

Fruiting Bush Growing Guide

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Section 1

SOIL AMENDMENTS & HOW TO USE THEM

CANADIAN SPHAGNUM PEAT MOSS: Excellent. Low/acid pH, porous, holds moisture and nutrients. It is a good soil builder and conditioner. Peat Moss is a good way to increase organic matter, giving new plants or unhealthy plants a boost of energy.

SEDGE PEAT MOSS: Excellent. Check with the seller for the pH level of this product. Use this peat moss on the plants according to their pH requirements. Peat mosses will vary in pH according to where they originated from. Sedge peat moss has smaller fibers than Sphagnum peat moss. As a result this will leave less air space and not hold moisture as long as Sphagnum peat. The benefit is that it will hold nutrients and provide organic matter to condition the soil.

COMPOSTED WOOD BARKS & CHIPS: Good. If the composting is thorough this will have the same benefits as Sedge peat mosses.

COMPOSTED ORGANIC MATTER: Good. If well composted, this has the same benefits as Sedge peat moss, but with more nutrients and biological activity.

MANURE: Poor. Use sparingly, as these products will contain harmful Nitrate Salts for plants. It is best used if mixed with one of the other amendments at a low ratio.

POLYACRYLAMIDE CRYSTALS: Good. These are organic water holding particles. They are used in areas where rainfall is low. They are mixed with the soil or any of the soil amendments.

SAND: Builders sand or sharp sand is used to condition heavy clay soils.

BLACK HIGH ORGANIC SOIL: Used to build up depleted soils of organic matter or sandy soils. Check the pH of the soils before purchasing; think about what plants will be planted in the soil.

Our favorite soil amendment for acid loving plants is Acid Canadian Sphagnum Peat Moss pH of 3.5-4.5 and composted Pine Bark; mix them 50:50. For non-acid loving plants use Peat Moss with a higher pH of 6.5-6.0 at 50% and composted Pine Bark 50%.

PREPARATIONS & INCORPORATIONS OF SOIL AMENDMENTS: Mix the chosen amendments thoroughly and moisten well. It will be difficult to moisten Peat Moss once it is out of the bag, so insert a garden hose in the top of the bag and let water trickle, slowly filling the bag with water. This could take several hours and several soakings.

The amount of soil amendment to consider using for each plant is a minimum of

30% soil amendment and the remainder 70% soil that was dug from the planting hole. No more than 70% of a soil amendment should be added to the planting hole. Mix the amended soil evenly with the soil and fill the hole with the mix and plant the plant.

MULCHING & MULCH RECOMMENDATIONS

CONIFER BARK/CHIPS: Best quality as it lets water permeate through it and keeps moisture in the soil. Its decomposing qualities are medium.

HARDWOOD BARK/CHIPS: Good to poor quality. It has similar properties as conifer bark but decomposition is slower which can starve the plants of Nitrogen.

CONIFER SAWDUST: Good quality. Keeps moisture levels high and good insulation. It can however form a top crust during the summer, which can repel water.

SOFTWOOD SAWDUST: Good quality. Keeps moisture levels high and good insulation, but decomposes rapidly.

HARDWOOD SAWDUST: Good to poor quality. Keeps moisture levels high and good insulation, but decomposes slowly which can starve the plants of Nitrogen.

LEAVES/ANY FORM: Good quality, but decomposes rapidly.

PINE NEEDLES: Good quality, but decomposes rapidly.

MANURES: Poor quality. If manures are used apply liberally; they could have a bad effect on the plants and could cause burning from various nutrient salts.

PEAT MOSS: Very poor quality. Peat Moss will form a crust on top which repels water.

GRATED PAPER PRODUCTS: Good quality, but decomposes fast.

COMPOSTED ORGANIC MATTER: Good to best quality. There are several benefits for the plant from this mulch. However it does decompose quickly.

WHY APPLY MULCH ?

- A. To conserve moisture.
- B. To insulate roots, especially for shallow rooted plants.
- C. Nutrients.
- D. Winter protection from desiccation.
- E. Aesthetics.
- F. Weed control.

In order to benefit the plant from mulching, apply one of the selected mulches 1 to 6 inches beyond the root system of the plants' existing roots. The smaller the plant (example: ground covers), the less depth the mulch should be.

* Avoid mulches of Walnut (Juglan spp) as these could harbor toxins for certain plants.

SIZE AND DEPTH OF PLANTING HOLE

TREES AND SHRUBS: The width of the planting hole should be a minimum of 30% larger than the root on a container plant. For bare root plants make it 50% larger. A good depth for holes for a tree should be 12 to 18 inches. For shrubs the depth should be 12 to 24 inches.

GROUND COVERS: Normally all shallow rooted, so usually a bed prepared with amended soil only needs to be 6 inches in depth.

NOTES OF IMPORTANCE:

- A. Do not use amendments of the Walnut (*Juglan* spp).
- B. Do not incorporate granular fertilizer in the planting hole.
- C. Moisten soil amendments thoroughly before mixing them with the soil.
- D. Select the appropriate planting depth for the plant. The appropriate planting depth will be designated by a lighter stem color near the root; so do not plant any deeper than burying that part of the plant. When a container grown plant is being planted, plant the plant no deeper than the top of the soil of the container media.
- E. While planting, gently push the soil in around the roots of the plant to ensure that there are no air pockets between soil and roots.
- F. After planting apply water in order to saturate the amendments and soil. This will disburse the soil in and around the plants roots so new roots will form quickly and become healthy.

Section 2

HOW NUTRIENTS BENEFIT THE PLANTS

NITROGEN: Nitrogen increases the protein in plants. It is the nutrient that produces the dark green color in the leaves. If there is a deficiency of Nitrogen the older leaves will start turning yellowish or begin chloroses. If the deficiency is not corrected the new or young leaves will start yellowing. Nitrogen is also important for making new stems and growth on plants.

PHOSPHOROUS: Phosphorous is an excellent fertilizer to stimulate and promote newly transplanted plants. Most plants have a hard time getting enough Phosphorous. Phosphorous levels are fairly high in most soils but a high percentage is not water soluble and will not be available to the plant. A water soluble Phosphorous is recommended. The element will also increase the sugars in foliage and fruit. By having good sugar levels in the foliage insects will be less of a problem.

