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New approaches for Plum (*Prunus domestica* L.) production in tepid climate of Kashmir valley of Jammu & Kashmir: A Review

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Abstract

European plum (*Prunus domestica* L.) is one of the most important temperate fruit crops. Its origin is unclear as wild forms are missing. The genetic base which can be used for breeding is highly diverse and provides a good base for further improvement of the fruit crop. Information on the inheritance of single traits is rarely available. Breeding focuses on resistance and fruit quality. Classical breeding is the most important method applied. Very few data is available on the genome sequence. No marker assisted selection systems are available. Genetic engineering is limited to the transformation of embryonic tissue derived from seeds. *Prunus domestica* is the only *Prunus* species where genotypes completely resistant to the Plum pox virus exist. Plums are by far the most diverse of all the *Prunus* species and could be the most diverse of all deciduous fruit crop species. The fruit constitutes an important source of minerals, vitamins, sugars, and organic acid in addition to protein, fat, and carbohydrate. Native species of plums exist in nearly every temperate zone in the world where there is sufficient chilling to break dormancy. With diverse genetic material, plums are the ideal species to play a central role as a fresh fruit for local or regional markets. Adapted cultivars have wider adaptability and can be found or bred for in any temperate region of the world. The results agree with *P. domestica* having originated as an interspecific hybrid of a diploid *P. cerasifera* and a tetraploid *P. spinosa* that itself may have been an interspecific hybrid of *P. cerasifera* and an unknown Eurasian plum species. The low genetic diversity and lack of true wild-types coupled with the known cultivation history of Eurasian plums imply that *P. domestica* may have been a product of inter-specific cross breeding and artificial selection by early agrarian Eurasian societies.

Keywords: 4-2-56

1. Introduction

The European plum (*Prunus domestica* L.), also called a prune, belongs to the sub genus *Prunus* in genus *Prunus* (Rosaceae). Although the origin of the European plum, a major prune species, remains unclear (Hartmann and Neumüller, 2009) [10], prunes probably arose from the Caucasus region which is surrounded by the Caspian and Black Seas. Prune fruit contains various minerals, vitamins, and functional components such as polyphenols, and is noted as a nutritional food (Kimet *et al*, 2003). The prune fruit is thought to have an effect on intestinal regulation and reduce constipation because sorbitol is abundantly contained within its sugar (Cordova and Watson, 2011) [12].

A plum is a fruit of some species in *Prunus* sub genus *Prunus*. Mature plum fruits may have a dusty-white waxy coating that gives them a glaucous appearance. This is an epicuticular wax coating and is known as "wax bloom". Dried plums are called prunes, which have a dark, wrinkled appearance [1]. The name plum derived from Old English *plume* or "plum, plum tree", which extended from Germanic language or Middle Dutch, and Latin *prūnum* [2], from Ancient Greek *proumnon* [3] believed to be a loanword from Asia Minor [1, 10]. In the late 18th century, the word, plum, was used to indicate "something desirable", probably in reference to tasty fruit pieces in desserts. Plum or

2. Descriptions: Plums are a diverse group of species. The commercially important plum trees are medium-sized, usually pruned to 5–6 meters (16–20 ft) height.

The tree is of medium hardiness^[4]. Without pruning, the trees can reach 12 meters (39 ft) in height and spread across 10 meters (33 ft). They blossom in different months in different parts of the world; for example, in about January in Taiwan and early April in the United Kingdom^[5].

Fruits are usually of medium size, between 2–7 centimeters (0.79–2.76 in) in diameter, globose to oval. The flesh is firm and juicy. The fruit's peel is smooth, with a natural waxy surface that adheres to the flesh. The plum is a drupe, meaning its fleshy fruit surrounds a single hard seed.

Japanese or Chinese plums are large and juicy with a long shelf life, and therefore dominate the fresh fruit market in North America and East Asia. They are usually clingstone and not suitable for making prunes^[6]. They are cultivars of *Prunus salicina* or its hybrids. The cultivars developed in the US are mostly hybrids of *P. salicina* with *P. simonii* and *P. cerasifera*. Although these cultivars are often called Japanese plums, two of the three parents (*P. salicina* and *P. simonii*) originated from China and one (*P. cerasifera*) from Eurasia^[7].

In Europe, European plum (*Prunus domestica*) is also common in fresh fruit market. It has both dessert (eating) or culinary (cooking) cultivars, which include:

1. Damson (purple or black skin, green flesh, clingstone, astringent)
2. Prune plum (usually oval, freestone, sweet, fresh eaten or used to make prunes)
3. Greengage (firm, green flesh and skin even when ripe)
4. Mirabelle (dark yellow, predominantly grown in northeast France)
5. Victoria (yellow flesh with a red or mottled skin)
6. Yellow gage or golden plum (similar to greengage, but yellow)

In West Asia, myrobalan plum or cherry plum (*Prunus cerasifera*) is also widely cultivated. In Russia, apart from these three commonly cultivated species, there are also many cultivars resulting from hybridization between Japanese plum and myrobalan plum, known as Russian plum (*Prunus × rossica*).

