, leaf, fruit, and seed, as well as resistance to disease, insects, frost, drought, high lime and high pH under natural conditions (33, 37). The results are presented in Table 3.

Genetics Resources

Resistance to Sharka

Mathys & Souty (6) felt that no

known resistance to Sharka existed. However, 'Cacak's Best,' 'Stanley,' 'Agen 707,' 'Buhler Fruhzwetsche' (21, 31), some indigenous old plum cultivars and primitive cultivated landraces in Yugoslavia and other countries, are resistant or tolerant (33, 37).

Resistance to Polystigma rubrum

'Prune Peche,' 'Reine-Claude,' 'Diaphane,' 'Eculy,' 'Viollette,' 'De Juillet,' 'Emma Lepermann,' and 'Lincoln' (39) are resistant. Some of these are indigenous old plum cultivars and primitive cultivated landraces. 'Stanley,' 'Gulajeva,' 'Sakarka,' 'Silistrenska,' 'Montford,' and 'Bela Uhrapka' are also reported to be resistant (40).

Resistance to Puccini (Tranzschelia) pruni spinosae

'Montford,' 'Ontario,' 'Vilhemina Spat' (39) 'Bela Uhrepka,' 'Gabrovska,' and 'Silisstrenska' (40) are resistant. Some of these are indigenous old plum cultivars and primitive cultivated landraces.

It is very difficult to find plum cultivars that are resistant to both *Polystigma rubrum* and *Puccinia pruni spinosae.*

Resistance to frost

'Pamjat Timirjazeva,' 'Iskra,' 'Renkold Tambovski,' 'De Noire,' 'Grusevodnaja,' 'Volzenska krasavica,' 'Evrazija 21,' 'Rana Locikkaja,' 'Septembarskaja,' and 'Sopernica' are resistant (1). 'Jefferson,' 'Diamond' and some indigenous old plum cultivars, primitive cultivated landraces and wild forms of *P. insititia* are also resistant to frost (37). Eremin (1) suggested the use of *P. ussuriensis* x *P. nigra* cultivars, 'Skoroplodna,' 'Sestra Zara,' 'Suvenir Vostoka' and others for frost resistance. He also suggested the use of *P. domestica* x *P. insititia,* hybridized with diploid species *P. nigra, P. ussuriensis* and *P. americana* to obtain plum cultivars with high resistance to frost and for late blooming.

Breeding methods for frost resistance include diallel crossing, inbreeding, back-crossing to BC2, BC3 and in some cases to BC4 generation to create plum cultivars resistant to frost and diseases. Mutation breeding using pollen, seeds, buds, young plants, then sphaeroblast shoot production (10, 13) and clonal selection (9, 12, 14, 15, 17) are other methods.

Fruit quality, size, early-bearing, high yield

Cultivars having some of these traits have been reported (10, 20, 22, 23, 29, 30, 32, 36). 'Wangenheims Fruhzwetsche.' 'Stanley,' 'California Blue,' 'Pozegaca' clones give hybrids with larger fruit size. 'Ruth Gerstetter,' 'Prune Peche,' 'Rivers Early,' 'Althan Reine-Claude,' 'Reine-Claudes,' 'Agen,' 'Montford,' 'Pop Hariton,' 'Ana Spat,' 'Bluefre,' 'Scopelon,' 'Bilska rana,' 'Ersinger Fruhzwetsche,' 'Czar,' 'Tuleu Timpuriu,' 'Tuleu Gras,' 'Joris Plum,' 'Grand Duke,' and our new plum cultivars are very useful for fruit quality and other characters.

Rootstocks

Yugoslavia indigenous old cultivars and primitive cultivated landraces should be used to create new rootstocks, (3, 7, 8, 9, 10, 11, 13, 16, 30, 35). *P. munsoniana, P. hortulana, P. Maritima, P. subcordata, P. besseyi* (1) and *P. cocomilia, P. prostrata, P. spinosa,* as well as *P. cerasifera* should be used to create dwarf trees resistant to frost and for late blooming.

What is Needed to Assure Future Plum Production

The following problems need to be solved to assure plum production in the future:

1. The collection of plum germplasm. The conservation of these varieties and seedlings *in situ,* in orchards or in vitro. Finally, the protection of this germplasm and important genetic resources from gene erosion.

2. The development, by breeding of plum cultivars with high yields, quality, and resistance or tolerance to Sharka, *Polystigma rubrum, Puccinia pruni spinosa, Monilinia fructicola,* as well as resistance to *Xanthomonas pruni, Monilinia laxa, Coryneum beijerinckii, Stereum purpureum,* and mycoplasma are needed for cheaper plum production. Dwarf trees with strong root systems for easier hand picking, or mechanical harvesting will also reduce production costs.

3. Plum cultivars with higher amounts of amino acids, vitamins and K, P, Ca and Mg for human health will mean more nutritious fruit.

4. Ways to increase the use of fresh and dried plums by people of all ages are needed because plum fruit is relatively cheap, healthy and beneficial to human health.

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HEDRICK AWARD JUDGES

The American Pomological Society extends its appreciation to the members listed below who served as judges for the 1987 U.P. Hedrick Awards.

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