POTASSIUM: Potassium is the vital key to photosynthesis of plants. The element helps the plant use water more efficiently by promoting turgid growth. It is one of the elements needed for good fruit formation and sturdy stem growth. It also helps the translocation of other minerals available to the plant.

CALCIUM: Calcium stimulates leaf and root developments and strengthens the very plant structure by forming stronger cell walls. It reduces soil acidity so only use the Sulfate form of Calcium for acid loving plants. It will build structure in fruits and increase the quality and storage time of fruits.

MAGNESIUM: Magnesium is involved in the photosynthesis as a constituent of chlorophyll. Deficiency of Magnesium is a yellow to bronze or reddish color on the leaves. Old leaves will have scorched edges and a yellow orange appearance.

SULPHUR: Sulphur is necessary for chlorophyll formation. It will form plant protein and works with Nitrogen. Sulphur lowers soil pH so it is essential to use for acid loving plants.

MICRONUTRIENTS: All plants need micronutrients to some extent but these can be toxic to the plants if they are applied in heavy amounts. The small quantity available in water soluble or slow release fertilizers will normally not cause toxicity problems. For acid loving plants Iron deficiencies in the soil is sometimes normal. This is one micronutrient that will usually be missing in the soil and can be added in a chelated or sequestered form to the plant foliage safely.

FERTILIZERS

WHAT THE THREE NUMBERS MEAN: Fertilizers are either blended together or are available as a single element. When the fertilizer label has 3 numbers (Example: 20-10-5), those 3 numbers always mean Nitrogen first, Phosphorous second and Potassium third. The numbers indicate the amount of each fertilizer available in the product. The 20 equals 20% Nitrogen, 10 equals 10% Phosphorous and 5 equals 5% Potassium. There will be many variations of analysis of fertilizer from company to company. The fine print on the label will indicate what form of the element used was derived from.

MINOR ELEMENTS: Read the label on your fertilizer bag further as sometimes the manufacturer blends some trace or minor elements with the 3 major elements. The most common minor elements that are blended with the 3 major elements are Magnesium, Copper, Manganese, Iron and Zinc. These minor elements are normally in very low percentages because the plants do not require large amounts of minor elements, but do still need them. It is best to purchase a fertilizer containing minor elements. Most water soluble and slow release fertilizers will contain minor elements but granular fertilizers contain usually the 3 majors of Nitrogen, Phosphorous and Potassium.

TYPES OF FERTILIZER: 1. Water Soluble, 2. Slow Release, 3. Granular, 4. Organic.

WATER SOLUBLE FERTILIZER USES: This fertilizer is applied to the soil at planting time and is continued to encourage root formation. It can be used as a foliar feed, on groundcovers and house plants. This can be used in place of other fertilizers. Never soak the plants roots in a solution of water soluble fertilizer.

SLOW RELEASE FERTILIZER USES: This fertilizer can be used as a top dress after planting. It can also be incorporated within the soil amendment mix or inserted into the soil 2 inches deep around the outside of the root system. Top dress or incorporate in soil mix for house plants one time. This fertilizer can be applied instead of several applications of water soluble or granular forms of fertilizer. These types of fertilizers have different release rates. The reason for release rates is because of the different climates the fertilizer will be used in. A 3 to 4 month release can be used for USDA Zones 3 through 5. A 4 to 6 month release can be used in Zones 5 through 8. An 8 to 9 month release can be used in Zones 6 through 11. The analysis will depend upon the plant that it will be used to feed. Using a slow release fertilizer is easy but sufficient moisture must be present because the fertilizer will be released with heat and soil decomposition. If moisture is not present the fertilizer salts will build up in the soil and around roots, resulting in damage to the roots and death to the plants.

GRANULAR FERTILIZER USES: This fertilizer can be used as a top dress for plants. The fertilizers either banded or broadcasted. Banding applications mean the fertilizer is spread evenly down the row of the crop in a 18 to 36 inch width. Broadcasting applications mean the fertilizer is spread evenly across every square foot of soil. Never incorporate any granular fertilizer in the planting hole.

ORGANIC FERTILIZER USES: Organic fertilizers are available in powder, granular and liquid. Apply at planting time and continue through the life of the plant. The formulation of the organic fertilizers are different depending upon which products they are derived from. Some favorite formulations of organic fertilizers are: For sources of Nitrogen mostly, sea weed or kelp, fish emulsion, cotton seed meal, gypsum, non-toxic manures, legume crops and green manure crops. Sources of high Phosphorous are colloidal phosphate and bone meal. Sources of high Potassium are greensand, non-toxic manures, tobacco stems and wood ashes. Sources of high Calcium are marl, high calcium lime and gypsum. Sources for high trace minerals are seaweed or kelp, rock minerals, rock dust, granite dust and fish products.

RATES OF FERTILIZERS FOR GRANULAR FERTILIZERS

I. Apply granular fertilizers to plants that are planted in the soil. Never incorporate the fertilizer in the planting hole. Granular fertilizer should be applied after new roots form. Usually within 3 weeks the first roots begin to emerge looking for small amounts of food.

A. NITROGEN: Nitrogen for acid plants use Ammonium Sulphate 21-0-0. For a low rate use 1/2 ounce or 100 pounds per acre. For a medium rate use 1 ounce or 150 pounds per acre. For a high rate use 2 ounces or 200 pounds per acre. Nitrogen for non acid plants use Calcium Nitrate 15-0-05 or Ammonium Nitrate 32-0-0 or 34-0-0. For a low rate use 1/2 ounce or 100 pounds per acre. For a medium rate use 1 ounce or 150 pounds per acre. For a high rate use 2 ounces or 200 pounds per acre.

All Nitrogen should be applied in a band 18 inches to 36 inches wide and spread evenly around the plant. Do not ever place the fertilizer concentrated in a small area near the plant as it will damage it.

