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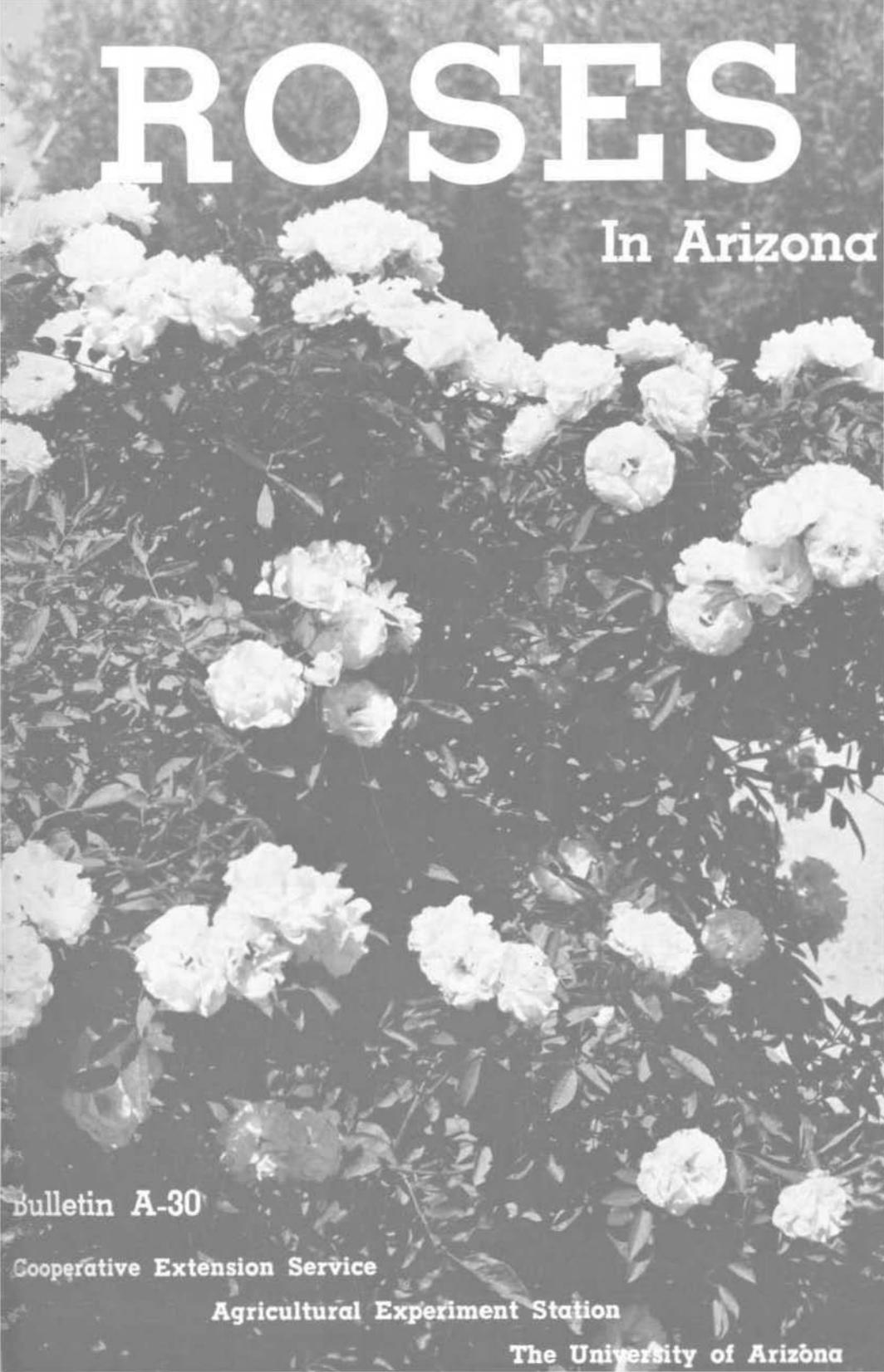
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ROSES



In Arizona

Bulletin A-30

Cooperative Extension Service

Agricultural Experiment Station

The University of Arizona

ROSES

In Arizona

Harvey F. Tate
Extension Horticulturist

By

R. B. Streets
Plant Pathologist

The University of Arizona

Roses are grown in every section of Arizona, but each garden or yard planting is a "law unto itself." If you observe a few simple rules of rose culture that apply to your own local area, you should get excellent results.

Plan Before Planting

Roses grow best in full sunlight. If there is shade, it should be on the plants in the afternoon.

Do not locate the rose garden near large trees, tall hedges, or close to other plants. The roots of these plants will compete with the rose bushes for nutrients and moisture. Dense shade from trees or overhanging roof eaves is

unfavorable.

Roses can best be grown in a bed set aside for this purpose rather than in individual holes or in combination with other plants.

If possible, locate the rose garden in an area where there is good drainage. Or prepare the bed so that drainage is assured. Avoid planting roses close to the

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(See Contents on page 22.)

south or west side of the house or patio wall as the reflected heat in the summer will generally damage the rose bushes.

Control any Bermuda, Johnson, or other perennial grasses or weeds and take steps to prevent them from re-infesting the area before rose bushes are set out. When preparing a bed in existing Bermuda turf, it may be necessary to kill grass roots by soil fumigation.

Preparing the Soil

Roses will do well in a wide range of soils. However, growth is best when the soil is relatively high in organic matter and has adequate fertility. Good drainage, to assist in eliminating salt and preventing its accumulation, is desirable.

To improve very sandy soils, mix in several inches of a clay loam soil having the qualities previously mentioned. For extremely heavy soils, mix in several inches of a sandy-type soil. Do not pulverize the soil in the mixing process.

In preparing the planting holes in good Arizona soils, particularly in the Salt River, Yuma, and Casa Grande valleys, and in areas where soils are similar to these, only a few simple steps are necessary. Dig the holes 15 to 18 inches deep and 15 to 18 inches in diameter. At this depth, insert the shovel blade one spade length deeper to be sure that there is no hardpan to a depth of approximately 24 inches.

Generally this soil does not need to be removed. If, however, a hardpan exists in the top 24 inches, remove the soil and replace with coarse, cloddy top soil in the hardpan zone. Do not replace with pulverized soil. Refill the hole.

After 1 or 2 shovelfuls have been replaced, sprinkle 1 to 2 cupfuls of a single or triple superphosphate or a high phosphate fertilizer such as 16-20 or 11-48 into the bottom of the hole. Continue filling the hole until just deep enough to accommodate the rose bush, or approximately 6 to 8 inches from the top. Then make a slight mound in the center.