The numerous species of *Prunus* sub genus. *Prunus* are classified into many sections, but not all of them are called plums. Plums include species of sect. *Prunus* and sect. *Prunocerasus*^[8], as well as *P. mume* of sect. *Armeniaca*. Only two plum species, the hexaploid European plum (*Prunus domestica*) and the diploid Japanese plum (*Prunus salicina* and hybrids), are of worldwide commercial significance. The origin of *P. domestica* is uncertain but may have involved *P. cerasifera* and possibly *P. spinosa* as ancestors. Other species of plum variously originated in Europe, Asia and America^[9].

3. Origin and history of plum:

Plums belong to the genus *Prunus* L., subfamily Amygdaloideae (syn. Prunoideae), and family Rosaceae Jussieu. The basic chromosome number of plum is 8 (x = 8). Plum is a member of *Prunophora* subgenus, which itself is subdivided into the sections *Prunocerasus* and *Euprunus*. The *Prunocerasus* section contains the following species: *P. americana*, *P. angustifolia*, *P. hortulana*, *P. munsoniana*, *P. mexicana*, *P. nigra*, and *P. maritima*. The *Euprunus* section contains the following species: *P. domestica*, *P. spinosa*, *P. cerasifera*, *P. salicina*, *P. cocomilia*, *P. insititia*, *P. simonii*, and *P. ussuriensis*.

Table 1: Important species of Plum:

Species	Common name	Origin	Chromosome number	Subspecies/varieties
1	2	3	4	5
<i>P. cerasifera</i> Ehrh.	Cherry plum, Myrobalan	West Asia, Balkans (Serbia, Romania, Bulgaria, Greece), Caucasus	16 (24, 32, 48)	<i>atropurpurea</i> , <i>pissardi</i> , <i>pendula</i> , <i>elegans</i> , <i>divaricata</i>
<i>P. cocomilia</i> Ten.	Italian plum	Italy, Serbia	16	–
<i>P. domestica</i> L.	Garden plum, European plum	Europe, West Asia	48	–
<i>P. insititia</i> L.	Bullace, damson, mirabelle, reineclaude (gage plum)	Europa, West Asia	48	<i>subsylvestris</i> , <i>italica</i> , <i>syriaca</i>
<i>P. monticola</i> Koch	Taurus plum	Asia	16	–
<i>P. salicina</i> Lindl.	Japanese (Chinese) plum	China	16 (32)	–
<i>P. simonii</i> Carriere	Apricot plum, Simon plum	North China	16	<i>purpurea</i>
<i>P. spinosa</i> L.	Blackthorn, sloe	Europa, North Africa, West Asia	32 (16, 24, 48)	–
<i>P. ussuriensis</i> Kovalev and Kostina	Ussurian (Manchurian) plum	China	16	–
<i>P. americana</i> Marshall	Common wild plum	East USA, to the Rocky Mountains	16	<i>mollis</i> , <i>lanata</i>
<i>P. angustifolia</i> Marshall	Chickasaw plum	USA (New Jersey to the Florida); Illinois, Texas	16	<i>watsonii</i> , <i>varians</i>
<i>P. hortulana</i> L.H. Bailey	Hortulan plum	USA (Kentucky, Tennessee to the Iowa, Oklahoma, Texas, Louisiana); Alabama	16	<i>mineri</i> , <i>pubens</i>
<i>P. maritima</i> Marshall	Beach plum	USA (Virginia)	16	<i>flava</i> (with yellow fruit)
<i>P. mexicana</i> S. Wats.	Big-tree plum	USA, Mexico	16	<i>polyandra</i> , <i>fultonensis</i>
<i>P. munsoniana</i> Wight and Hedrick	Wild Goose plum	USA (Texas, Ohio, Kentucky)	16	–
<i>P. nigra</i> Aiton	Canadian plum	Canada, USA	16	–

Plum has a large spreading area. According to Vavilov's research, there are three spreading centers for plum species: Euro-Asian, North American, and East Asian^[13].

In the Euro-Asian center, the following species are present: *Prunus domestica*, *Prunus insititia*, *Prunus spinosa*, and *Prunus cerasifera*, which are widespread in South Europe, Western Asia, around the Caucasus Mountains, and Caspian

Sea, but also in the Balkans, as well as in the Mediterranean countries.

In the North American center which starts from the Gulf of Mexico and the West coast of the USA to Canada in the North, the following species are spreading: *Prunus nigra*, *Prunus americana*, and *Prunus munsoniana*.

The third center, East Asian, includes the following species: *Prunus ussuriensis*, *Prunus salicina*, and *Prunus simonii*.

From this large diversity, the most important species in commercial orchards are European or domestic plum (*Prunus domestica* L.; hexaploid species with $2n = 6x = 48$) and Japanese plum (*Prunus salicina* Lindl. diploid species with $2n = 4x = 16$). European and Japanese plums belong to the same taxonomic section, but they are differentiated by origin and requirements to environmental factors.

4. Climatic requirements

Plums usually require a tepid or temperate climate for its growth, however cultivation can be found between the hills of Kashmir with temperature nearing 0 degrees to the plains of Rajasthan with soaring temperatures of more than 45 degrees. Plums require less chilling hours less than 7.2 degree Celsius. Plums can endure high summers as well as freezing winters.