B. PHOSPHOROUS: For all plants Triple Super Phosphate is the normal Phosphorous source used, analysis 0-46-0. Never apply to container grown or indoor plants. This recommendation is for plants grown outdoors in soils or amended soils. Four ounces for acid or non acid plants broadcasted in an area of 100 square feet for low, medium and high fertility plants. The amount of Phosphorous needed to apply will vary from soil to soil; if the soil tends to be low in Phosphorous this is a good starting point and safe fertilizer.

C. POTASSIUM: For all plants Potassium Sulphate 0-0-50 is the best chemically available form of Potassium. In Potassium deficient soils apply 6 ounces broadcasted in an area of 100 square feet. Never apply to container grown or indoor plants. This is a recommendation for plants grown outdoors in soils or amended soils.

D. CALCIUM SULPHATE (Gypsum) 22% Calcium: For all plants use on acid or non acid plants alike. It is one of the best soil conditioners and will loosen up any clay type soils. Rates to apply when Calcium is needed for all plants are as follows: Sandy to sandy loam type soils use 2 1/2 pounds per 100 square feet or 1000 pounds per acre. Clay soils use 5 pounds per 100 square feet or 2000 pounds per acre. Broadcast only and use finely ground gypsum.

E. HIGH CALCIUM LIME, 31% Calcium: Apply to raise pH of soil and to add Calcium for most plants. Test the pH of the soil before applying the Calcium. If the pH is above 7.0 use Calcium Sulphate (Gypsum).

F. MAGNESIUM: The best Magnesium is Magnesium Sulphate 17%. If the plants have deficiencies apply 1/2 ounce of Magnesium Sulphate in 1 gallon of water or 2 pounds per 50 gallons of water. Apply 2 cups of solution per plant saturating the soil at least 18 inches around the plant.

G. IRON: Iron in chelated form or sequestered form should be used. Apply only to deficient plants and mix according to the directions on the label. If plants are badly chlorotic more than 1 application should be made per year, but not more than 3. Apply 2 applications in the following year, one in early spring when new leaves emerge and the second 4 weeks later.

H. MICRONUTRIENTS: Zinc, Copper, Manganese, Boron and others should only be applied if a soil test is taken and results are published to make recommendations.

RATES OF FERTILIZERS FOR WATER SOLUBLE FERTILIZERS

I. After plant is planted use water soluble fertilizer high in Phosphorous. Analysis similar to 12-32-14 with minors. Apply 3 applications, one after planting and the other two at ten day intervals.

- A. Low rate for acid or non acid plants apply as follows:
One half ounce of fertilizer per gallon of water (2 lbs. per 50 gallons water). Apply the solution to the soil, using 8 ounces per plant (10 gallons per 160 square feet).
- B. Medium rate for acid or non acid plants apply as follows:
One ounce of fertilizer per gallon water (3 lbs. per 50 gallons water). Apply the solution to the soil at 8 ounces per plant (10 gallons per 160 square feet).
- C. High rate for acid or non acid plants apply as follows:
One and one half ounce per gallon of water (4 lbs. per 50 gallons water). Apply the solution to the soil 8 ounces per plant (10 gallons per 160 square feet).

II. After roots grow and are established or 3 weeks after planting apply a water soluble fertilizer that has higher Nitrogen and low Phosphorous, similar to an analysis of 28-8-18. When growth resumes in the spring from a plant that was planted in the Autumn or an established plant begins to grow apply the water soluble fertilizer in the same analysis of 28-8-18. Apply the fertilizer as follows:

- A. Mix the water soluble fertilizer according to the rates previously given for the high Phosphorous.
- B. Apply the higher Nitrogen fertilizer 10 days after the last application of the high Phosphorous root promoting fertilizer. Re-apply the high Nitrogen fertilizer at 14 day intervals 2 months before a predicted killing frost in the autumn. In the colder zones of 3 and 4 the last application should be made 3 months before the first predicted autumn frost. The solution of fertilizer can be applied as a foliar feed or better leaf run off to be soaked into the soil.

RATES OF FERTILIZERS FOR SLOW RELEASE FERTILIZERS

I. These fertilizers are available in 2 forms: a 10 to 20 gram tablet, lasting 1 to 2 years of release and a 9 prilled granular lasting 3-4 months, 6-8 months or 8 to 9 month formulation. The granulars are commonly available. Analysis will vary from each manufacturer. A good analysis of this fertilizer will be 17-6-12 or 20-10-5. A good release time of 6 to 8 months for most plants in most USDA Zone locations.

- A. Low rate for low acid or non acid plants apply as follows:
Apply a 2 year, 20 gram tablet or 1 ounce of 17-6-12, 6 to 8 month per plant 2 inches into the soil. Keep a one inch soil barrier between the root and the fertilizer. Place the fertilizer on 2 sides of the plant by breaking the tablet or use one half ounce of the granular release on each side of the plant, or incorporate in the soil mix.
- B. Medium rate for acid or non acid plants apply as follows:
Apply a 2 year, 20 gram tablet or granular slow release 17-6-12 at 2 ounces per plant 2 inches into the soil. Keep a one inch soil barrier between the root and the fertilizer. Place the fertilizer on 2 sides of the plant by breaking the tablet or use 1 ounce of the granular release on each side of the plant, or incorporate in the soil amended mix.
- C. High rate for acid or non acid plants apply as follows:
Use 2, 20 gram tablets or 3 ounces of granular slow release 17-6-12, 6 to 8 month, per plant 2 inches into the soil and keep a 1 inch soil barrier between the fertilizer and root system of the plant. Place the fertilizer on 2 sides of the plant or incorporate in the soil amended mix.
- D. Indoor and outdoor potted plants apply as follows:
Top dress only granular slow release fertilizer. 17-6-12, 6 to 8 month. Rates are as follows: (Rates are in grams)

<u>Size</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
5" pot	3	5	6
6" pot	5	6	11
8" pot	17	26	34
10" pot	30	45	60
15" pot	50	75	100
18" pot	72	110	145
25+" pot	150	225	300

- E. Groundcovers apply as follows:
Broadcast per 100 square feet at 6 pounds for low rate, 9 pounds for medium, and 12 pounds for high. Reapply the second and future growing seasons. See Conversion chart on page 84-91.