Place the crown of the root system on the mound and spread the roots around

and down the sloping sides in their natural growing position. The crown should be about 2 inches above the desired height to allow for settling during first watering.

Carefully add enough soil to fill the hole. Firm the soil around the roots. Continue to add and firm the soil until the hole is filled to 1 inch from the top.

Apply water slowly to soak the entire soil mass disturbed in making the hole. If the soil settles so that the crown of the plant is below the intended level, gently lift the plant to the proper level and rewater by probing the hose tip into the soil around the roots as the water is running. After the water has receded into the soil, finish filling the hole with soil to the desired level.

Special soil preparation is necessary in areas where there is caliche, shallow gravelly soil, hardpan, or generally poor soil. In such areas, prepare the bed by removing the soil to a depth of 24 to 30 inches. Apply 3 to 4 inches of manure and 3 to 4 inches of soil in the bottom of the hole and mix thoroughly, but do not pulverize. Then fill with a mixture of one shovel of rotting organic matter to five shovels of soil. If the soil contains caliche, or is of very poor quality, replace it with good garden loam.

If fertilizer is needed after the bed is filled, it may be applied as superphosphate or a mixture containing low nitrogen and high phosphorus. The material may be sprinkled over the bed surface at the rate of 2 to 5 pounds per 100 square feet and worked into the soil a spades depth. Neither of these operations is necessary in areas that have good, deep, loam soils.

If drainage is a problem, dig a hole down through the hardpan or caliche layer to determine if good drainage can be established. If proper drainage can be made, continue soil and hole preparations as indicated previously, after all caliche material has been removed. If good drainage cannot be made, select a different location for the rose bed or garden.

If salty soil is a problem, the affected soil should be removed and replaced with good top soil. In this case, the holes should be 2½ to 3 feet in diameter to insure replacement of an adequate volume of top soil. Use this procedure also where soils are rocky.

Soils low in organic matter or fertility do not create a serious problem. They can be gradually improved by proper mulching and fertilizing.

Plant at Right Time

Rose bushes should be planted four to five weeks before the buds start to grow. This allows the roots to become established before top growth starts.

In southern Arizona, the best time to plant is from the last half of December through February. Although it is generally not recommended, roses can be planted until the first of April. In northern Arizona, plantings should be made during March and April.

Plant rose bushes as soon as possible after getting them from the nursery. Cut off any broken or injured roots and cut the canes back to about eight inches in length before planting. Keep roots of new plants wrapped in wet sacks or protective wrapping until they are planted.

Although most rose growers prefer planting bare root roses, canned plants are available in nurseries at other times of the year.

Select Good Plants in Good Condition

Practically all the roses planted in Arizona are bare-root stock. Most varieties are budded onto a hardy root stock which is adapted to Arizona soils. It is wise to purchase No. 1 or No. 1½ grade field-grown plants. Never buy lower grades or inferior plants.

Examine the roots to be sure they are soft and pliable and not dried out. The bark on the canes should be plump and green and not shriveled or dry.

Often plants are held in warm, dry salesrooms with very little moist protective wrapping around the roots. This allows them to dry out quickly and become damaged. Rose plants subject to this type of storage make very poor growth or fail to grow at all.

Rose bushes dipped in wax are not satisfactory for the southern Arizona counties because of wax burn that occurs on the canes during the hot weather following planting.

Allow Enough Space

In the mild climate of southern Arizona, plant hybrid teas and hybrid perpetuals from 3 to 5 feet apart.

Space floribundas according to their potential size or use. Those growing from 18 to 24 inches in width are usually spaced 3 feet apart in the row.

The small polyanthas are normally spaced 12 to 15 inches apart especially where mass effect is desired.

The beauty of climbing roses is dependent upon large masses of blossoms. Vigorous growing climbers need to be spaced 8 to 10 feet apart for best development.

Climbers will grow well on an east or north wall exposure, but are usually damaged by direct or reflected heat on a south or west wall unless they are on a wooden trellis 6 to 12 inches or more from the wall. In this manner, the heat damage is reduced or minimized but not eliminated by the air spaces between the plant and wall.

One of the principal causes of unsatisfactory results with tree roses in southern Arizona is the effect of exposure of the trunk to the sun. The injury sustained varies from slight sunburn damage, which checks growth of the stem tissues on the southwest side of the trunk, to cracking or serious burning causing death of the tissues affected.

Either of these types of injury can be prevented by shading the south and west sides of the trunk with cardboard or wood lath. Painting the trunk with white cold water paint may be done but is less effective.

How To Plant Roses



1. Prepare soil in bed or hole 6 to 8 weeks before planting. At planting time, remove the soil from a hole that is large enough to receive roots when spread in a normal position.

2. Form a cone of soil over which the roots will fit.





3. Examine roots for defects. Prune off broken tips. Discard plants with crown gall or nematodes on the roots.

4. Place roots over the cone of soil in normal position and cover by sifting moist soil in and about them.





5. Fill the hole with good top soil that has been firmed about the roots. Be sure that the bud union is about one inch above the soil level after the soil has settled and has been mulched.

6. Leave 3 or 4 canes on the new plant and cut these back from 6 to 8 inches in length.





7. Irrigate immediately and thoroughly after planting. The plant may be covered with a piece of burlap for several weeks until the roots become established. Water lightly twice a week for the first month.

Transplanting Old Roses

Roses of any age that are healthy and have grown well can be transplanted. Generally, however, transplanting roses is not recommended since most good varieties are inexpensive and are available each year. Good thrifty bushes from one to three years old are best for transplanting. Old, stunted bushes that are making poor growth are apt to be diseased and should not be moved to a new bed area. Therefore, transplanting should be re-

stricted to those bushes that are healthy and have considerable specific value.

The dormant season is best for transplanting. Small bushes can be moved without balling, but larger specimens should be transplanted by taking a ball of soil with the roots.

The top of the bushes to be moved "bare root" should be cut back two-thirds. In digging, save as much of the root system as possible. Tops of "balled" roses should be cut back at least one-half before being moved.

Irrigating

Provision for watering must be made when the plants are set out. Generally, the rose bed, trench, or individual plant is flood irrigated in a shallow basin. The basin or bed should be 2 or 3 inches below the ground or lawn surface. However, rose beds in areas where flood

irrigation is used should not be lower than the soil surface or the plants will be over-irrigated. This often causes the plants to become chlorotic.