5. Variety: There are many varieties of plums ranging in taste from sweet to tart. Some types of plums have a red sour flavored-skin that surrounds sweet juicy yellow flesh. Other varieties of plums are extremely sweet with dark purple skin and amber-colored flesh. There are two types of varieties, the European, that contain less water and more soluble solids, suitable to be dried, and the Japanese, more juicy for fresh consumption.

Some European varieties are thought to come from the *Prunus domestica*, a wild plum tree that grows near the Caspian Sea. Another wild ancestor of the European and South African varieties can be *P. salicina*, in China and Japan. In addition, the Americans have used the wild plum *P. subordinate*, from America, to cross with European plum or Asian varieties.

According to information of the Departamento de Cultivos Leñosos de la Escuela Universitaria de Ingeniería Técnica Agrícola (EUITA), Valencia, (<http://www.euita.upv.es>), in Spain the plum tree is mainly cultivated in Murcia, Comunidad Valenciana, Andalusia, Aragón, Catalonia and La Rioja. The most exported varieties are Reina Claudia, Santa Rosa and Golden Japan. Other cultivated varieties are Red Beauty, Formosa and Burbank.

5.1. We must distinguish between the European plum tree and the Japanese

1. The European plum (*Prunus domestica*), usually bears pale green ("Claudias") or purple ("Prunas") fruits, to which dry plums belong, since they have a high content of soluble solids and contain little water; this makes dehydration much easier. The most used varieties for their industrial processing belong to the group Ente, like Agen of Ente GF 707. For instance, in Alicante and Castellón, the most cultivated varieties are Stanley, Claudias, Ana Spath, President and Giant. Normally, this group is well adapted to regions with continental climate due to their flowering, greater demand of cold and less demanding in cares.
2. The Japanese plum (*Prunus salicina*), with earlier maturation and, in general, reddish and black epidermis, although some can be pale yellow, like "Golden Japan".

Its water content is high, so it is very juicy. For instance, in the Rivera Alta of the Comunidad Valenciana (Spain), we find the varieties Red Beauty, Methley, Golden Japan, Formosa, Santa Rosa and Burbank. They are cultivated mainly in the warmest areas due to their flowering period, although in some cold areas we can see almond trees grafted with the variety Red Beauty, important for its pink-dark colour and its earliness. The main plum producing countries are China, the United States, Rumania and Germany.

3. In the U.S.A., the most cultivated varieties are, in alphabetical order, Beauty (available from the end of May to the beginning of July), Burbank, Gaviota (June to August), Golden Japan (January to May and June to August), June Blood (end of June to the beginning of July), Kelsey and Ontario (July to September).
4. In Rumania, the variety Switzen or Quetsh, original from Asia and that is also produced in Germany, France and The Netherlands, is available in September and October. In Germany, the varieties of greater diffusion are Czar (August), Ontario (July to September), Opal (August) and Switzen (September to October).

5.2 Some of the types of plums include

- **Moyer plum.** This common plum has sweet taste. It has purple skin with juicy yellow-orange to amber flesh.
- **Damsons plum.** Popular tart-flavored plum with dark purple skin and yellowish green flesh.
- **Elephant Heart plum.** This type of sweet Japanese plum has dark red to purple mottled skin and sweet juicy red flesh.
- **Greengage plum.** Green type of plum with a delicious honey-sweet taste.
- **Myrobalan plum.** Small round plum that looks like red or yellow cherry.
- **Santa Rosa plums**
- **Blood plum**

Before looking at the many varieties of plums and prunes, let's look at some of the delicious plum hybrid fruits that are popular. Plums are related to other drupes such as apricots, peaches, and nectarines. Growers can cross these types of fruits to create new types of deliciously sweet stone fruits. Plumcots, apriums, and pluots are all naturally developed fruits that combine varieties of plums and apricots.

- **Plumcots**—A cross between apricots and plums that are half plum and half apricot. These fruits have the shape of apricot but the skin color and sweet taste of plums.
- **Apriums**—these drupes have more apricot than plum and have fuzzy skin similar to apricots. Just like apricots, they have sweet orange flesh.
- **Pluots**—these stone fruits are more plum than apricot. They look like red apricots and have a distinct taste of plum.

5.3. Types of Plums (With Pictures and Common Name): Let's look in more detail at the various types of plums that are common in local stores. You will find out about the best plums for eating fresh and about the ones that are tastiest in cooked and baked food.

Moyer Plums: Moyer plums are a common purple plum and one of the most popular varieties. These are extremely sweet plums that have dark burgundy to purple skin and juicy yellow-orange to amber flesh. This plum variety is considered one of the best European plums for its shape and taste. Moyer plums are large plums with a long oval shape and high sugar content. This species of plum is delicious fresh and is often dried to create sweet prunes. Moyer plums tend to ripen late in the season. You can tell if the plums are ripe by gently squeezing the skin. Your fingers should leave a slight indentation if the fruit is ripe. If the flesh feels hard or doesn't give slightly, you need to wait until it ripens.



Fig 1: Moyer Plums

Damsons

Damsons are a popular dark-skinned European variety of plum that has tart-flavored flesh and skin. Unlike many other varieties of plums, damsons are high in sugar with an astringent taste. The purple-blue skin covers firm yellowish-green flesh that has a sour taste. This sweet and sour taste combination makes damson plums excellent for using in savory or sweet dishes to add a bit of tartness. Damsons are usually ripe for harvesting from late August until October. There are several cultivars in the damson subspecies *Prunus domestica insititia*. Some popular cultivars are 'Blue Violet,' 'Shropshire Prune,' 'Common Damson,' and 'Frogmore.'



