Growing Plums in Florida¹

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Plum production has good potential for commercial growers and homeowners in Florida and other mild winter areas throughout the Gulf coast. However, most seasonal plums on the market are from California and will not perform well enough in Florida to produce fruit. From 1998 to 2001, plum cultivars have been released from the University of Florida's breeding program that adapt to our mild winters and high disease pressures. Because they have cropped reliably and produced high quality fruit, these cultivars are recommended for trial in Florida. The names of all University of Florida plum cultivars begin with the prefix 'Gulf.' These cultivars are Japanese type plums (*Prunus salicina* Lindl.) and have resistance to plum leaf scald (*Xylella fastidiosa*) and bacterial spot (*Xanthomonas campestris*). Fruit size is satisfactory (about 1 1/2 to 2 in. diameter) and fruit quality is good. They ripen in early to late May or about two weeks before California plums.

Plum Cultivars Adapted to South Central, Central, North Central, North and Northwest Florida

'Gulfbeauty' was released in 1998 and patented by the University of Florida. Fruit color is dark reddish purple and the flesh is yellow with a green hue (Fig. 1). The skin is sour, which is common in Japanese plums, but the flesh is sweet, sub-acid and firm, when ripe enough to eat. The flesh clings to the stone even when soft ripe. Fruit are round and medium small, about 1 3/4 in. diameter, and weigh from 55 to 70 grams. 'Gulfbeauty' is the earliest plum to ripen from the University of Florida breeding program. Ripening occurs about 5 days before 'Gulfruby' and about 8-12 days before 'Gulfblaze.' As the fruit approach full ripe their color becomes noticeably darker (Fig. 2). Ripe fruit will hang on the tree for 7-10 days. Quality is good, especially for an early ripening plum. During its season no other fresh plums are available. Bloom and cross-pollination occurs with 'Gulfruby' and 'Gulfblaze' and overlaps with 'Gulfrose.' Fruit set is good with flowers formed on spurs and the previous season's shoots. Trees are vigorous and semi-spreading. In the

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absence of freezing conditions, thinning is required to obtain adequate size and prevent limb breakage. Trees are very resistant to bacterial spot and moderately resistant to plum leaf scald.

Figure 1. 'Gulfbeauty' before final ripening color.

Figure 2. 'Gulfbeauty' showing ripening color.

'**Gulfblaze**' was released and patented by the University of Florida and provides a mid-season plum (Fig. 3). Fruit are very firm and medium-large, averaging 1 7/8 to 2 in. diameter and weighing 70 to 80 grams. They are round and semi-freestone. Fruit color is dark red to purple and the flesh is orange, sweet and sub-acid (Fig. 4). The skin is sour. Fruit quality is good and the large size is appealing. Fruit ripen 8 to 14 days after 'Gulfbeauty.' Bloom, pollination, fruit set and ripening characteristics are the same as for 'Gulfbeauty.' However, the tree is not as vigorous as 'Gulfbeauty' and may not live as long. Leaves, stems and fruit of 'Gulfblaze' are highly resistant to bacterial spot and leaves are very resistant to plum leaf scald.

'**Gulfrose**' is the most recent patented release by the University of Florida, ripening about one week

Figure 3. 'Gulfblaze' fruit.

Figure 4. 'Gulfblaze' fruit showing flesh color. Scale in centimeters.

later than 'Gulfblaze' (Fig. 5). The fruit are very firm, nearly round, semi-freestone and medium large, weighing 70 to 80 grams. The skin is dark reddish purple and the flesh is blood red in color (Fig. 6). Fruit quality is very high with good firmness and shelf life. The fruit have a sweet, aromatic flesh and a moderately acid skin. There is no bitter aftertaste common in other blood plums such as 'Mariposa.' Fruit ripening occurs with 'Gulfblaze.' Bloom, pollination, fruit set, and ripening qualities are the same as for those of 'Gulfbeauty.' Trees are moderately vigorous, semi-spreading and precocious, bearing the second year after planting. 'Gulfrose' is resistant to plum leaf scald and bacterial spot.

'**Gulfruby**' first appeared in the nursery industry with 'Gulfgold' in 1982, and both originated from the University of Florida breeding program. They were not released by the university because 'Gulfruby' is susceptible to bacterial spot and 'Gulfgold' is susceptible to plum leaf scald. They are public (not patented) cultivars. Bacterial spot occurs readily on

Figure 5. Young 'Gulfrose' fruit.