At each irrigation, the water should penetrate the soil to a depth of 2 to 3 feet. The amount of water required de-

depends on the type of soil. Irrigate slowly to insure adequate penetration through the entire root zone. This is important not only to supply moisture to the entire root zone, but also to leach salts out of the beds.

After planting, it will be a week or two before the plants will need watering again, depending on the age of plants, the planting depth, and kind of soil. Water the plants again when the leaves first show signs of slight wilting. If plants are watered too often, the leaves will turn yellow and become chlorotic and plants will become unthrifty.

Observe and learn how often to irrigate the plants in your garden for best

growth. During the warmer days of spring, fall, and throughout the summer, loam soils in most of the state will have to be irrigated once every 10 to 14 days, except in some of the lighter, shallow or rocky soils. These will require an application every 5 to 10 days.

In the shorter days of winter, irrigate once every 15 to 21 days in lighter soils, and every 21 to 30 days in the heavier soils in the Salt River Valley. During hot, dry spells and windy weather, the plants may require water more often.

In the southern counties, it may be desirable to induce dormancy in the fall by withholding irrigation from mid-November until the plants are pruned.

Cultivating

The principal reason for cultivation is to keep grasses and weeds from successfully invading the rose beds. Pull weeds, or cut by shallow scraping of the surface so as not to disturb the feeder or roots

developing and functioning near the surface.

Shallow root development is typical of plants properly mulched.

Remove bermuda or any other grasses or weeds from around the plant. Cultivate only the top 2 to 3 inches of soil.





Apply to each plant 2 to 3 ounces of a commercial fertilizer mixture (1) after pruning, (2) after growth is a few inches long, and (3) again in the early fall. Keep a mulch of barnyard manure or other organic matter all during the season.

Fertilizing

It is better to apply small amounts of fertilizer to roses often, rather than to give heavy applications once a year. Roses need to be supplied with nitrogen and phosphorus. Most Arizona soils contain enough potash, so this does not need to be added as a fertilizer.

Fertilize established plants several times during the season with 2 ounces (2 tablespoonfuls) per plant of a fertilizer material such as 10-10-0, 10-20-0, 16-20-0, or commercial rose foods of equal nutrient content. Put on the first application in the spring after pruning and cleaning the beds; another when the new growth is 3 to 4 inches long; and a third about six weeks later. For fall blossoms, fertilize the plants between the 1st and the 15th of September, depending on the area.

Liquid rose fertilizers which are readily available to the plant are now used by many rose growers as sprays applied to

the plant foliage. These liquid materials are used to advantage alternating with dry soil applied materials. Follow directions on the container when using these fertilizers.

Barnyard manure is an excellent mulching material for roses and also supplies part of the fertilizer requirements. Apply it as a mulch about 2 to 3 inches deep after the roses are pruned and beds are cleaned up in the spring. As the manure mulch decomposes and the layer thins out apply additional amounts.

Other mulching materials such as peat moss or leaf compost may also be used. A mulch should be maintained on the rose bed throughout the year.

If poultry, rabbit, or sheep manure is used as the mulch, the application should not be over an inch in depth. *The manures should never be dug into the soil.* Other good mulching materials are dried grass clippings free from seed stalks, rotting straw, leaves and peat moss.

Pruning

The main purposes in pruning roses are to cut-out dead and diseased wood, thin out weak and crossing canes, head back the more vigorous canes, and shape the bush. Allow the bushes to grow rather large if a mass display of blossoms is desired.

The question of how much to cut back a rose bush is always of much concern. All healthy, live canes will produce blossoms from 4 to 6 years or even longer.

When canes fail to produce good blossoms, they should be removed by cutting back to the ground and allowing new canes to replace them. If old canes are left in the bush too long, it may be difficult to get new canes to start near the base of the bush and the plant becomes leggy and unattractive.

Examine the plant to see if there are any live, healthy buds near the base of

the cane. If not, do not cut the cane below a good bud or lateral branch.

Never leave a stub when pruning. To prune the tops, make the cut within about one-fourth inch of the bud and on a slight angle away from the bud.

A moderate thinning out of old canes each year will encourage the bush to develop new canes from the base. When removing old canes, cut as close to the crown as possible.

With few exceptions, rose bushes tend to grow upright. They can be made to spread by always cutting back to outside buds or lateral branches. Outside buds are those on the outside edge of the branch or cane, whereas inside buds face the inside of the plant. If the plants are too spreading, the cut should be made at the inside buds or branches. This will give a more upright growth.

There is a wide difference in the growth habits of rose varieties. It is almost impossible to set a general pattern as to the height to prune a plant or the number of canes that should be left.

Taller-growing varieties such as Presi-



This is a 2 year old bush before pruning. Prune during the dormant season at least 3 to 4 weeks before growth starts. On young plants or during mild winters, plant may still have some green leaves.



Above is the same bush after pruning.

dent Herbert Hoover, Buccaneer, and Texas Centennial produce long canes which will bear heavy crops of flowers. These and other varieties of this type should be allowed to grow taller and with a wider spread than less vigorous varieties.

The Peace variety should definitely not be cut back too severely. Many varieties flower poorly and often the canes die back if they are pruned too severely.

Types of Pruning

There are three principal types of pruning for rose bushes:

Heavy Pruning—Thin to three or four canes, 6 to 8 inches high. This produces (when disbudding is practiced) a few very large, long-stemmed blossoms of show quality. With this method, the bushes are often short-lived in hot climates.

Moderate Pruning—In the warmer parts of the Southwest, better growth of the bushes and more flowers are produced by moderate pruning every year, leaving five to twelve canes about 18 to 24 inches high. This develops a much larger bush that shades the ground and results in less injury from heat. This method is best suited to the average garden.

Light Pruning—Light pruning requires a minimum of cutting. Plants are allowed to remain three to four feet in height after pruning. This type of pruning produces a profusion of showy, short-stemmed blossoms. Plants pruned in this manner are best used as flowering shrubs. These large bushes are very vigorous and productive, but require wider spacing than smaller bushes, unless a hedge is desired.

Hybrid Teas

Prune hybrid teas in later winter or early spring just before growth starts. It is best to wait until the severest winter weather is over.

In some areas, growers do not prune until the buds have swollen or even started new growth. Pruning earlier may start new growth which may be damaged or killed by late frosts. This is especially true in the middle and high elevation areas of Arizona.

To start the job of pruning, cut out any dead wood or stubs. Be certain to cut back to live wood. Next, remove any diseased or malformed canes. Then cut out any weak or spindly branches or canes. If there are too many canes in the center, thin these out to the desired number by removing the older canes.