RATES OF FERTILIZERS FOR ORGANIC FERTILIZERS

Manures contain some of the best nutrients for plants. The best type to obtain is dry. Below are the values that manures have.

FRESH MANURE WITH MOISTURE AND BEDDING (Rates are pounds per ton)

Type	Nitrogen	Phosphorous	Potassium
Cattle	11	4	10
Goose	22	29	10
Chicken	22	11	10
Hog	11	6	9
Horse	13	5	13
Sheep	20	15	21
Turkey	26	14	10

DRIED PRODUCTS AVAILABLE COMMERCIALY (Rates are pounds per ton)

	10-20	20-40	40-60
Cattle			
Chicken	30	35	40
Hog	45	42	20
Sheep	32	25	41

These amounts of nutrients are available over a long period of time. If applications plan to be used, apply the manures in early spring so the nutrients will be available to get to the plant when the plants need it, and the plants will not grow too late in the summer. If the plants grow too late in the summer or early autumn a freeze or winter could damage the plants' growth.

A. **FISH PRODUCTS:** Used as a foliar drench to run off on to the soil.

B. **SEAWEED OR KELP:** Used as foliar feeding to foliar drench to leaf run off. This product contains the most micronutrients and other beneficials. The products have been known to solve disease problems.

C. **BONE MEAL:** Soil applied usually incorporated.

D. **GREENSAND:** Soil incorporated.

E. **COLLOIDAL OR HARD ROCK PHOSPHATES:** Soil incorporated.

F. **COTTONSEED MEAL:** Soil incorporated or top dress.

G. **LEGUME CROPS:** Vetch, Alfalfa, Clover are Nitrogen fixers. Plant these amongst the plants in the aisle ways and they will feed plants with Nitrogen.

H. **GRANITE DUST OR ROCK DUST:** Soil applied and incorporate.

I. **WOOD ASHES:** Apply small amounts and incorporate into the soil.

J. **MARL:** Contains Calcium so only apply after a pH test is taken, as it will raise the pH of the soil.

Section 3

Table 1

Changing Soil pH with 90% Sulfur granular or powder on 100 sq. ft.

Present ph of soil	Pounds of Sulfur** Per 110 Sq. Ft. for pH of							
	4.0		4.5		5.0 Blueberry Range		5.5 Blueberry Range	
	Sand	Loam	Sand	Loam	Sand	Loam	Sand	Loam
4.0	0.0	0.0						
4.5	0.4	1.2	0.0	0.0				
5.0	0.8	2.4	0.4	1.2	0.0	0.0		
5.5	1.2	3.5	0.8	2.4	0.4	1.2	0.0	0.0
6.0	1.5	4.6	1.2	3.5	0.8	2.4	0.4	1.2
6.5	1.9	5.8	1.5	4.6	1.2	3.5	0.8	2.4
7.0	2.3	6.9	1.9	5.8	1.5	4.6	1.2	3.5
7.5	2.7	8.0	2.3	6.9	1.9	5.8	1.5	4.6

* Reprinted from New York State Agricultural Experiment Station Circular 189. Spread sulphur in a 5 ft. wide band evenly in the row.

Apply Sulphur 4 - 6 weeks before planting and it is best if the Sulphur can be worked in the soil for faster acting.

Table 2

Changing Soil pH with 90% Sulfur granular or powder on acreage

Present pH of soil	Desired pH Value ----- (Blueberry Range) -----														
	4.0			4.5			5.0			5.5			6.0		
	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay
4.0	Pounds of Sulfur per Acre														
4.5	174	523	610												
5.0	348	1045	1133	174	523	610									
5.5	523	1525	1612	348	1045	1133	174	523	610						
6.0	653	2004	2091	523	1525	1612	348	1045	1133	174	523	610			
6.5	828	2526	2614	653	2004	2091	523	1525	1612	348	1045	1133	174	523	610
7.0	1002	3006	3093	828	2526	2614	653	2004	2091	523	1525	1612	348	1045	1133
7.5	1176	3485	3572	1002	3006	3093	828	2526	2614	623	2004	2091	523	1525	1612

* Reprinted from New York State Agricultural Experiment Station Circular 189. Spread sulphur in a 5 ft. wide band evenly in the row.

Apply Sulphur 4 - 6 weeks before planting and it is best if the Sulphur can be worked in the soil for faster acting.

Section 4

FUNGICIDES

There are many Fungicides derived from chemicals and a few from natural substances.

The best method in controlling fungus is to keep the plants healthy by growing them in their proper environment with good fertility, water requirements and pruning. Keeping the ground below the plants free of infected twigs and leaves helps prevent fungal spores from mutating as well.

Fungicide should be used with caution as they are toxic and could be dangerous if applied incorrectly.

I. LISTING OF COMMON CHEMICAL FUNGICIDES

A. BENOMYL (Benelate) - Controls Black Spot, Botrytis, Brown Rot, Gray and White Molds, Anthracnose, Mummy Berry, Powdery Mildew, Scab, Fusarium Wilt and Septoria Spot.

RATE: Using a 50 wettable powder, rates will vary from 1 to 6 pounds per acre, depending upon the disease. Check the label.

B. CAPTAN - Controls Anthracnose, Leaf Spot, Fruit Rots, Cankers, Botrytis, Alternaria Fruit Rot and Stem Infections. Captan is a chemical that should be used mixed with Benomyl to control some of the diseases.

C. FUNGINEX - Controls Powdery Mildew, Downy Mildew and Mummy Berry.

D. RIDOMIL - Controls Phytophthora and Pythium.

E. ALIETTE - Controls Phytophthora, Downy Mildew, Brown Rot and Fruit Rot.

II. READILY AVAILABLE FUNGICIDES THAT ARE SAFER TO APPLY TO EDIBLE CROPS FOR HOME GROWERS AND FRUIT AND VEGETABLE GROWERS.