Figure 6. 'Gulfrose' fruit showing flesh color and pit freestone.

the leaves and small twigs of 'Gulfruby' and is aggravated by summer rains. Generally the tree will survive from 5 to 8 years and provide several crops of early ripening plums. Plum leaf scald is not debilitating on 'Gulfruby.' Fruit are medium, up to 2 in. diameter, and round in shape (Fig. 7). The flesh is sweet, yellow in color with a greenish tinge and adheres to the small pit at soft ripe. Skin color is red to purple and it is sour. Fruit will hang on the tree 3-5 days after full red skin color develops and will ripen 7 to 10 days before 'Gulfblaze.' Fruit sunburn can occur in some years, especially when temperatures are above 95°F. The tree is upright and vigorous but bacterial spot cankers can limit its vigor and stunt the tree's growth.

'**Gulfgold**' is a yellow plum, but develops a red blush as ripening progresses. Fruit flesh is yellow and soft when ripe. Although developed by the University of Florida it is not patented. Fruit ripen in late May to mid-June. They are the sweetest of the 'Gulf' series probably due to the long fruit development period. Because of its sweetness

Figure 7. 'Gulfruby' fruit.

'Gulfgold' makes the best dried fruit of all the 'Gulf' series. 'Gulfgold' is susceptible to plum leaf scald and generally will not live long. Trees are dwarfing in growth habit. Bloom is after 'Gulfruby' by a few days and 'Gulfgold' will cross-pollinate with the other 'Gulf' plums. 'Gulfgold' is no longer recommended.

Plum Cultivars Conditionally Recommended for Trial for North Florida Due to a Higher Chilling Requirement

Plum cultivars with the *Au* prefix are out of the breeding program at the University of Auburn and 'Robusto,' 'Segundo' and 'Byron Gold' are from the Georgia breeding program. The Auburn plums pollinate each other with the same being true for the Georgia cultivars.

'**Au-Homeside**' produces a light red plum with amber flesh. Fruit size is oval and about 2 1/3 in. diameter. Fruit is attractive and overall quality is good. Ripening date is mid June, and fruit tends to size well before color is achieved. Trees are not vigorous. 'Au-Homeside' is resistant to plum leaf scald.

'**Au-Producer**' has dark red skin and the flesh is also red. Fruit size is small, round, and less than 2 in. diameter. Fruit quality is high and the plums ripen in mid-June. Tree vigor is moderate, but trees tend to require heavy thinning. 'Au-Producer' is resistant to plum leaf scald.

'Au-Roadside' produces a magenta fruit with a red flesh color. Fruit size is less than 2 in. diameter and is oval in shape. Fruit quality is very good. Ripening date is mid-June. Tree vigor is high. Fruit tends to be too soft for commercial shipping. 'Au-Roadside' is resistant to plum leaf scald.

'Au-Rosa' produces red fruit with some light yellow areas. Fruit size is 2 in. diameter and round in shape. Fruit quality is good and fruit are attractive. Fruit ripen in mid June.

'Au-Rubrum' skin color is maroon and flesh color is red. Fruit size is 2 in. diameter and round in shape. Ripening date is mid-June. Tree vigor is good.

'Byrongold' produces a fruit with yellow skin and flesh. Fruit will develop a red blush during the latter part of ripening. It's shape is round and 2 in. diameter. Fruit are very firm and are of good quality. Ripening date is late June to early July and fruit color before they are ripe. Tree vigor is high, but it will have some problems with leaf scald. Chilling requirements are around 450 hrs.

'Excelsior' is an old native plum discovered by George Tabor of Glen St. Mary's Nursery. Both the flesh and fruit are yellow. The fruit size is about 2 in. The flesh is somewhat translucent and watery. The tree requires about 400 hrs of chilling in order to set fruit.

'Methley' is an older variety that is no longer recommended due to small fruit size, lack of firmness and susceptibility to plum leaf scald and other diseases of bacterial origin. It is self pollinating.

'Ozark Premier' produces a purple/red-colored fruit with red flesh. It is not recommended due to susceptibility to plum leaf scald.

'Robusto' has a ripening season in early June. The tree blooms in early March and requires from 400 to 500 chill hours. The fruit are red and the flesh is yellow.

'Santa Rosa' produces a purple/red colored fruit with red flesh. Santa Rosa is an older cultivar that is no longer recommended due to susceptibility to plum leaf scald and other diseases of bacterial origin.

'Segundo' is a red plum with yellow flesh. It needs about 400 to 500 hours of chilling to fruit. Ripening time is mid to late June and the fruit are somewhat soft.