Make all cuts clean and do not leave stubs. After pruning, vigorous bushes should have from 5 to 8 canes. If the bush has a good spread, up to 12 canes can be left.

Next comes the job of cutting back the top. If the moderate pruning method is used, plants one or two years old with moderate vigor may be cut back to 15 to 24 inches. Cut more vigorous plants back to 18 to 36 inches.

As the bushes grow older, the height and width (or size) will vary according to the space available. As a rule, cut back the new growth of canes about one-third. If there are any side branches, save two to three well spaced ones and cut them back to 4 to 6 inches in length.

Mohave, Tiffany, Sutter's Gold, and President Hoover are examples of varieties that tend to grow very upright. These plants should be thinned out in the center and the remaining canes cut back to outside buds or laterals.

It usually takes the rose grower several years to learn how to properly handle each variety. New varieties are sold each year, and it is necessary to prune these carefully until the habit of growth is determined.

The bud for new shoot growth is formed in the axil of the leaf. The flower bud is formed at the top of the new cane. At pruning time, these old flowering heads and older canes should be removed and the new canes saved for later flowering wood. If old canes are not removed for a year or two, pruning becomes a major job.

If the top growth is allowed to become too thick, there will be very little, if any, growth of new canes from the base of the plant. The correct balance of pruning, whether it be severe, moderate, or light, is to keep the bush producing an adequate number of long, healthy new canes for an abundance of flowers every year.

Thin out the new growth in a rose bush to allow enough light and air to reach all parts of the plant. Keep as much flowering wood as the plant can support to produce acceptable blossoms. More branches will mean more but smaller, shorter stemmed flowers.

In an established bush, use strong, new canes to replace the older ones. In replacing the canes, or cutting back the top, do not destroy or change the general shape of the bush unless it will improve it.

In pruning vigorous rose bushes, be careful to examine the strong growth. Suckers coming from below the bud union should be removed at any time during the season as they are noticed. The sucker growth canes are tall, rather slender, light green in color and the leaves are smaller than those of the budded varieties.

Floribundas

Floribundas are pruned differently than hybrid teas. Floribundas vary in height from 12 to 15 inches to 5 or 6 feet. The bushes are more compact and usually are grown for the mass effect of the flowers. The canes are smaller and when pruning more of them should be left.

In beds or hedges where only one variety is planted, prune the plants to keep them uniform in size and height. Thin out the tops and cut them back just enough to encourage new wood to grow in the bush, or enough to control the plants for the purpose for which planted.

Floribundas produce numerous flowering heads that need to be thinned out at the end of the season. As the plants get older, the older canes should be replaced with new ones. The floribundas can be pruned to hold them at a uniform height to produce a hedge effect.

It may be necessary during the season to cut back the over-vigorous canes to control the height and plant shape. If there is no need to control the height or shape, very little pruning is necessary.

Grandifloras

Grandifloras are pruned the same as the taller floribundas.

Others

Large bush roses such as Harrison's Yellow, the Rugosas, Austrian Copper, and other species grown for large bushes need little or no pruning except removal of all dead wood. If the plants become too large, cut out the excess growth to reduce the plant size. If the canes are branched, they may be cut back to laterals. Never cut off all the tips of the canes.

Climbers

Climbing roses are pruned to make them fit the trellis, pergola, fence or place where they are being grown. These roses blossom on either one and two year old wood. Climbers may be pruned during the dormant season or in the late spring or summer after flowering, preferably the latter.

Plants that have not been pruned for several years usually are thick and bushy with new and old canes. These should be pruned while dormant as it is easier to see the canes and laterals that should be pruned out or cut back. They can be taken out with minimum damage to other canes. Pruning at this season will remove some canes that would flower in the spring, but if properly done, ample flowering wood can be left.

Plants that are not too bushy should be pruned after blooming. Remove the older grey-colored canes and save the healthy green ones. Laterals can be cut back to 8 or 10 buds. The long canes should be trained by arching or tying them in a horizontal position. This makes every bud produce a flowering branch.

Some of the very vigorous varieties such as cl. Herbert Hoover, Belle of Portugal, Mermaid, Banksia, and Cecile

Brunner should be trained over a fence, pergola, porch, or garage roof where there is ample room to spread. These varieties are best in mass effect. Remove the dead and old canes after flowering.

Climbers such as Paul's Scarlet, Blaze, Silver Moon, American Beauty, and American Pillar should be pruned after blooming, leaving as much flowering wood as possible in the plant.

Seal Cut Ends

When the pruning job is completed, all cut ends of the canes larger than a

pencil should be covered with a sealing compound. A sealing compound with an asphalt base is best as this prevents cane borers from getting in the ends of the canes.

Don't Over-Prune

In caring for your rose bushes, prune moderately and try to reason out what you are doing. *In case of doubt do not prune!*

There are several different types of roses. Select the type, or types, best adapted to your area. Then choose varieties of these types that are hardy and easy to grow.

Floribundas and Polyanthas

Floribundas and *Polyanthas* have gained in popularity in Arizona until they are about equal to the hybrid teas. Both the floribundas and polyanthas produce flowers in clusters. The floribundas are known for their vigorous growth and profusion of medium to large size blooms. These plants are very hardy and many varieties bloom almost continuously. The polyanthas are small growing bushes with clusters of small flowers. The plants generally are not as hardy as the floribundas.

Grandifloras

Grandifloras are the newest class of roses. The plants are generally vigorous and tall growing. The flowers are similar in form to those of the hybrid teas, but are usually borne in clusters, similar to the floribundas, on stems long enough for cutting and arranging.

Hybrid Teas

Hybrid Teas are one of the most popular roses grown in Arizona. They provide excellent cut flowers, and in the warmer sections of the state, they bloom almost every month of the year.

Hybrid Perpetuals

Hybrid Perpetual roses are vigorous and cold hardy. Their main period of bloom is a few weeks in the spring, but some varieties will have a few flowers again in the fall.

Shrub Roses

Shrub Roses include the rugosa, the species roses and other old-fashioned favorites such as the moss, damask, and cabbage.

Climbing Roses

Climbing Roses may be either hybrid teas, hybrid perpetuals, floribundas, or rambler varieties. Each of these have long canes and need special handling. The flowers may be borne in clusters or on single stems, depending on the variety and method of training.

(Prepared by J. N. Roney, Extension Entomologist)

Many insects attack roses in Arizona. The most important ones are aphids, thrips, red spiders, flat-headed borers, and leaf-cutter bees. Effective methods can be used to control all these insects except the leaf-cutter bee.

When using chemical sprays and dusts for control, be sure to follow carefully the directions on the container.