Fig 2: Damsons

Elephant Heart Plum

As its name suggests, the elephant heart plum is a large, heart-shaped stone fruit. Dark red to purple mottled skin covers sweet juicy red flesh that has a firm texture. This plum variety is classified as a Japanese plum variety, and they taste delicious when eaten fresh. The flesh is so soft and juicy that some say it's almost like drinking juice. These sweet plums have a wonderful balance between sweetness and tartness. The red flesh is tart and sweet, and the skin tastes like berries. Elephant heart plums are generally ready for picking between September and October.



Fig 3: Elephant Heart Plum

Greengage Plum (*Prunus domestica*)

The greengage plum is one of the few green varieties of plums when they are ripe. The plums are small and round and have a delicious honey-sweet taste. The juicy flesh has a firm texture that is common with many European plums. Depending on the greengage plum cultivar, the green skin can have hints of red blushing or yellow on it. Many consider greengage plums as the best plums to use in desserts. Greengage plum trees blossom in spring, and the bumper crops are ready by late summer and early fall. It's at this time when the fruits are at their sweetest. This popular European variety is a clingstone plum, meaning that the skin clings to the pit.



Fig 4: Greengage Plum (*Prunus domestica*)

Myrobalan (Cherry Plums)

Myrobalan plums are small round fruits that look like red or yellow cherries. There are several different cherry plum cultivars that produce small plums ranging in taste from sweet to tart. The sweet varieties of Myrobalan plums are delicious when eaten fresh. The tarter cultivars are suitable for using in baking or making jellies. Apart from growing small cherry-like plums, these plum trees are popular backyard ornamental types of fruit trees. The plum trees can grow as small garden shrubs or small decorative fruit trees. They are also one of the first trees to flower in spring.



Fig 5: Myrobalan (Cherry Plums)

Santa Rosa

'Santa Rosa' plums are drupes that have reddish-purple skin with juicy strawberry-colored flesh. These medium- to large-sized plums have a round shape. Biting into 'Santa Rosa' plums reveals a thin skin that covers plump, juicy flesh. There is hardly any tartness in the taste, and many say that the sweet taste is reminiscent of cherry-flavored fruit punch. Santa Rosa plums are suitable for many uses, including eating fresh or using in baked goods.



Fig 6: Santa Rosa

Satsuma (Blood Plum)

Satsuma plums are a Japanese variety of medium to small round plums. The maroon skins on this plum variety tend to be firm and tough with a sour flavor. However, the deep red-colored flesh is very sweet that offsets the bitter-tasting skin. Although called a satsuma plum, they have nothing to do with

the citrus fruit. The common name *blood plum* refers to the deep red color of the skin and flesh. Satsuma plums are a semi-clingstone variety, meaning that the flesh partially clings to the stone. These Japanese plums tend to be larger in size than European red plums.

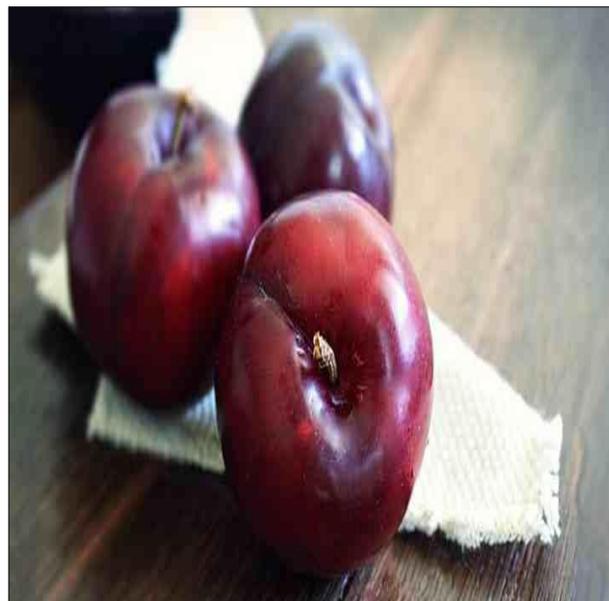


Fig 7: Satsuma (Blood Plum)

Simca Plums

Simca (simka) plums are a variety of large, heart-shaped plums that have deep reddish skins with blueish-purple dusty waxy coating. The dark-red skin covers golden-yellow flesh that has a pleasantly sweet flavor.

As with most Japanese varieties of plums, Simca plums are larger and juicier. These delicious plums are best eaten fresh due to their juicy flesh.



Fig 8: Simca Plums

Mirabelle Plums

Mirabelle plums look similar to apricots as they have bright yellow-orange skins. These sweet plums are sometimes called Mirabelle prunes or cherry plums. Cutting open the soft skin reveals sweet amber flesh and a stone in the middle. Their high sugar content means that these round fruits are excellent for making jellies, jams, and baked goods.

It's rare to find these plum trees growing outside of France. Also, the soft flesh of the fruit means that it doesn't travel

well, so you will usually only find these plums sold in France. However, you can plant Mirabelle plum trees in your garden if you want to grow some of the sweetest plums available.