Chilling Hours and Heat Units

"Chilling hours " or "chill units" refers to the hours of temperature below 45°F and above 32°F that occur while the tree is dormant. Deciduous trees require a certain number of these hours for buds to break in a timely manner and start the growing season that follows the winter cold period. It is a natural method of adaptation, thus higher chilling fruit tree cultivars grow and fruit in higher chilling locations. If a plum adapted to a northern area is grown in Florida, it will not break buds properly and adapt to our climatic cycle. Through the University of Florida's fruit breeding program, the 'Gulf' series of plum trees have been developed that are adapted to our mild low-chill winters (Table 1). They will fruit from the Fort Myers area to the panhandle of Florida, the lower southern regions of Georgia, and the warmer areas of the gulf coast states. These plums bloom with the 150 chill-hour peach cultivars at Immokalee, the 200-250 chill-hour peaches in Orlando, the 250-350 chill-hour cultivars at Gainesville and with the 400-500 chill-hour peaches at Quincy (Fig. 8).

Figure 8. Map showing average winter chill hours for the state of Florida.

Although the 'Gulf' series plums have a low chilling requirement, they need more warm days than peaches to break winter dormancy. This condition is referred to as a heat requirement, which has a period of night and day temperatures above 55°F and 65°F, respectively. For the 'Gulf' series of plums, this period should last from 1-2 weeks. Relating actual temperatures to chill hours and heat units is not exact, as these conditions vary throughout the winter and from year to year. However, temperature conditions are a general indicator of how a tree will perform in a certain area. During most winters in Florida, the 'Gulf' series of plums will not flower too early, nor be overly susceptible to spring freezing. Similarly, they will not flower or foliate late, or show other symptoms of inadequate chilling that can lead to reduced or no fruit set. Thus they have a wider adaptation than peach cultivars with similar chill requirements. They bloom before the standard Japanese cultivars in lower-chill areas of the state but in higher-chill areas they bloom with or after many of the early blooming high-chill Japanese cultivars.

Pollination

The 'Gulf' series plums, like most Japanese plums, are not self-fruitful but have been shown to be cross fruitful in all combinations (Fig. 9). Trees for pollination are planted in a ratio of 1 pollinator for every 5-8 cropping trees. Honey bees appear to be the main pollinator. Some fruit set may occur when pollinated with the wild plums. Cropping ability in the 'Gulf' plums is very high and fruit thinning must be done in order to obtain large fruit and keep limbs from breaking. Fruiting occurs both on spurs and along the previous season's shoots. These plums are precocious, often fruiting in the second year after planting.

Fruit Development Period

Fruit development period refers to the time between when the flower bud opens and the fruit is ripe. It is shorter during warmer growing periods and longer when the season is colder. It can be used as an indicator of when the fruit will be harvested (Table 2).

Figure 9. Plum bloom.

Bloom time for the 'Gulf' series plums generally is in late January in south Florida, early to mid-February in central and north central Florida, and mid-February to early March in north and north-west Florida.

Fruit Harvesting

Florida-grown plums are harvested by hand, normally from early May through early June. Firm fruit can be carefully bulk packed in a box, or placed in cell pack divider trays in a container. A tree will normally ripen its fruit over a 10- to 15-day period corresponding with the length of bloom and the efficiency of pollinators. Fruit of the 'Gulf' series are firm, but if picked late, they will either be soft or soften quickly. Proper harvesting time allows the fruit to ripen and develop sweetness off the tree with a shelf life of 1 to 2 weeks. It is best to cool fruit as quickly as possible after harvest. This can be done with either a hydro-cooling or forced cold air system. In smaller operations, a refrigerated cooler will work.

Yields

Plums should be planted with spacings either 15 x 20 ft. or 20 x 20 ft. within and between rows. This allows for about 145 to 149 trees per acre,

respectively. Plum fruit must typically be thinned to allow for satisfactory fruit size. Yield on a mature plum tree that has been properly thinned will be about 1 to 1 1/2 bushels or about 60 to 90 lbs of fruit per tree.

Orchard Establishment

Plums, like all fruit trees, should be planted in full sun. The best soil and location for plum culture is a well drained sandy loam located on hilltops with good air drainage for spring freeze protection. Other locations can be acceptable, although plum and especially peach rootstocks will die in soils that retain excess water. In addition, spring freezes are more likely to occur in low lying locations where cold air tends to settle. 'Nemaguard' and 'Flordaguard' peach rootstocks or plum / plum-hybrid rootstocks should be used to reduce the impact of nematodes. The use of nematode-resistant rootstocks is most critical in sandy soils. Fumigation for nematodes is not a realistic option for plums, peaches or nectarines. Fertile soils are preferred over non-fertile soils.