Aphids

Aphids on roses may be of several different species. They appear as small, soft globular shaped insects which collect in large numbers on the new growth shoots, under leaves, and on new flower stems and buds. Aphids may appear any time of the year but usually are more abundant soon after new growth appears in the spring of the year.

Aphids suck the juices from the rose plant and deposit honeydew on the leaves. They also cause new leaves to be misshapen.

Sometimes, aphids are controlled by predators or parasites. When chemicals are needed for control, use malathion, diazinon, nicotine sulphate, or mixtures containing these materials. Follow directions on the package.

Thrips

Thrips are small, slender, straw-colored insects which attack the young buds and flowers of roses. This insect does serious damage as it feeds on the unfolding buds by causing them to blast. On open flowers, the petals turn brown.

Start control operations as soon as the first buds appear, and continue through the blossoming season. Thrips may be controlled by spraying with dieldrin, toxaphene, or diazinon --- or dusts of the same materials may be used when avail-

able. Be sure to start the control measures *before* the thrips injure the buds or flower petals.

Red Spiders

Red Spiders or Spider Mites may cause a great amount of damage to roses as well as to other flowers and shrubs. They spin a fine web over the under surface of the leaf and feed under the protection of the web. These mites thrive during the hottest and driest season of the year.

Frequent hosing off of the leaves will control most of the red spiders. Preferably this should be done early enough in the day to allow the plants to dry off before evening. For chemical control use diazinon, tedion, kelthane or chlorobenzilate.

Flat-headed Borers

Flat-headed Borers often infest badly sunburned rose bushes. Also, the adult beetles may deposit eggs in pruning wounds on the ends of canes after pruning. After hatching, the borers burrow into the canes killing the portion of the plant that is infested.

Seal all pruning wounds with a sealing compound immediately after pruning. Cut off all infested canes and burn them.

Leaf-cutter Bees

Leaf-cutter Bees often cause serious injury to rose bushes and flowering plants. The insect is a small bee of a metallic blue or green color and is very difficult to control. The bee cuts out a half moon or circular portion from the rose leaves, generally from the new growth.

At present, there is no control except to destroy the bee's nest. The nest may be made in holes of trees. Many times these

bees make their nests in holes made by other insects

Other Insects

Other insects may occasionally do dam-

age to roses, but they are of minor importance. First determine what insect is causing injury, then apply the appropriate control measures. Be sure to follow directions given on the package.

More roses die or make unsatisfactory growth from errors in planting, watering, and care—and other unfavorable cultural conditions—than from diseases in Arizona.

The climate of Arizona, especially in the southern part, while in many respects favorable for successful rose culture, is in other respects unfavorable. The diseases and other factors causing poor growth appear very closely associated with climate.

Many serious rose diseases, such as black spot, anthracnose, and cankers, have never been found in Arizona. There are, however, several diseases which are important enough to stimulate frequent requests for assistance.

In case of doubts to a specific disease, you may get assistance by contacting your local County Agricultural Agent.

Root-Knot Nematode

A frequent and often unrecognized cause of poor growth in roses in the southern part of the state is the root-knot nematode.

The above-ground symptoms—stunting, yellowing of foliage, and premature death—may be associated with other causes. Therefore it is necessary to examine the fibrous roots of the plant for the distinctive swellings or knots which are about one-eighth to one-fourth inch in diameter and one-half inch or more in length. In some infestations, the roots become matted; in others, many roots decay and the fibrous roots are few.

Enlarged lenticels (pores) occurring on *Odorata* root under conditions of high moisture should not be confused with nematode galls.

The female nematode is a slender, microscopic round worm which penetrates the tissues of the root tips where it feeds, matures, and lays from 300 to 800 eggs. After hatching, the young nematodes may live in the same root or emerge and move to other roots.

Nematodes multiply very rapidly and under ideal conditions there may be as many as 10 or 15 generations a year. Under the most favorable conditions, a generation may require only 22 to 27 days.

The most favorable soil temperatures for the development of nematodes is between 58°F and 80°F. Therefore, the nematodes are much more active and injurious during the summer. Once established they are impossible to eradicate, as they can survive in soil for months, and in the egg stage they are resistant to drying and to chemicals.

Control

The practical measures for the control of root-knot in roses and similar plants may be classified into four groups:

1. *Exclusion.* To avoid introduction of nematodes into your garden, examine the roots of barerooted roses before purchasing, and reject those having root-knot. Infestation in canned roses usually can be detected by examining the roots on the surface of the ball of soil after the container is removed. Infested plants should be destroyed, as it is not possible to detect and prune out all diseased roots.

2. *Care and Fertilizing.* The useful life of roses which show only slight to moderate nematode injury often can be lengthened by extra care and the use of extra fertilizer. Infested plants suffer more in poor soils than in fertile ones.

3 *Soil Fumigation Before Planting.* In small areas, nematodes have been successfully controlled in the soil by injection of chemicals such as: Dichloropropane (Shell DD or Dowfume W-85), ethylenedibromide, chloropicrin (Larvacide) 2 to 5 cc. per square foot of area treated.

To be effective, these compounds must be injected at a depth of about six inches with a special applicator when soil temperature at a depth of six inches is between 65° and 80°F. Each hole should be promptly covered with soil when the chemical is injected, and the entire treated area sealed with a gasproof cover such as a plastic sheet or water seal.

These chemicals will *kill all roots* in the treated soil. Therefore, they should be used only to treat soil before planting. Do not use them around living plants, or within 10 feet of valuable trees or shrubs.

4. *Treatment.* Recently a new nematocide, dibromochloropropane (Nemagon or Fumazone) was found to have a very low toxicity to living plants. This chemical has been proven most effective on surface-feeding nematodes, such as the citrus nematode, but will also kill root-knot nematodes which are not embedded in the roots.

A dilution of 1 to 4 tablespoons of the emulsifiable concentrate (Nemagon EC 2) to four gallons, applied at the rate of 2 gallons per square foot normally gives good control without damage to the plants. Treatment may injure roses which are grown in a limited amount of soil in containers.

Texas Root Rot

Roses are frequently attacked by Texas root rot. This, next to root-knot, is the most serious and wide-spread plant disease in southern Arizona.

Rose bushes which appear healthy — then suddenly die during the months of June through September may have Texas root rot. While the attack seems to come without warning, a keen observer would have noted a yellowing of the foliage and a tendency of the leaves to wilt slightly in mid-afternoon several days

before the very noticeable symptoms appear.