Fig 9: Mirabelle Plums

Varieties of Sweet Black Plum (With Pictures)

Black plums get their name from the dark purple skin that surrounds their flesh. Many of the fresh plums sold in stores and supermarkets are types of Japanese black plums. They are prized for their sweet taste, golden yellow flesh, and lack of tartness.

Black Ruby

One of the most popular types of black Japanese plums is the 'Black Ruby' cultivar. This juicy plum has reddish-black skin that surrounds yellow flesh. This round plum is one of the few sweet plum varieties that ripen in mid-summer.

One of the reasons why this type of plum is a popular variety for eating fresh is that it's a freestone variety. You can bite into the sweet flavorsome flesh and the stone comes away fairly easily. Most Japanese black plums are clingstone varieties.



Fig 10: Black Ruby

Friar

'Friar' plums are popular large Japanese plums with sweet, juicy flesh. The skin on these round plums is a dark purple color with hints of a blue dusty wax coating. These sweet plums have light orangey-amber flesh that covers a small pit. Although the plum is juicy, it has a firm flesh, making this a popular variety to eat fresh.

One of the benefits of growing friar plum fruit trees is that they have a long harvesting time. The crop is ready for

picking in late August, and the trees usually produce a bumper crop.



Fig 11: Friar

Black Beauty

'Black Beauty' is another type of Japanese plum that has bright yellow flesh and dark, deep purple-red skin. This drupe fruit is extremely juicy when biting into its firm flesh. These dark oval plums are medium to large size and are another popular variety for eating fresh.

To know if this plum variety is ripe for eating, gently squeeze the fruit. If it is just slightly soft, it is ready for eating. If the plums are still hard and unripe, you can put them in a paper bag at room temperature to speed up the ripening time. 'Black Beauty' plums have an excellent balance of sweetness with only hints of tartness.



Fig 12: Black Beauty

Black Splendor

'Black Splendor' plums live up to their name—they have a fantastic sweet taste. The skin of these sweet plums is dark violet, and the waxy coating gives them a smoky appearance. Biting into these delicious stone fruits reveals a dark burgundy flesh that covers the large pit in the middle.

One of the beauties of 'Black Splendor' plums is that they are a large variety of plum that ripens early in the season. Hints

of tartness from the black skin combined with the sweetness of the beet-colored flesh make these plums a variety to look for.



Fig 13: Black Splendor

El Dorado

Another type of sweet black plum is the 'El Dorado' cultivar. Even with its firm amber-colored flesh, this plum has a sweet flavor. This plum variety is a great all-rounder as it's one of the most versatile types of black plum you can grow. The firm flesh and tart skin holds up well in cooking and baking. The intensely sweet, juicy flesh also makes this a perfect plum for snacking on.



Fig 14: El Dorado

Black Amber

The 'Black amber' variety of plum gets its name from the black, slightly tart skin and juicy amber-colored flesh. Compared to other dark-skinned plums, the 'Black amber' has firm flesh and distinct tartness to the taste. The round plums have a bluish appearance due to the waxy coating that covers most types of prunes.

This plum cultivar is usually ripe for eating in mid- to late summer. You can use this plum in cooking as its firm flesh and sweet-sour taste adds flavor and texture to many dishes.



Fig 15: Black Amber

French Prune

The 'French Prune' is a type of fresh plum that is perfect for drying to make prunes. The drupe fruit has a long, oblong shape similar to a small pear. The dark, smokey skin has hues of purple and light blue that covers dark amber flesh. The French Prune Plum tree produces fruit that is ready for harvesting in late summer. The most popular variety in the United States is the 'Improved French Prune' that makes some of the finest and sweetest prunes you can eat.



Fig 16: French Prune

Italian Prune Plum:

Similar to the French Prune, the Italian prune variety is a large, oblong, egg-shaped plum with a powdery coating on purple-blue skin. This freestone plum variety has green-amber juicy flesh that turns a deep fuchsia color when cooked. As the fruit ripens on the plum tree, its sweetness intensifies. Although Italian prune plums are suitable for eating fresh, most of the harvest is dried to create prunes. Sometimes dark-skinned Moyer plums are sold as Italian prunes or French prunes.



Fig 17: Italian Prune Plum:

‘Owen T’ Plums

If you are looking for the largest type of plum, then the ‘Owen T’ cultivar is thought to be the biggest. A single plum can weigh up to 8 oz. (230 g) and measure a whopping 3” (7.5 cm) across. These large plums have bluish-dark purple skins surrounding sweet flesh that is a light yellow color. ‘Owen T’ plums are usually ready for eating in mid-season.



Fig 18: ‘Owen T’ Plums

‘John W’ Plums

The other type of massive dark-skinned plum is the ‘John W’ cultivar. This plum cultivar is similar to the ‘Owen T’ variety in size. The difference between these two cultivars is skin and flesh color. The ‘John W’ plum variety has deep red-purple colored skin that surrounds deep orange flesh. These plums ripen later in the season than ‘Owen T’ plums.