Orchard establishment of plums is similar to that of peaches and nectarines. Plums may be planted in rows 15 to 20 ft. apart. For long term ease of movement for tractors and equipment, a between-row spacing of about 20 ft. is preferred, but not necessary. An in-row spacing of 15 to 20 ft. is common. Twelve feet can be used but it will be hard to work between the trees once they have reached full size.

A soil test should be taken a year before planting. Although plums do not have exacting soil requirements, it is advisable to adjust soil pH to between 5.5 to 6.5. Soil test results will provide a recommendation on the addition of lime or sulfur based on the target pH. It is most efficient to apply lime or sulfur to soil after weeds or grasses have been removed and the soil has been tilled.

During late summer or early fall before tree planting, weeds in the planting row can be removed manually or with herbicides. If applying herbicides, do not till the ground until after weeds have been killed. Tilling the in-row strips will also facilitate tree planting, early weed control and early tree growth.

Tree Planting

Plant bare-root trees in December or January at the same depth they were grown at in the nursery. All roots should be covered by soil. Containerized trees can be planted any time, but if they are pot bound they are best planted when dormant so that the roots can become established before leafing. Water trees thoroughly at planting. During the first year after planting, the four main considerations are irrigation, weed control, fertilization, and rabbit or deer damage.

In most locations, irrigation is essential. Weed control is advisable, either by manual methods or by the use of pre-emergence and post-emergence herbicides. For homeowner plantings, manual methods of weed control may be satisfactory, while herbicides may be the method of choice for medium to large plantings. If herbicides are the method of choice, they may have to be applied throughout the year. Initially, a weed-free, in-row, strip about 3 ft. wide is satisfactory. It should be expanded to 5 ft. after a few years as trees grow larger.

Training, Pruning and Fruit Thinning

Training refers to shaping the basic tree framework, while pruning refers to removal of shoots and limbs to promote continued tree productivity. When planting a bare-root tree, training begins the first year by removing at least 1/3 of the top to balance it with the root system. This is called heading back. Ideally, trees should be 2 1/2 to 3 ft. tall after heading back. Most of the buds will break within 1 ft. from the top. Remove all buds below 18 in. height. Generally, 3 to 5 bud-shoots are equally spaced around the trunk to form the scaffold limbs. Shoots should be encouraged to grow at a large angle from the trunk. Scaffold limbs and vigorous shoots may be trimmed back or removed if they are tending to dominate the center. Branches that grow toward the outside form a strong tree framework. During the second and subsequent years, secondary limbs will develop from the primary 3 to 5 scaffold limbs.

Each year the tree will increase in size by several feet. Tree size should be kept within bounds by pruning. Most of the pruning is done when the tree is dormant during the winter months between

December and February. For the first few years, more new growth can be retained than in later years when trees approach their desired size. Pruning has the objectives of controlling tree height, eliminating branches that cross or tangle and allowing adequate light penetration to the interior. Unlike peaches, which are shaped like the outside of a bowl, the center of a plum tree is not removed. Mature trees are topped, limiting their height to around 7 ft., so fruit can be picked without the use of ladders. Summer pruning in June after fruit harvest follows the same objectives but less wood is removed. Many plum cultivars set fruit on long whips. These whips are cut back to 1-3 ft. to limit fruit load and prevent breakage. In addition to forming fruit on whips, older trees set fruit on 2-4 ft. spurs, so some of these can be removed to limit crop load (Fig. 10, Fig. 11).

Figure 10. Unpruned tree showing cluttered center, unrestricted height and low hanging limbs.

One of the most significant activities in stone fruit production is thinning the crop load in order to develop marketable fruit size. Pruning is used to reduce the amount of hand fruit thinning that would be necessary. Fruit are removed either by hand

Figure 11. Pruned tree with some center removed, the height limited and the lower limbs removed.

picking or beating the limbs with a piece of rubber hose or PVC pipe. This is done about a month after bloom when fruit are 3/8 to 1/2 in. diameter. The pit must not be hard or the thinning will not be effective. Bloom thinning or thinning when the fruit are too small is not done because plum trees will normally shed a large quantity of flowers and small fruit. Ideally, fruit should be spaced 3 to 6 in. apart. If the crop is light, only heavy clusters should be broken up, leaving fruit spaced closer. Since plums have a long bloom period, thinning cannot be done all at once. It lasts for a month and requires at least three visits to each tree. Generally all of the late bloom will fall off and not set fruit. With this in mind it is important to judge what the crop load will be and thin fruit accordingly. Thinning should not be done until most of the danger of freezing is over.