A. BORDEAUX MIXTURE - A mixture of Copper and hydrated Lime. Controls Anthracnose, Scab, Black Rot, Fire Blight, Leaf Spots and other fungal diseases. Do not use the Bordeaux mixture during cool wet climate conditions as plant damage may occur. A common Bordeaux mixture is 8-8-100 analysis, which means 8 pounds Copper Sulphate, 8 pounds of Hydrated Lime dissolved in 100 gallons of water. Stock solutions can be made up equaling one pound of the product to 1 gallon of water. For acid loving plants use less Lime if mixture is to be sprayed often. Some plants may experience phytotoxicity, so experiment with plants before applying the mixture.

B. COPPER SULPHATE - Controls Anthracnose, Scab, Bacterial Spots, Botrytis, Fruit Rots, Brown Rots, Downy Mildew and some Leaf and Stem Blights. Do not use the product during wet weather when temperatures are below 50 degrees Fahrenheit because plant damage will occur. There are many forms of liquid and powder Copper products on the market.

C. LIME SULPHUR - A caustic fungicide that burns germinating spores. Controls Scab, Brown Rot, Powdery Mildew and other fungal diseases. It can be sprayed on the plant during the dormant seasons in autumn and spring. Do not apply when temperatures are over 80 degrees Fahrenheit. It is advisable to apply after a rain or overhead irrigation and the foliage is still wet. By applying Lime Sulphur in the autumn and spring many of the spores will be killed before the growing season is started. Mix a dilution of 1 part Lime Sulphur to 50 parts of water and coat the plants with a spray.

D. SULPHUR - Sulphur has the lowest toxicity to plants than other products. It works by preventing fungal spore development when it is sprayed on foliage. As a preventative use the product every 2 weeks but do not apply when temperatures exceed 80 degrees Fahrenheit. Sulphur controls many fungal diseases such as Rose Black Spot, Rusts, Anthracnose, Black Rot, Leaf Spots, Scab and Powdery Mildew. Sulphur will be phytotoxic to cucurbits, squash, melons and some raspberry cultivars. It is best to mix Sulphur with a wetting agent since it is best to stay on the foliage.

E. SEAWEED, KELP - Applications of Kelp at recommended rates at frequent intervals will keep the plants healthy and will help control Botrytis infections, Leaf Spots and other fungi and will suppress fungal spores.

Section 5

INSECTICIDES

There are chemical insecticides and natural insecticides and predatory insect controls. Insecticides should only be applied if a problem in the garden or orchard is beginning to cause damage. The reasons for delaying an insecticide application are two fold. Predatory insects will be killed and chemicals are costly and are not easy to apply.

I. CHEMICAL INSECTICIDES

A. MALATHION - A wettable powder used to control aphids, fruit worms, leaf worms and many other insects. This is the best chemical to use for killing aphids but direct spray underneath the foliage.

B. SEVIN - A wettable powder used to kill many insects in the foliage and sometimes it can be used to kill damaging grubs in the soil.

II. NATURAL INSECTICIDES

A. INSECTICIDAL SOAPS - Made from fatty acids for commercial and home growers to control insects. They work by coating the insect so the insect cannot breath. Apply a thorough cover spray on bottom and top foliage every 7 to 14 days or every 2 to 3 days when infestations are bad. Soaps will control white fly, aphids, mites and other soft bodied insects. Mixing 1/4 to 1/2 cup of 70% Isopropal Alcohol with each quart of prepared soap will have better insect control. The Alcohol may burn foliage of some plants and do not apply the soaps when temperatures exceed 85 degrees Fahrenheit.

B. GARLIC PRODUCTS - Garlic sprays will deter the insects from the sprayed areas. Insects do not like the odor of garlic. To make a garlic spray: chop up 20 cloves of garlic finely and place them into 1 pint of mineral oil for 48 hours. Strain the oil and use 1 to 2 ounces of the garlic oil to 1 quart of water or an insecticidal soap. There are garlic products on the market.

C. HORTICULTURAL OILS - Oils are used as preventatives. Use oils only during the dormant season, usually in the spring before new growth emerges. Oils will coat the branches and trunks of shrubs and trees and work by suffocating insect eggs. There are light oils available that can be used in the growing season. The viscosity of these summer applied oils should be 50 to 70; and use a 2% to 3% solution with water. These are good control measures for mites and aphids.

E. SEAWEED OR KELP - This product, if applied often will aid in keeping the plants healthy and the sugars high in the plants. Insects are less likely to attack a healthy plant.

F. BACILLUS THURINGIENSIS(BT) - A liquid or wettable powder form. It is a bacteria that worms and caterpillars will digest and will damage their system. Apply the product when the worms are present only and cover all foliage of the plants. A sticker should be added to the wettable powder. Use a light oil, fish emulsion or insecticidal soap for this purpose.

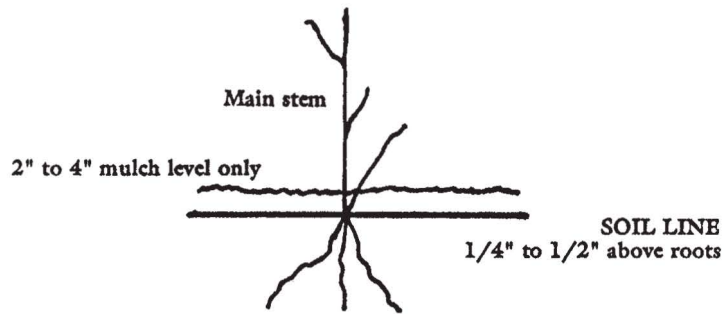
G. MILKY SPORE - An excellent product to control soil grubs. The grubs ingest the fungus and succumb. Apply the powder around the area of the plants roots either on top of the soil or it is also good to work it into the soil.

H. OTHER INSECT SPRAYS - Some new insect sprays on the market are: Hot pepper sprays, Neem products, Caffeine antifeedent sprays.