Fig 19: ‘John W’ Plums

5.3. Plum Variety Descriptions**5.3.1. Japanese Plums**

Early Magic: The early magic ripens in mid-July. Fruit size is medium. This medium sized fruit is purplish-red and covered with waxy bloom giving it a bluish cast. The flesh is amber-yellow, firm, juicy, sweet and very good tasting.



Fig 20: Early Magic

Early Golden: The early golden is one of the first plums of the season, ripening in the second part of July. Similar to shiro plum, it is small to medium in size, firmer than the shiro, mild tasting, sweet and does not stick to the pit. The early golden is an excellent choice to satisfy your early season sweet tooth.



Fig 21: Early Golden

Methley: One of the first out of the orchard in mid-July, this is well known variety that has been present on the market stands for a long time. This fruit is harvested with a green shadow, but ripens to a vibrant purple with a deep red flesh at market. This small round fruit is the perfect pop-able sweet treat on a hot July day.



Fig 22: Methley

Shiro: The shiro needs no introduction as it is the most well-known of the Japanese varieties. Be sure to handle this petite yellow plum with care as they bruise easily. Smooth and sweet, you will surely encounter the shiro at farmers markets in late July.



Fig 23: Shiro

Santa Rosa: The Santa Rosa is a beautiful, large, red fruits with gold flesh. It is a sweet plum that is delicious when eaten fresh, cooked or canned. It is ready the first week of August.



Fig 24: Santa Rosa

Starking Delicious: This new variety is gaining acclaim for its great taste and ease of growing. It is disease resistant making it a very environmentally friendly option. Ripening in the second week of August, this deep red Japanese plum is a delicious summer treat.

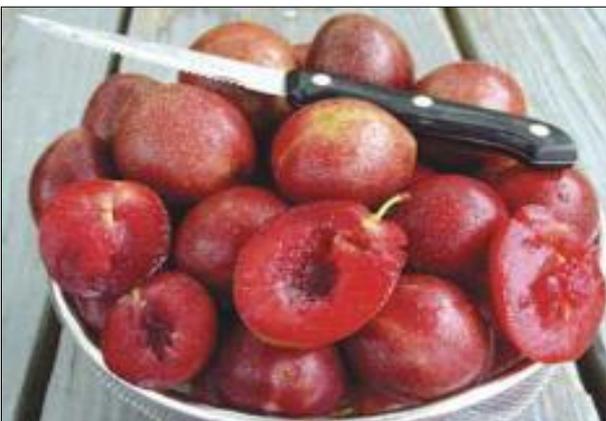


FIG 25: Starking Delicious

Ozark Premier: The Ozark premier is a large, plump, roundish plum. The skin is red with a waxy bloom. Its firm flesh is yellow, fine-grained, and juicy. The Ozark premier will appease your appetite with its sweet, great taste.



Fig 26: Ozark Premier

Burbank: The Burbank is a well-known old variety. The fruit is medium-sized and has attractive orange-red color that covers most of the surface with a base color that is amber-yellow. The flesh is yellow, fine-grained, firm and juicy, sweet and very good tasting. The peak harvest is in the second part of August-beginning of September



Fig 27: Burbank

Red heart: you would be fortunate to find the redheart at the farmers market in mid-august. A finicky producer, the redheart is one of the tastiest plums grown in the state. It is aesthetically appealing being large, smooth, and heart-shaped with dark purplish red skin covered with golden specks. The flesh is blood red, firm and juicy. There are few other varieties that rival the redheart's sweet aromatic goodness.



Fig 28: Red heart

Ruby queen: The Rubyqueen is a medium sized fruit with a firm flesh and excellent flavor. It has a beautiful dark red/black skin with a deep red flesh. This is really a gem of a plum.



Fig 29: Ruby queen

Fortune: The fortune is a large bright red plum on a yellow background. The flesh is yellow, firm and juice. This attractive, good-tasting plum ripens in mid to second part of September.



Fig 30: Fortune

Lydecker: The Lydecker is a new variety of plum harvested the first week of September. It is dark blue-black and nearly round, similar to many California dessert plums. It is said to have a superior ripe flavor to the more common varieties in its ripening season.



Fig 31: Lydecker

Simka: The fruit of the simka is large, uniform, with a very shallow suture. It is a very attractive, good-tasting plum. It is sweet with an excellent firm texture. The skin is very dark red almost ebony and the flesh is very light green to slightly yellow. It's a very good choice for the first week of September.



Fig 32: Simka

Alderman: The Alderman is a very attractive plum that has nice brilliant orange-red skin color and orange-yellow flesh. Skin is very firm, shiny, and waxy-like. The fruit is medium to large often 2"-2 1/2" in diameter. It has good texture and taste. It is a very good late plum. It ripens in the third/fourth week of September.



Fig 33: Alderman

5.3.2. European Plums

Vibrant: The first European plum to be harvested, the Vibrant is a beautiful plum with a violet-blue skin and amber flesh. It is a medium to large-sized fruit with good firmness and sweetness with a medium acid content for a nice balanced flavor.



Fig 34: Vibrant

Vanette: The Vanette is a large, purple-blue, freestone plum. It has good sugar/acid ratio that accounts for excellent taste. . Most years ripens in the third week of August. It is very good dual - purpose plum and is one of the best fresh market plums. It is an excellent all-around plum. It's great for cooking, canning and fresh eating.