Freeze Protection

During winter dormancy, prior to bud swell, freeze damage seldom occurs to plum trees in Florida since minimum temperatures must drop below 5°F for injury to occur. However, crop damage can occur in late winter when flowers are exposed to sub-freezing temperatures. The most likely scenario for this damage is after the passage of a cold front. A clear, cloudless night sky allows the radiation of heat from the earth's surface to the atmosphere. The critical minimum temperature that a flower bud can tolerate is dependent on the stage of its development. During bud swell, flower buds can tolerate 25°F without damage. However, after flowers have opened

and/or the fruit have formed they can only tolerate 28-30°F. Even at these temperatures damage can occur depending on the duration of exposure.

For protection from freezing temperatures, trees can be covered with a propylene tarp or other material. However, covers alone will radiate more heat than an open situation so a heat source must be used. Water from microjets used for irrigation will provide an excellent source of heat. This trapped heat and fog will provide protection from very low temperatures. Electric heat sources such as light bulbs can also be used.

Another method of cold protection is to use sprinkler irrigation (Fig. 12). When water freezes it releases heat to objects it contacts. During many Florida freezes, sufficient water can be applied through overhead irrigation systems to protect flowers and young fruit from freeze injury. Water is continuously applied throughout the freeze until the ice is rapidly melting the following day. Rate of water application and coverage are critical for freeze protection. Some factors which affect the rate of water application include temperature, water vapor content of the air and wind speed. Generally, water volume must be around 1/3 in. per hour and wind velocities less than 10 mph. If insufficient water is applied, or sprinklers do not provide adequate coverage, then the amount of freeze damage may be greater than if no water had been applied at all. Disadvantages of freeze control with irrigation include the breakage of scaffold limbs and shoots with the weight of ice, the use of a large amount of water applied to the area, and the investment in large wells with diesel power, which has proven to be more reliable than electric power. A more thorough discussion of freeze protection can be found in *Protecting Blueberries from Freezes in Florida* at <http://edis.ifas.ufl.edu/HS216>.

Irrigation

Irrigation is necessary during the establishment year and is important to provide moisture during dry periods through the life of the tree. Drip, microjet, or overhead irrigation can be used, each of these having advantages and disadvantages. Drip uses the least amount of water and does not wet the foliage. In clay

Figure 12. Freeze protection with over-head irrigation, showing bent limbs from ice load.

soils of upper north Florida and the panhandle, water from a drip emitter will spread laterally to cover the root zone. However, in sandy soils a single drip line down the row will not wet the entire root zone due to vertical water movement. Microjets are similar to drip and provide better coverage of the root zone. Both of the low volume methods require maintenance to eliminate particles and/or precipitates that clog the orifices. Overhead will permit watering of between row cover crops, and it is easier to spot clogged nozzles with this system. It also serves as a freeze protection system. For homeowner plantings, manual watering is satisfactory. Irrigation twice a week of 2 gallons for a small tree and up to 8 gallons for a large tree is generally satisfactory.

Fertilization

Do not apply synthetic fertilizer at planting time. Fertilization should be light during the first year. Generally three applications of fertilizer are applied, during late winter about bud break, in June after fruiting, and in late August. Spread from 1/2 to 1 lb of 10-10-10 (N-P₂O₅-K₂O) evenly in an area about 2 to 5 ft. around each tree. Micronutrients can be supplied by using a 10-10-10 with micronutrients. For the first year, fertilize at the rate 1 lb of 10-10-10 per tree. During the second year, the amount of fertilization can be doubled to about 2 lb, with mature trees receiving 3 or more lb per year. Depending upon leaf and soil fertility levels, ammonium or calcium nitrate can be substituted for a 10-10-10. However, the amount of actual nitrogen should stay about the same. For example, 10-10-10 is 10% nitrogen and

ammonium nitrate is 35% nitrogen. Thus, it takes about 3 units of 10-10-10 to equal one unit of ammonium nitrate. The choice of 10-10-10, with micronutrients or any other fertilizer or fertilizer combination can be based on leaf nutrient levels. Optimum leaf nutrient levels are presented in Table 3.

Insects

Mention of a pesticide is for identification purposes and does not imply endorsement of that product. Always read and follow label directions exactly when using any pesticide. Current information on pesticide use can be obtained from local County Extension Offices.