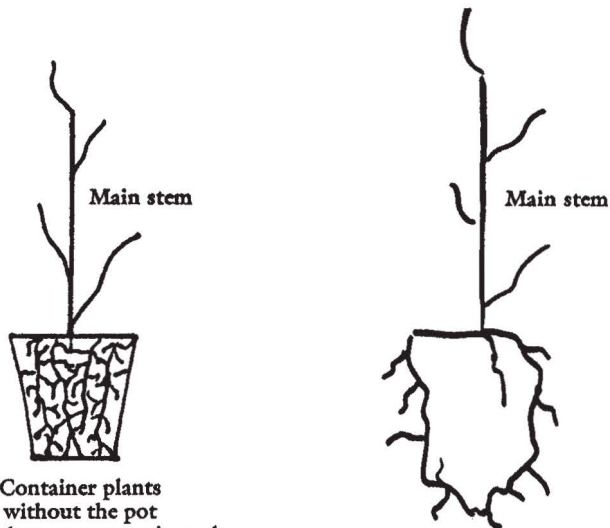
I. PREDATORY CONTROL - There are many animals and insects that will feed on harmful insects. To name a few: Frogs, Toads, Birds, Lady Bugs, Preying Mantis, Lacewing and Syrphid Flies, Hover Flies and Parasitic Wasps. An environment can be created for these predators. They also like vegetables besides being carnivorous.

Section 6

Planting depth for plants



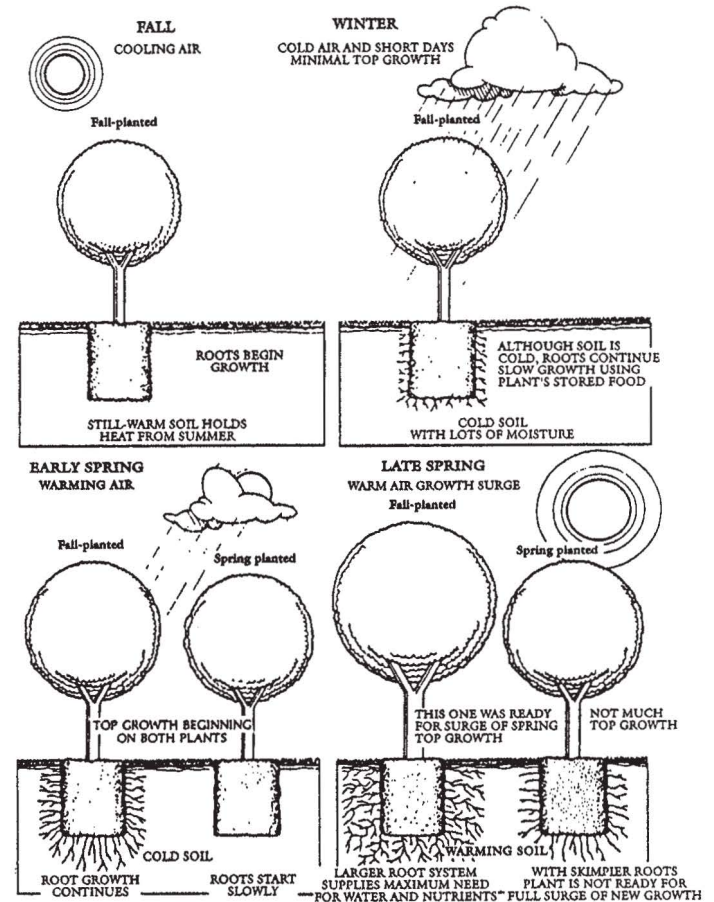
Before planting a container grown plant, read this below



Container plants without the pot
(Do not plant your container plant without breaking the root ball.)

Container plant after the roots have been broken up before planting

Advantages of Fall Planting



There are advantages to fall planting but there are some areas where it is not recommended. Below are approximate dates that plants should be planted.

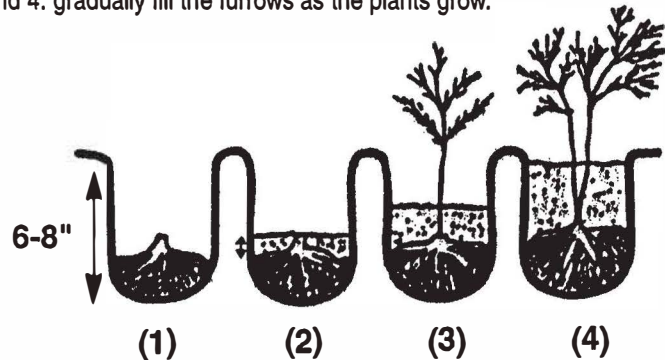
USDA ZONES	BEST PLANTING DATES
2A-4B	March through July
5A-6A	September 1 through October 30 or early spring
6B-7B	September 20 through November 25 or early spring
8A-11	November 15 through April 15

Brambles are plants that are normally planted in the early spring since the plants are dug in November in Michigan. If a container grown plant is used for the brambles they can be planted at the above recommended dates.

Planting example for Asparagus

PLANTING CROWNS

1. Set crowns upright in wide furrows, six inches deep, with roots spread.
2. Cover with two inches of soil. Do not add compost!
3. and 4. gradually fill the furrows as the plants grow.



Section 7

USDA ZONES
11-9 (Indoors)

ABUTILON
Abutilon vitifolium and other spp.

TYPE OF PLANT: An attractive shrub or trainable tree formed plant that is native to warm regions of the world.

SEASONAL COLORS: Foliage will remain evergreen and the leaves are the shape of maple leaves. Some cultivars have variegation in the foliage and some retain the green color. Bell shaped flowers appear on the plants year round and colors will vary from red, yellow or orange depending upon the cultivar.

PLANT USES: Good accent plant in perennial gardens, decks, patios and in homes.

pH REQUIREMENTS: 5.0 - 6.8.

SOIL TYPES: Sandy loams to clay loams or potting soils.

LIGHT REQUIREMENTS: Full sun is best, shade is okay. In heavier shade the plants become greener and then will show signs of yellowing leaves until the correct sunlight is given to them.

PLANT SPACING: The plants will grow up to 3 feet in diameter and as tall as the grower needs, so space accordingly.

GROWTH RATE: Plants are vigorous and in 2 months a small 3 inch plant will reach mature height and width. The plant is long lived, known to grow vigorous at 8 years old.

MULCHING: Not necessary, but beneficial.