Fig 35: Vanette

Castleton: The fruit of the Castleton is medium-sized, dark blue, oblong, and freestone. It has a sweet to mildly acidic taste. It is very good dual purpose plum; suitable for fresh and cooking/preserving. A known favorite when it comes to home canning, it makes an excellent burgundy jam. Find them at the end of August to the first part of September at a farmer's market or fruit stand near you.



Fig 36: Castleton



Fig 37: N.Y. 6

N.Y. 6: The N.Y. 6 is a relatively large blue-skinned, yellow-fleshed European plum. It is a favorite variety for baby food as it has a very mild taste which makes it excellent choice for mixing with other fruit. It is a great choice for baking.

Early Italian: The Early Italian is an old, well-known variety of blue plum that is also called "Early Fellenberg". With its pleasant firmness and its great taste, the Early Italian is one of the highest caliber plums Michigan has to offer.



Fig 38: Early Italian

Stanley: The Stanley is the go-to for European plums. It is medium to large fruit with dark blue skin and yellow-green flesh. It can be identified by its distinct neck.



Fig 39: Stanley

Valor: The Valor plum is large and very good tasting. Its skin is an attractive dark purple, speckled and the flesh is greenish-yellow. It is semi-freestone and can be found starting the first week of September.



FIG 40: Valor

N.Y. 9: This plum ripens in the first week of September. The fruit size varies due to the crop load and goes from small to large. The flesh is green and the skin is purple, covered with waxy bloom so it appears blue. It has mild taste and is rather sweet. Though, it is processing variety, when picked when the flesh color starts changing from green to amber, it has just enough acid to make it well eating plum.



Fig 41: N.Y. 9

Blufre: The Blufre is a medium-large sized European plums. It is blue-skinned and yellow-fleshed with a very distinctive flavor. The Blufre is a good choice for all your baking needs.



Fig 42: Blufre

Long John: The fruit of the Long John is large and has an interesting shape: it is quite long and bit “flattened”. The skin is dark maroon, almost black, and covered with the waxy bloom, which gives it nice blue color. The flesh is orange, firm and pleasantly tart. It is freestone and it ripens with the Stanley at the first of September, but is larger and better quality.



Fig 43: Long John

Autumn Sweet: The Autumn Sweet is a new European blue-skinned, yellow-fleshed plum. It is said to have superior quality to that of the traditional Italian plum. It ripens the first week of September, making it a great choice for lunchboxes that kids are sure to love.



Fig 44: Autumn Sweet

Blue Damson: The Blue Damson is an old variety, renowned for its superb preserves and baking characteristics. It is a small blue plum with a yellow flesh. The Damson is in high demand throughout farmer's markets from individuals longing for the most mouthwatering jams and most intriguing plum bounces.



Fig 45: Blue Damson

Italian: The Italian is a medium to large fruit with purple skin and yellow flesh. It is a sweet plum that stores well and is a great dual purpose plum.



FIG 46: Italian

Tulare Giant: The Tulare Giant is a new Japanese plum variety. It is a large reddish-grey skin plum with an amber flesh. Eat this one fresh because its incredible sweetness is rivaled by few other varieties.



Fig 47: Tulare Giant

Empress : The Empress is a well-known European plum variety. It has large, elliptical, symmetrical fruit of very good quality. The skin is purple and covered with heavy waxy bloom. The flesh is greenish-yellow and it is semi-cling. The Empress is a very nice late-season choice.



Fig 48: Empress

5.4. Most of the commercial varieties of plum grown in India belong to Salicina (Japanese) group. Their fruits have a superb taste and are suitable as fresh fruit while others for processing. Important plum cultivars for plains requiring low chilling period are:



Fig 49: Satlum purple subtropical plum

Satluj purple

Its fruits are quite large, bright crimson with thick flesh, possessing excellent shipping quality. They ripen in the second week of May, their average yield being 30kg/tree. Since this variety is self-incompatible, it should be planted with variety Kala Amritsari.

Kala Amritsar

It is most popular cultivar grown in Punjab; its fruits are medium-sized, round and dark brown at maturity. Flesh is yellow, moderately juicy and excellent for jam-making. Self-fruitful, its yield improves if pollinated with Titron. The fruits ripen during mid-May, the average yield 40-50kg/tree.

Titron

It is a self-fruitful variety. Its yield improves if 'Alucha Early Round' is planted as pollinizer. Fruits are medium-sized with deep purple color and thin skin. Since its flesh is yellow, it is

excellent for jam-making. The fruits ripen second week of May, the average yield is 25-30 kg/tree.

Jamuni Meeruti

Fruits are small –sized, dull yellow, thin skinned with soft melting flesh. They ripen during April-end and yield about 28kg/ tree.

Kataru Chak

This is partially self-fruitful variety but its yield improves if pollinated with ‘Kala Amritsari’. Fruits are large, purplish with creamy flesh. They are good for jam and squash – making.

Alu Bokhara

It is a self-unfruitful variety and should be planted in rows alternating with those of ‘Howe’. Fruits are large, yellow colored occasionally tinted with red. Pulp is juicy and sweet.

Howe

Fruits are large, round, sweet juicy. They become red at maturity. They ripen in second fortnight of May, the average yield being 30-35kg/tree. Using Alu Bokhara as pollinizer is helpful.