For diagnosis, dig up the dead plants and carefully examine the roots. The presence of delicate strands of buff-colored fungus filaments on the surface of the roots will establish the disease as Texas root rot. In case of doubt, it is advisable to refer the specimens to your County Agricultural Agent.

During the summer, the fungus may appear on the surface of the ground as white mats of cottony filaments which turn to buff-colored powdery spore masses within two or three days. These usually are found in shady locations, especially after rains or where the soil is moist after an irrigation.

Texas root rot is caused by a fungus known as *Phymatotrichum omnivorum*. This fungus is native to the alkaline soils of the semi-arid southwest and becomes very destructive to plants under irrigation where conditions for its growth are favorable.

Control

Texas root rot is a most difficult disease to control because it persists in the soil for years and attacks most of the commonly cultivated trees, shrubs, and other ornamentals. In fact, the dangers of spread to any other susceptible plants in a city lot of ordinary size is so great that prompt and vigorous action should be taken to eradicate root rot before the whole planting becomes infected.

Since the disease does not become evident until it has destroyed so much of the root system that the plant dies from lack of water, very prompt action is necessary to save the infected plants. *Checking the spread of root rot is more important than saving the sick plants.*

The following procedure has proven successful in treating shade trees and other ornamentals as well as roses.

When rose bush, tree, or shrub first wilts you may stop the advance of the disease by doing the following things.

First loosen the soil of the infected area so the treatment materials can penetrate more effectively. Then build a soil bank about 6 inches high around it and scatter ammonium sulphate evenly over

the soil at the rate of 1 pound to 10 square feet. Next, add an equal amount of agricultural sulphur to the same area and stir it into the loose surface soil until the sulphur color disappears.

Fill the basin with water to a depth of three inches. This carries the ammonium sulphate down into the root zone.

This treatment can be used without injury to either healthy or diseased plants if directions are followed closely. The dosage is very heavy and plants may be defoliated or killed if too little water is used. From one-half to three-fourths of the top growth should be removed from infected plants.

Generous use of well-rotted manure or other organic matter as a mulch is advised for roses in areas where root rot is prevalent. Before replanting in root rot areas, prepare soil as suggested under "Soil Preparation." When possible, move the rose bed to a new location.

Crown Gall and Hairy Root

Crown Gall is one of the common and serious diseases of roses. It gradually devitalizes the bushes and shortens their period of productivity and life.

Crown galls appear as nearly spherical, woody growths, usually on the rootstock below ground, but may occur on the canes above ground. They may occur at the point of budding, on the side where buds have been removed, or at the base of the rootstock. Galls on the roots themselves are often the result of infection through cuts and other wounds made in digging and transplanting.

Galls vary in size with age and the size and vigor of the roots attacked. Crown galls from the size of a cherry to that of a baseball are commonly seen, although both larger and smaller specimens are not rare.

In hairy root, which is much less common than crown gall, no definite galls are produced, but an excessive number of weak, fibrous roots appear.

Crown gall is caused by a bacterium, *Agrobacterium tumefaciens*; hairy root by *Agrobacterium rhizogenes*. Both organ-

isms overwinter in the diseased tissues of infected plants, but they may survive in the soil for more than a year but not for two full years. New infections arise at points where cuts and injuries have occurred.

Control

1. Destroy diseased plants because the removal of galls usually fails to check the disease.

2. Before replanting where roses have been lost from crown gall, remove the soil to a depth and width of at least two feet and replace with noninfested soil.

3. Infection takes place only through wounds, so use care in planting. Prune off damaged roots. Pruning cuts should be protected with a wound dressing.

4. Inspect the roots of all new plants before purchase or planting. Reject those having suspicious lumps or swellings, or evidence that such gall-like swellings have been removed.

5. Certain antibiotics have been found to be very effective against new crown gall and hairy root infections: (a) Dipping the root systems of bare rooted roses in a 100 ppm solution of Agrimycin 100 and planting without rinsing, kills crown gall bacteria on contact with broken and abraded roots and so protects them against infection; (b) The same solution applied to galls on growing plants by means of cups which allow the solution to be absorbed through holes drilled in the galls will cause the death of the gall tissue; and (c) Removal of a large portion of the gall and binding to the cut surface a wad of absorbent cotton saturated with Agrimycin solution has often saved a valuable plant.

6. Buy roses from reliable nurseries that handle quality plants. The Arizona Commission of Agriculture and Horticulture through its inspection service is performing a valuable service by inspecting all lots of roses and other nursery stock shipped into the state, and the stock of nurseries operating within the state, and condemning all lots harboring plant diseases and insect pests. The most common diseases intercepted are crown gall and root-knot.

Powdery Mildew

Another widespread and often important disease of roses is powdery mildew. It usually can be found in rose gardens of any size in Arizona early in the growing season, or in the fall when dew occurs frequently.

The powdery, whitish or grayish growth on the young leaves, flower buds, thorns, and tender canes readily identifies the disease. These powdery, whitish spots which are made of chains of small colorless spores (the "seeds" of the fungus) appear on the foliage as soon as the leaves begin to develop in spring.

Mildew spreads rapidly in warm, damp weather, but usually is checked by hot, dry weather in June. In very susceptible roses, the powdery mantle may spread over the leaves, young shoots, thorns, pedicels, unopened buds, and petals. This results in a drying and shedding of the foliage and unopened buds or the failure of buds to open properly. Plants are rarely killed by mildew, but their immediate value as ornamentals is reduced.

Powdery mildew is caused by a fungus, *Sphaerotheca pannosa* var. *rosae*, which overwinters as the common spore stage or as perennial mycelium, especially in association with the buds.

Nearly all types of roses are susceptible to mildew to some degree, but in Arizona's dry climate most varieties escape serious injury. The rambler varieties, Dorothy Perkins and Crimson Rambler are so badly injured by mildew and so bleached by intense sunlight that they should be replaced by some of the excellent climbers which are more resistant to mildew.

Among the climbers, Mermaid and Bonfire (rambler) are practically immune, while cl. (climbing) Cecile Brunner, cl. Red Radiance, cl. Golden Emblem, cl. American Beauty, cl. Santa Anita, cl. Summer Snow, Blaze, and Paul's Scarlet are highly resistant.

Control

1. Remove or avoid planting varieties very susceptible to mildew. Mildew growth on susceptible varieties produces

Caution: Do not use sulphur sprays where they will spatter on trellises or woodwork painted with *white lead* paint, as the spray will react with the basic lead carbonate and form black lead-sulphate stains. Paints made with zinc oxide will not discolor, as zinc sulphide is white. A drop of spray mixture on the painted surface will indicate whether or not your paint will discolor.

many spores that infect other varieties.