WATER REQUIREMENTS: If growing in full sun keep the top inch of the soil moist to the touch and plant will be happy with light waterings on the foliage. If growing indoors water sparingly usually letting the soil become dry to the stage just before the plant foliage will wilt or droop because of lack of water.

FERTILIZER REQUIREMENTS: High fertilizer requirements. Use non-acid.

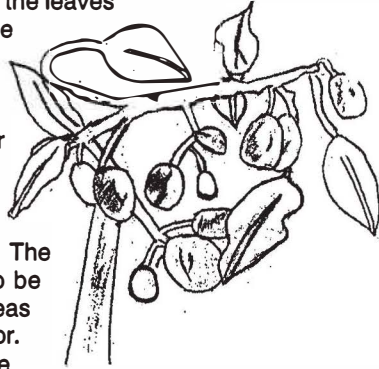
PRUNING: To create a bush form, pinch the tip of the plant where the desired height of the branching is to start. Tree form: keep the side branches trimmed off from the base upwards to the tip, leaving 2 inches of new leaf growth at the tip. As the plant grows repeat the first step until the desired height is reached. After the height is reached pinch the terminal tip off and let the plant branch normally, pinching whatever growth may be growing abnormally longer than the rest of the branch. See the training example on page 76-78.

INSECTS: Aphids and chewing insects may be a problem, so apply Malathion or Sevin as needed.

FUNGUS: None.

ARCTIC KIWI
Actinidia arguta

TYPE OF PLANT: A fruiting vine that is native to Siberia and parts of Asia.
SEASONAL COLORS: Early spring and summer the leaves are bright shiny green. In the late summer to early autumn the fruits ripen and hang down from the cordons like large size grapes. The first frost will turn all the leaves bright yellow and they will soon fall from the branches exposing a naked art work of twisting grayish brown branches.



PLANT USES: The fruits are prized for their delicious flavor. The fruits have a similar flavor to the fuzzy kiwis but there is nothing that tastes better than a vine ripe kiwi. The fruits have tiny seeds that are palatable but there is no fuzz on the fruit so no peeling is necessary. The edible ornamental value of the vine is good to be used to make a trellised fence to separate areas or make a kiwi arbor rather than a grape arbor. The plant needs to be pruned in the fall. The prunings can be used to make Christmas wreaths.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPES: Well drained sandy, sandy loam or clay loam.

LIGHT REQUIREMENTS: Full sun is needed to produce fruits. Partial shade is okay but heavy shade is not advisable.

PLANT SPACING: In row spacing should be 6 to 15 feet depending on climate. The colder the climate the closer in row spacing should be. Aisle spacing should be 10 to 12 feet depending upon which trellis system is used. The T-Bar trellis is recommended so 12 feet aisles are best.

GROWTH RATE: A one year plant grown in a 2 1/2 inch pot will produce fruit the fifth season. It is recommended to plant the small plant in a nursery row at close spacing for one growing season, then transplant the plant in 2 weeks before a frost or wait until the following spring. The first years' growth on a one year plant should grow 12 to 24 inches tall and only one stem should be the strongest used. This will be the plant's supporting trunk for the future. As the future trunk grows, the tip should be pinched 3 weeks before a normal frost date. This will harden the bottom growth and the new growth will be ready for the hard freezes of autumn and winter. Year two the main trunk will continue to grow in early spring. When the trunk reaches the 5 to 6 foot level pinch the tip again. By pinching at this time it will do two things, create branching for cordons and harden off the new trunk growth. Year three development of cordons on the center wire will begin. Train these by tying them to the wire. Late summer pinch the tip of the cordons to harden them off. They will regrow in the spring. Year four continues growth of cordons and fruiting laterals will develop on the cordons. See Page 76 for illustration of training.

MULCH: Not needed unless they are planted in sandy soil.

WATER REQUIREMENTS: The first 2 years it is important to keep the plants moist. The first two top inches of the soil should remain moist to the touch.

FERTILIZER REQUIREMENTS: High rate non acid type. These plants love to eat!! No fertilizer should be applied 3 months prior to a normal spring frost.

(Example: Expected frost date September 15 so no fertilizer after June 15). The

AMERICAN CRANBERRY
Vaccinium macrocarpon

reason late fertilizer applications are not recommended is because the plants will grow too late in the summer and the tender growth will be subject to damaging autumn and winter freezes.

PRUNING: When plants are mature, pruning should take place every 2 weeks during the growing season and one time when the foliage is off of the plant in autumn. Summer pruning is done to remove sucker growth and growths that emerge from the main trunk. Pruning of fruiting arms and laterals is important and thinning the cordon of growth is important. First choose the fruiting arms in early summer that you want to keep. The fruiting arms should be spaced 6 to 12 inches apart on the cordon. As the fruiting laterals grow from the arms they must be cut to a length of 18 to 24 inches long by August; if not cut they will not produce fruit buds for the future crop. Keep any unwanted growth pruned out so the sun can ripen the fruit evenly and vigor can go into making fruit buds on the laterals. There will be 2 sets of fruiting laterals; one set will have fruit, the other set will be new laterals for the next years crop. Winter pruning is easy. It is mainly clean up the cordon time. Remove at the cordon the fruiting arms that produced fruit and any unwanted growth that is growing in between the 6 inch separation of the new fruiting arms. A fruiting arm can produce the laterals or 2 to 3 years but after that they will become unproductive. Remove all fruiting laterals that produced fruit the prior season. They will be unproductive. After the male vines flower and pollinate the female flowers, cut the arms that produced the flowers to a length of 24 inches. Prune them in the dormant season the same as female plants.

INSECTS: Aphids are the main problem because the leaves are soft. Apply insect spray of Malathion or Sevin.

FUNGUS: Botrytis may be a problem in some years but very seldom. A dormant spray of Lime Sulphur in the autumn and early spring is recommended.

TYPE OF PLANT: An evergreen trailing ground cover, producing edible fruits. The Cranberry is one of the U.S. native fruit plants.