The insects that are of major concern to plum growers are plum curculio, San Jose scale, mites, and peach tree borers. Control of these pests is not difficult, but timing, method of application, and knowledge of the insect's biology is critical.

Plum curculio is a weevil that emerges during the early part of fruit development (Fig. 13). The female will make a cut on the small plum fruit and deposit an egg in the flesh. The cut is crescent shaped and heals over, forming a light brownish scar within 12 hours (Fig 14). The egg rapidly hatches and the small, whitish worm eats its way toward the pit of the fruit. If the pit or stone has not turned woody or hardened but is still soft, the worm will enter the gelatinous material of the seed's embryo and feed (Fig.15). The small plum will then turn reddish and drop from the tree. If the worm did not reach the seed before pit hardening, it will tunnel around the pit and then emerge. The tunnel will hold brown fecal matter and the injury will increase chances of the fruit ripening prematurely and rotting. When the worm exits the fruit, it will pupate in the ground and emerge as an adult in as soon as 60 days, if temperatures are warm enough, and continue the cycle. Worms of succeeding generations can be inside the fruit when it is harvested and there is little evidence outside of what the fruit is like on the inside (Fig. 16).

The time to make decisions about an insecticidal spray is when the adults emerge. Monitoring populations can be done with Tedders traps placed in the orchard. Information on these traps is found in the publication *Traps for Monitoring Plum Curculio and*

Figure 13. Adult female plum curculio.

Figure 14. Half-moon cut on fallen fruit with gummosis.

Figure 15. Curculio larvae eating the embryo. Rotting at the point of entry, with gummosis.

Figure 16. Multiple cuts for egg laying.

Pecan Weevils at

<http://ufinsect.ifas.ufl.edu/weevil-trapping.htm>.

Natural events, such as shuck split, can also indicate when the females are present and beginning to lay eggs. As the plum enlarges, the shuck will be forced to split off the fruit. This shuck is the outside of the flower where the anthers or pollen-holding structures existed. By this time, the anthers have dried and are on a ring that earlier broke off the old flower base. It is now carried around the lower 1/3 of the fruit and has become rather tight fitting due to fruit expansion. When the fruit become large enough, the shuck ring breaks and falls off, thus the term shuck split. In wild plums, populations of plum curculio are present and follow a natural cycle. Shuck split generally coincides with the emergence of the curculio, so observing the wild plums for the start of this event, is a factor in spray timing.

Another indicator of emergence is portions along the plum leaf edges or areas on the small fruit having been eaten by the curculio. The insects usually start feeding a few days before they lay. Watching the fruit for the crescent shaped cuts reveals when the female is laying eggs. Generally, the female will start cutting fruit toward the outside of the canopy and cut each succeeding fruit moving down the limb toward the interior of the tree. Often, her first attempts at laying will not form a larva inside the fruit and the crop can be adequately protected with an insecticide at the first sign of cutting. It is possible to see the curculio weevils in the tree. They are about 4mm in length and have a long snout. Moderate winds will blow

them out of the tree, so they are easier to spot in the morning or evening. They are not easy to find and will move around to avoid being seen. A good method to observe the insect is to place a white sheet under the tree and shake the branches. The weevils will fall and can be spotted on the white background.

The most common insecticide used for curculio is Imidan however, other products or natural pyrethrum are labeled for use. The general rule for control is to make a foliar cover spray when the curculio emerge and repeat in 10 days to two weeks to kill those that have emerged after the first spray. The spray need not drench the tree to run-off but should wet the foliage and fruit. More information and current recommendations can be obtained from your County Extension Office or the publication, *Insect Management in Plums* at <http://edis.ifas.ufl.edu/IG078>.

San Jose scale is a piercing sucking insect that can be devastating to trees if populations are allowed to establish. After hatching, the female probes through the bark and sucks plant juices for food. About one week after inserting her mouthpart, she will develop a waxy coating. Once this is developed, she cannot be killed by insecticidal poisons. The hatch does not occur all at once which further limits the effectiveness of poisons. San Jose scale appears as grayish, raised waxy spots on the tree bark. Unlike the larger white peach scale that can be easily spotted in the late summer because of its snowy white male populations, San Jose scale is not easy to see. However, populations can be confirmed by slicing a small sliver of bark off at the cambial layer and observing purplish dots on the limb where the female has been feeding (Fig. 17).

Figure 17. San Jose scale on the bark with exposed red coloration where the female has probed and is feeding in the cambium.