2. Avoid heavily shaded areas. Powdery mildew thrives in reduced sunlight. Foliage frequently wet from sprinklers often has more mildew. However, a strong stream of water will wash mildew spores from infected foliage.

3. Spray or dust with fungicides to prevent build-up of mildew.

(a) Dust with dusting sulphur (300 to 325 mesh) when the first leaves unfold and repeat at intervals of 10 to 14 days. This gives good control of mildew. A small hand duster is large enough to apply the dust to the home garden in a few minutes. Be sure to distribute the dust evenly, but never heavily enough to show plainly. The fungicide kills the superficial fungus which has developed and protects against further infection as well.

(b) *Actidione* PM or *Phaltan* sprays have given excellent control of powdery mildew. (This is preferred by many as it is more effective than dusting.) These materials can be used throughout the season regardless of temperature. Wettable sulphur spray, with a detergent added as a wetting agent, will give good control. (It will burn foliage if daytime temperatures rise above 90°F.)

(c) *Lime Sulphur*, one part in 50 parts water will give good control. There are a number of sprays containing calcium polysulphide now on the market which are effective. (Liquid sulphur will burn foliage if daytime temperatures rise above 85°F.)

4. Two new fungicides, Maneb, and Phaltan (11), have been found to control powdery mildew without injury to rose foliage. Maneb, one-half ounce in 3 gallons of water applied as a spray, leaves no residue. Phaltan at the same rate, leaves a heavy white residue on the foliage which greatly limits its usefulness.

Do not spray water on plants from sprinkler heads in the evening or in shady or crowded locations where foliage will not dry off promptly.

Chlorosis

Chlorosis — the lack of normal green color — is general and severe in roses as well as in many other woody plants in Arizona. While chlorotic foliage may be due to any of a number of causes, it is generally associated in some way with the physiology of the plant.

Chlorosis may develop because of a deficiency of nitrogen, magnesium, or iron, or because the plant was subject to unfavorable growing conditions such as low temperatures, excessive moisture, or disturbed mineral ratios (magnesium-iron, or phosphorus-iron). But the most common form encountered in arid climates is called lime-induced chlorosis.

Three definite degrees of chlorosis are easily recognized and, if no steps are taken to correct the cause, plants may pass rapidly from one stage to the next.

1. *Mild chlorosis* — The young leaves show normal green veins with paler green areas between.

2. *Moderate chlorosis* — The young leaves lack normal green color; both the blade and veins are pale green to yellow and growth is stunted.

3. *Severe chlorosis* — Leaf blades are pale yellow with margins and tips brown and dry. Plants in this stage often die slowly.

Chlorosis is most pronounced in the youngest leaves on the growing tips. The older leaves of plants recently affected may be a normal green.

In soils high in calcium, the trace of

iron necessary for green color in plants is not available to the plant. This condition is aggravated by generous irrigation of such soils.

Preventing Chlorosis

Chlorosis is more widespread and severe where soils lack organic matter. Annual applications of manure supplemented by commercial fertilizer (nitrogen and phosphate) will, to a large extent, prevent chlorosis.

In preparing new rose beds, removing the soil to a depth of 24 to 30 inches and mixing with the removed soil 5 pounds of manure to which have been added $\frac{1}{4}$ pound sulphur and 1 ounce of ammonium sulphate per cubic foot of soil (based on volume of excavation) gives good insurance against chlorosis.

Rose varieties which have Pernet "blood" in their ancestry are particularly susceptible to chlorosis. These varieties usually show some yellow or orange shading in the petals, and include many varieties. Talisman, Autumn, and Joanna Hill are examples.

On the other hand, any of the red- or pink-flowered varieties that are crimson or crimson pink, that is have a bluish tinge, will normally do well in fairly alkaline soil. The following are a few varieties: Peace, Etoile de Hollande, Crimson Glory, Nocturne, San Fernando, Tallyho, and Santa Anita.

Control and Elimination of Chlorosis

Chlorosis may be treated in five ways:

1. Regulate water application. Chlorosis is aggravated by excess water. (Water regulation is a necessary step in addition to following any of the preceding chlorosis prevention measures.)

2. Supply soluble iron to the plant roots by making holes in moist soil in the root area from 3 to 6 inches deep. Put in each hole a heaping tablespoon (about 1 ounce) of ferrous (iron) sulphate and cover with soil. Apply $\frac{1}{2}$ to 1 pound per bush (about $\frac{1}{4}$ to $\frac{1}{2}$ cupful) depending on size of bush. Each irrigation will diffuse enough soluble iron to the adjacent portions of the root system to supply the plant.

The same amount of iron salt broadcast over the soil is not very effective as most of it becomes chemically fixed in unavailable form. One treatment is usually effective for two to four years. Marked recovery usually occurs within a month after treatment.

3. Insert the iron compound directly into canes 1/2 inch or larger in diameter. This gives a quicker response but requires more care and skill than soil application. A hole not over one-fourth the diameter of the cane is bored to the center and filled with iron citrate and the hole closed with tree paint.

4. Make soil conditions more favorable by application of agricultural sulphur and manure at the rate of 2 pounds of sulphur to a cubic foot of manure. Scatter the sulphur on the manure and

mix it well with the surface soil. Improvement is usually noted in one or two months. Application of iron sulphate in holes may be used to supplement this treatment.

5. Iron chelates recently have been offered as an effective treatment for chlorosis in plants. Some recent formulas (particularly Sequestrene Fe 138) designed for alkaline soils have given very good results. Sequestrene Fe-330 acts more slowly than Fe-138 but the effect lasts longer.

As these compounds are at present much more expensive than the sulphur, ferrous sulphate, and manure recommended above, they might be reserved for difficult cases of chlorosis which do not respond quickly to the other treatments.

Just a moment . . .

This publication has been provided to you as a part of the service to Arizonans by your local County Extension Office. It was prepared and published by the Cooperative Extension Service and the Agricultural Experiment Station of The University of Arizona.

We are constantly trying to determine whether the information, such as provided in this Rose bulletin, is useful to you and has helped you to better understand and overcome the problems of growing roses more successfully. We would appreciate your help in answering the questions below and then clipping the coupon and mailing it to your local County Extension Office at the address shown on page 22. Thank you!

1. Was the information given in this bulletin easy.....or difficult.....(check one) to understand? (If difficult, write in difficult page numbers here.....)
2. Are the pictures helpful in showing what is described? Yes.....No..... (If no, write in page numbers of pictures not helpful.....)