Alpha

Fruits are round and small. They develop red color at maturity and ripen in second week of June, the average yield being 25kg/tree.

Late Yellow

Fruits are rounding, medium-sized, sweet and juicy. They become lemon-yellow at maturity and ripen in the first fortnight of May, the average yield being 25kg/tree.

Alucha Black

Fruits are small-sized, dark purple. They ripen late in the season. Since trees are self- incompatible, they may be planted with that of

Titron: Peshawari Kala

This is somewhat shy-bearing variety but its fruits have a good-keeping quality. Fruits are black with relatively thick skin.

Damson plum

Fruits are medium-sized, round with thick skin, yellow and juicy. They ripen in first week of June, the average yield being 40kg/tree.

6. Propagation and rootstock

Plums can be propagated successfully on peach, plum and wild apricot rootstocks. For light soils use of peach rootstock is recommended, whereas for heavy soils, plum Kabul Green Gage cuttings or apricot rootstocks give better results. Rooted cuttings of Kala Amritsari can be used directly without budding. For this stem-cuttings are prepared in the first week of December an after callusing for about a month they are planted in field at a distance of 15 cm x 30cm in January. The rooted cuttings can be used directly or budded in May-June or cleft grafted during December –January. For raising rootstock, like peach, plum (Desi) seeds are sown in November. They germinate in spring and seedlings are allowed to grow single stemmed. The seedlings of pencil

thickness are budded during May-June. Shield or T-budding gives good results. Rest of the seedlings can be bench grafted during December-January.

7. Soil requirements

Typical loam sandy soil, which is deep, is the best when it comes to the cultivation of plums. Plums best grow within the neutral pH range of soil (5 to 6.5). Soil that dries fast or logs water for a longer period of time should be avoided at all costs. Proper drainage systems should be maintained within the soil for achieving better productivity of plums.

8. Rootstocks

Rootstocks can be raised by sowing peach, plum seeds in the month of October end or first week of November. The seeds sprout by the months of February to March. The seedlings are allowed to grow till they reach around 7 inches long and 2mm in diameter. Budding is done during the months of May till June. Shield budding technique is best suited.

9. Propagation

Propagation can be done using either through cuttings or seed. Varieties like Kala Amritsari involve hardwood cuttings. The Kabul Green variety can be also used for propagation. IBA solution can be used for increasing the root percentage. Cuttings measurement is more or less like a pencil which amounts around 7 inches long and 2 mm in diameter. Use of the IBA solution takes the success rate to around 80%. Kala Amritsari seeds are collected during summers and stored. The accumulated seeds are then sewn around the month of November under sandy soil. The thickness of sand over the seeds is maintained around 5 cm for good germination. The process completes when a shoot starts to appear out of the seed. The seedlings are then sown in a distance of 8-10 cm from each other in lines. The lines should have a distance of 25 to 30 cm between them. Light irrigation is generally good and the same will be ready for grafting next year.

10. Planting

The young shoot grows for around 1 year and then can be planted in the fields possibly in the month of December. The distance to be maintained between the plants and rows should be 6 meter. Square system cultivation is done and a total of around 270 trees are planted per hectare of land.

11. Training/ Pruning

Training is to be done according to the variety. Most of the Japanese group ones are most likely to have a spreading habit, therefore open center systems should be used. Modified leader structure should be used for the upright growing plants. Leader branches should be altered after plantation of 4 years. Also 4 to 5 secondary branches should be collected. Light pruning has to be done to the trees around the month of January to achieve proper growth and good quality spur. Plum fruit is observed after 1 year and the older wood spurs.

12. Fertilizer

Fertilizer has to be applied according to the soil. Loamy soil requires more whereas hard soil requires less.

1. As per the age of the plant, it also depends on the application of fertilizer. Main components being Farm yard manure, Urea, Super phosphate and potash.

2. For 1-2 year olds, 5-10 Kilos Farm manure 50-100 grams Urea, 60-120 grams Superphosphate and 25-50 grams of potash.
3. For 3-4 year olds, 15-20 Kilos Farm manure 150-200 grams Urea, 180-240 grams Superphosphate and 75-100 grams of potash.
4. For 5-6 year olds, 25-30 Kilos Farm manure 250-300 grams Urea, 300-400 grams Superphosphate and 125-150 grams of potash.
5. For 7 year- over, 40 Kilos Farm manure 300 grams Urea, 400 grams Superphosphate and 200 grams of potash.
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13. Inter-Cropping

Crops like black or green gram, cluster bean and pea can be used as intercrops.

14. Fruit Thinning

Hand thinning should be followed before the fruit size starts to increase more slowly and generally marks the start of the second stage. Fruits should have space of around 7 cm between them.

15. Weed Control

Glyphosate should be used for weed control. Amount of application should be 10 ml per liter of water.

16. Water supply

Proper water irrigation should be maintained between the months of March to May for better fruits.

17. Harvest

Harvesting should be done as per the needs. If sold locally, then pickings should be done when the fruits become fully ripe or else pickings should be done when the fruit develops half skin colour. Plums can decay easily; hence have to be handled well. Baskets and boxes with cushioning of hay should be used for transporting the fruit to avoid any damage to the fruits.

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