The most effective method of control is to apply one or two applications of 3% dormant oil when the trees are dormant. Oil will kill males, attached females and those that are crawling before they adhere to the tree. It is critical to spray trees every year, even when they are first planted. The best method of spraying is to use a hand gun at 300-500 psi and thoroughly soak all areas of the tree. The spray should penetrate into crevices of the bark and be applied to runoff. Air blast sprayers are often used in large orchards but it is important to have windless conditions, slow ground speeds, large nozzles, and perfect spray patterns. Spraying should be done after winter pruning since coverage will be easier with some of the wood removed. If infestations are heavy, two oil applications can be made. Built up scale populations will have insects on top of each other, thus the first spray will only kill the top layer. In this case the first application is applied in November or December, before the January-February spray, or two weeks after the one in January. If spraying is done in the late fall, trees should be pruned early.

Oil at the 3% rate is only used on trees before new leaves have emerged because the oil will burn foliage. However, it is possible to apply this oil when leaves are starting to shoot out but before they have expanded, with only minor damage. Products such as Sun Oil, or other more highly refined brands with low sulfur content, will be a better choice in this circumstance. Oil applications should not be made if the following night temperatures will fall below 28°F during the succeeding 4-day period. Similarly, oil should not be applied if day temperatures will exceed 85°F. Oil spreads and applies easiest when temperatures are above 60°F. Rainfall should not occur within 24 hrs. For more information, see the publication *Insect Management in Plums* at <http://edis.ifas.ufl.edu/IG078>.

Tree borers. The lesser peach tree borer (*Synanthedon pictipes*) and the peach tree borer (*S. exitiosa*) are potential pests of plums. Gummosis with frass, or sawdust within a gum mass, is an indicator of the presence of borers. They can be exposed by digging under the bark behind the gum mass in the tunnels where the white, caterpillar-like worm will be feeding (Fig. 18). When they are found, borers can be killed by hand. In commercial plantings,

insecticidal applications of Lorsban may be applied to the trunk and other areas where borers are feeding. Usually, in Florida, the peach tree borer is more common and it is found in the trunk near ground level. Borers prefer peach to plum wood, and since most plums are grafted to peach rootstock, borers are often in the first section of trunk that is peach before the graft. Lorsban should be applied as early as possible in June after fruit harvest. It is a restricted pesticide and all labeling instructions apply. For more information on borers, see the publication *Peachtree Borers in the Home and Commercial Peach Orchard* at <http://edis.ifas.ufl.edu/IN489>.

Figure 18. Lesser Peach Tree Borer with tunnels and gummosis containing frass.

Two-spotted spider mite (*Tetranychus urticae*) and **European red mite** (*Panonychus ulmi*) can sometimes build up in plum trees during dry weather in April to June. They are less than 1/16 in. diameter and orange to red in color. Natural enemies (including an imported ladybug species) can often keep mites under control. Under no circumstances should pesticides be considered unless populations build up to over 10 mites per leaf.

Catfacing insects (many species of **tarnished plant bugs, stink bugs and leaf-footed bugs**) can cause considerable damage to developing fruit. These are medium large (3/8 to 3/4 in. long) sucking insects that cause fruit deformities and reduce fruit marketability. Catfacing insects can be especially damaging to fruit during the 14 days prior to harvest as their probing may lead to brown rot infections. Insecticides such as Imidan and the pyrethroids are labeled for use, but pre-harvest restrictions must be

observed. Generally, the insecticides used to control the plum curculio will somewhat limit stink bug build up. Controlling succulent weeds that these insects feed on will also help reduce populations. However, it is not uncommon to see many of these insects from a second or third generation appear near fruit harvest. One properly timed spray when large quantities of these insects are feeding in the trees will do much to aid in their control. Often, living with some damage is the most practical approach. Traps or biological control measures may be considered. More information can be found in the paper *Monitoring Stink Bugs with the Florida Stink Bug Trap* at http://ufinsect.ifas.ufl.edu/stink_bugs/stink_bugs.htm.

White peach scale (*Pseudaulacaspis pentagona*) has a broad host range, including plum. It can be found on trunks and limbs of peach, nectarines, and sometimes plum. White peach scale can be easily spotted in the late summer and fall by snowy white male populations located near the female colonies (Fig. 19). At this time, populations are increasing and the trees are losing foliage making spotting easier. The females appear as white raised spots, 1/16 to 1/8 in. diameter, with a dark center dot. This insect can be debilitating but is not often found on plum. The best control is the use of dormant spray oil during the winter months and is the same as discussed in the San Jose scale section.