3. After having read "Roses in Arizona" do you feel that you have gained some knowledge in better understanding how to grow and manage

rose plantings? Yes.....No..... (In which areas?).....

4. Would you like similar publications in other interest areas? Yes.....No.....

(If Yes, please list topics)

a..... b.....
c..... d.....

5. Would you have been willing to pay for this bulletin? Yes.....No..... (If Yes, how much?.....)

(OVER)

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Trade names used in this publication are for identification only and do not imply endorsement of products named or criticism of similar products not mentioned.

The authors acknowledge with thanks assistance in the preparation of this bulletin from D. W. Pew, horticulturist, and Lowell F. True, county agent.

Here are other publications you may need. Get a copy from your County Agricultural Agent or County Home Agent.

Bulletins

- A-18—Control Insects of Flowers, Shrubs, and Shade Trees
- A-8 —Pruning Hedges, Shrubs, and Trees
- A-7 —Indoor Gardening in Arizona
- A-6 —Lawns for Arizona

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- 264 —Bulbs for Northern Arizona
- 243 —Flowers for Southern Arizona
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- 122 —Control Garden Insects

Reports

- 166 —Landscaping Arizona Homes

6. Are you aware that there are many other publications (as listed in Folder 68, Arizona Farm and Home Publications) available at your local County Extension Office? Yes.... No. .

7. Are you familiar with the County Extension program conducted in your county as a service to residents by the Cooperative Extension Service which is a part of the College of Agriculture at The University of Arizona? Yes.....No.....

8. How did you find out about "Roses in Arizona?" From Newspaper....., Magazine....., Radio....., Television....., Friends or Neighbors....., Other.....

9. Are you a farmer or member of a farm family? Yes.....No.....

Thank you for your help.

Your county extension office is listed below. Please send your completed coupon to your county office.

County	Address
Apache	70 W. 3rd St., St. Johns, phone 337-4914
Cochise	150 N. Railroad Ave., Willcox, phone DU 4-2167
Coconino	Courthouse, Flagstaff, phone PR 4-6781
Gila	Courthouse, Globe, phone 425-2031
Graham	921 Thatcher St., Safford, phone 428-2611
Greenlee	Main St., Duncan, phone 2691
Maricopa	1201 W. Madison St., Phoenix, phone AL 8-8651
Mohave	301½ Beale St., Kingman, phone SK 3-3788
Navajo	Fairgrounds, Holbrook, phone 524-3630
Pima	112 W. Pennington St., Tucson, phone MA 2-0221
Pinal	City-County Bldg., Casa Grande, phone TE 6-5221
Santa Cruz	Courthouse, Nogales, phone AT 7-2194
Yavapai	Courthouse, Prescott, phone HI 5-0390
Yuma	1047 Fourth Ave., Yuma, phone SU 3-4451

(A complete list of rose varieties is available at the office of the local County Agricultural Agent.)

Hybrid Teas

RED

Bush:

Crimson Glory
Etoile de Hollande
Chrysler Imperial
Christopher Stone
New Yorker

Climbers:

Improved Blaze
cl. Christopher Stone
cl. Crimson Glory
cl. Etoile de Hollande

SHADES OF RED

Bush:

Charlotte Armstrong
Mme. Henri Guillot
Tallyho

Climbers:

cl. Charlotte Armstrong

SHADES OF PINK

Bush:

Countess Vandal
Helen Traubel
Mission Bells

Climbers:

cl. Countess Vandal

PINK

Bush:

Dainty Bess
Picture
Santa Anita
The Doctor

Climbers:

cl. Dainty Bess
cl. Picture
cl. Santa Anita

YELLOW

Bush:

Golden Rapture
Mrs. E. P. Thom
Golden Scepter
Arlene Francis

Climbers:

cl. Golden Rapture
High Noon
cl. Mrs. E. P. Thom
cl. Golden Showers

WHITE

Bush:

Caladonia
Frau Karl Druschki
McGredy's Ivory
Snowbird

Climbers:

cl. McGredy's Ivory
Silver Moon
cl. Snowbird

MULTICOLOR

Bush:

Mrs. Sam McGredy
Peace
President Herbert Hoover
Talisman

Climber:

cl. Hinrich Gaede
cl. Mrs. Sam McGredy
cl. Peace
cl. President Herbert Hoover
cl. Talisman

Floribundas

RED AND SHADES OF RED

Bush:

Valentine
Fusilier
World's Fair
Red Cap
Texan
Geranium Red
Heat Wave
Spartan

Climbers:

cl. Floradora

PINK AND SHADES OF PINK

Bush:

Betty Prior
Else Poulsen
Pink Bountiful

Climbers:

cl. Pinkie

WHITE

Bush:

Ivory Fashion
Summer Snow
White Bouquet

Climbers:

cl. Summer Snow

YELLOW AND ORANGE SHADES

Bush:

Goldilocks
Margo Koster
Green Fire

Climbers:

cl. Goldilocks

MULTICOLOR

Bush:

Fashion
Ma Perkins
Pinocchio
Circus

Climbers:

cl. Circus

Grandifloras

Carrousel, Red
Roundelay, Red
Starfire, Red
El Capitan, Fiery Red

Queen Elizabeth, Pink
Buccaneer, Yellow
Montezuma, Scarlet and Orange

Rose Varieties for Elevations Above 6,000 Feet

Bush:

American Beauty — Red
Austrian Copper — Copper Red
F. J. Grootendorst — Red
Frau Karl Druschki — White
Gruss an Teplitz — Red
Harrison's Yellow — Yellow
Magna Charta — Red
Paul Neyron — Pink
Rosa Hugonis — Yellow

Floribunda:

Eutin — Satiny Red
The Fairy — Red, small double
Wildfire — Red, single
World's Fair — Red
Chatter — Red
Summer Snow — White
Goldilocks — Yellow
Betty Prior — Pink
Else Poulsen — Pink

Climbers:

cl. American Beauty — Deep Pink
cl. American Pillar — Pink
cl. Chevy Chase — Crimson
cl. Crimson Rambler — Crimson
cl. Coral Dawn — Coral Pink
cl. Dorothy Perkins — Pink
cl. Dr. Huey — Red
cl. Dr. W. Van Fleet — Pink
cl. Excelsa — Red
cl. Hiawatha — Red, White Center
cl. New Dawn — Pink
cl. Paul's Scarlet — Red
cl. Improved Blaze — Red
cl. Silver Moon — White
cl. Summer Snow — White

For Hedge Plants:

Red Glory (Hybrid 311)