Figure 19. Heavy population of male white peach scale. Notice the snow-like appearance.

Western Flower Thrips (*Frankliniella occidentalis*) is a minute, barely visible insect that can cause blemishes to nectarines and plum fruit. Homeowner control is rarely warranted, but

commercial control is sometimes necessary to produce fruit that is free of blemishing.

Diseases

Bacterial Spot, caused by *Xanthomonas campestris* pv. *pruni*, primarily attacks leaves, but also infects shoots and fruit. Leaf infection begins with water soaked spots that change from yellow green to purple to dark brown spots that eventually fall out and form a hole. On fruit, lesions and gummosis occur. Twig cankers also may cause a knobby appearance and may persist several years until twig death. The best control is to use bacterial spot-resistant cultivars.

Bot Rot is caused by *Botryosphaeria dothidea*. It is a fungal disease that causes gummosis on the trunk and major limbs (Fig. 20). This disease is minimized by maintaining good sanitation. Remove all fruit at harvest and remove all pruning wood from the orchard environment as this organism can sporulate from decaying plant tissue.

Brown Rot is caused by the fungus *Monilinia fructicola*. Brown rot can attack blooms, fruit, leaves, and stems. It over-winters on blighted stems and mummified fruit. Brown rot can be a problem during wet weather, but disease pressure will be less severe than it is on peach. Infections will appear as masses of brown to brown gray spores on infected tissue. Practices designed to increase airflow throughout the tree canopy and to remove previous year's infected tissue will reduce the incidence of brown rot. There are no plum cultivars resistant to brown rot, and fungicide sprays may be necessary during wet weather.

Oak Root Rot is caused by the fungus *Armillaria mellea* and/or *A. tabescans*. The disease is especially problematic in locations that harbor the remnants of oak, hickory, or forest tree roots. Thus, it is best to plant on land that has been cleared of trees for at least 20 years. Root death of plum trees is often accompanied by mushroom bodies that may be visible under the tree canopy. There is no good source of chemical control, but plum rootstocks are not susceptible.

Figure 20. Gummosis on peach caused by *Botryosphaeria dothedia*.

Plum Leaf Scald is caused by the bacterium, *Xylella fastidiosa*. This disease is characterized by a plugging of the xylem vessels by the bacteria. The disease is vectored by leafhoppers. Before planting, remove the wild plum trees within several hundred yards of the orchard. The first symptoms are yellowing around the leaf margins and browning and desiccating of the leaf tips. This is followed by shoot dieback and tree death. The best solution is to use plum-leaf-scald-resistant cultivars.

Rabbits and Deer

Rabbits and deer can be serious impediments to the establishment of plums. Both animals will eat the bark, especially in the spring, and deer will break limbs. At planting time, various forms of rabbit guard or aluminum foil can be used to thwart rabbit damage, while a deer fence may be required where deer pressure is high. The major pest problem

associated with plum culture at the North Florida Research and Education Center has been deer. In rural areas or in areas where deer populations exist, it may not be possible to grow plum trees without protection from this animal.

Table 1. Estimated chill hours for the 'Gulf' series plums.

Cultivar	Time (hrs)
'Gulfbeauty'	225
'Gulfblaze'	250
'Gulfrose'	275
'Gulfruby'	225
'Gulfgold'	250

Table 2. Fruit development period of the Gulf series plums.

Cultivar	Time (days)
'Gulfbeauty'	75
'Gulfblaze'	95
'Gulfrose'	95
'Gulfruby'	82
'Gulfgold'	110

Table 3. Optimum levels of leaf nutrients of plum from leaves collected during mid-summer from non fruiting spurs.

Element	Symbol	Optimum Range
Nitrogen	(N)	2.4 - 3.0%
Phosphorous	(P)	.14 - .25%
Potassium	(K)	1.6 - 3.0%
Calcium	(Ca)	1.0 - 1.5%
Magnesium	(Mg)	0.3 - 0.8%
Boron	(B)	25 - 60 ppm
Iron	(Fe)	100 - 250 ppm
Zinc	(Zn)	20 - 5 ppm
Copper	(Cu)	6 - 16 ppm
Manganese	(Mn)	40 - 160 ppm
Molybdenum	(Mo)	20 - 200 ppm
Source: Jones, J.B, B. Wolf and H.A. Mills. 1991. Plant Analysis Handbook, a practical sampling, preparation, analysis and interpretation guide. Micro-Macro Publishing, Inc. ISBN 1-878148-001.		