SEASONAL COLORS: The most spectacular season is autumn when the bright red large fruits appear on the stems. As the plant progresses into the autumn the foliage turns burgundy in color. This color remains until after flower time. The tiny flowers appear in late spring and early summer and are inconspicuous but are very detailed with whitish pink petals with a red throat. After flowering the new growth will begin and foliage will be a bronzy red color and change to deep green in mid summer. The tiny leaves are one inch long and narrow leaves on the stems give the appearance of the plant being delicate. However, these plants are tough and grow in most climates and situations.

PLANT USES: The biggest use of the plant is for its' fruits. Native Americans enjoyed the fruits and today all Americans have had fresh cranberries or cranberry juice. It is one of the most popular fruits today. The plants are adaptable to be grown as an upland or bog ground cover. The plants are vigorous and establish well in most soils, so the use as a ground cover has been successful. Because of its' trailing effect it also makes a wonderful hanging basket and can be grown in a pot for patio or plantings.

pH REQUIREMENTS: 4.0 - 6.5.

SOIL TYPE: Sandy soil, sandy loams to boggy type soils. Boggy type soils are okay for the plant to grow in as long as there is not standing water for more than a few days. The plants do like fairly good drainage.

LIGHT REQUIREMENTS: Full sun is best but they will grow in 50% shade.

PLANT SPACING: Using a plant grown in a 2 1/2 inch pot plant them 6 inches apart and stagger each row if planting a mass planting. When plant size is increased by 2 inches (example: 4" container) the plant spacing can be increased another 6 inches (12 inches apart).

GROWTH RATE: The first year the plant will mainly start root development. The branches should grow outward at least 4 to 8 inches long. The second year the branches will become fuller with side branching. Within 3 years the plant will have a spread of 10 to 16 inches and the center of the plant will be full of new branches, flowers and fruit.

MULCHING: Not necessary.

WATER REQUIREMENTS: Keep the top inch of the soil moist but do not over water. The small leathery leaves will not transpire water quickly. Excess water will kill the plant if too much is applied during the growing season.

FERTILIZER REQUIREMENTS: Low rate acid type. When plants are immature it is best to use a water soluble fertilizer. After the first growing season light applications of granular fertilizers are recommended.

PRUNING: The plant can be mowed leaving 1 1/2 inches of growth above the soil. Another method is to thin the plant by raking up the lower growing stems and cutting about 30% of these stems. Mowing is easier but fruit will be sacrificed, so only mow if the plants become unsightly because of age. Any pruning should be done between late autumn and early spring.

INSECTS: For aphids apply recommended controls.

FUNGUS: Fungus will attack the fruits especially in major cranberry production areas. In landscapes and gardens fungus problems should not be a problem. The plant itself is not susceptible to any fungus except Phytophthora, due to over watering, excess fertilizers or poor drainage.

USDA ZONES
3-8

ASPARAGUS *Asparagus officinalis*

TYPE OF PLANT: Herbaceous perennial.

SEASONAL COLORS: Green stems in early spring which are the edible parts. After harvest is complete more stems develop during the summer, growing to 3 feet tall.

PLANT USES: Mainly as a food crop.

pH REQUIREMENTS: 6.5 - 7.5.

SOIL TYPES: Well drained soils are a must, so if planting in clay make a raised bed.

LIGHT REQUIREMENTS: Full sun is best, but they will grow in partial shade.

PLANT SPACING: In row spacing is recommended at 12 inches apart. Row spacing depends on equipment width but space no further than 5 feet. The row width for plant development will develop as far as 18 inches wide.

GROWTH RATE: Plants grow fast. The first year after planting let the stem develop and by autumn they will be finished growing. In the early spring the second year mow the stems to ground level then new stems will grow upward from the ground

USDA ZONES
3-7

BEARBERRY *Arctostaphylos uva-ursi*

TYPE OF PLANT: A trailing groundcover growing a few inches tall and has a capability to spread over large areas. Non evasive.

SEASONAL COLORS: All times of the year this plant is spectacular. In the late spring through the summer the foliage becomes bright green. At the end of summer the small oval shaped leaves become leathery and change color to a very deep jade green then to burgundy by mid autumn. By autumn bright red fruits cover the stems of the plant, sometimes hiding the foliage. The fruits will sometimes be attached to the plant until the next spring when pure white bell shaped flowers appear.

PLANT USES: This plant will grow deep roots so it is good for erosion control; the stems that grow outward will form roots that help to keep the soil where the landscaper or gardener wants it. It is one of the only plants that will adapt itself to pure sandy soils. It is found growing along lake shores and dry sandy forests. The plant will take abuse from high and low temperatures and dry soils. The berries are a food source for wildlife. Part of the plant has medicinal qualities and is harvested from the native plants, so commercial growing should be considered. Bearberry is a native plant in North America in the family of Ericacrae.

PH REQUIREMENTS: 4.0 - 6.5.

SOIL TYPES: Well drained only in sand or sandy loam soils.

LIGHT REQUIREMENTS: Full sun to full shade. It will do best with some sunlight.

PLANT SPACING: Using a plant grown in a 2 1/2 inch pot, plant them 6 inches apart and stagger each row if planting a mass planting. When plant size is

increased by 2 inches (example: 4" container) the plant spacing can be increased another 6 inches (12 inches apart).

GROWTH RATE: The first year the plant will mainly start root development. The branches should grow outward at least 4 to 8 inches long. The second year the branches will become fuller with side branching. Within 3 years the plant will have a spread of 10 to 16 inches and the center of the plant will be full of new branches, flowers and fruit.

MULCHING: Good for the first year but not necessary after the first year.

WATER REQUIREMENTS: The plants have low water requirements. After planting apply water to moisten one time per week until new growth appears. Then apply small amounts of water. The plant should never need water after it is established. The leathery leaves' texture has a low evaporation rate. Water can kill this plant.

FERTILIZER REQUIREMENTS: Low rate acid or non acid. Use only water soluble fertilizer or slow release fertilizer. Granular fertilizer should be avoided as it will kill the plant.

PRUNING: Prune only unwanted stems to keep in a designated area.

INSECTS: None.

FUNGUS: Phytophthora susceptibility because of poor drainage, excess moisture or over fertilization.

USDA ZONES
5-9

BLACKBERRIES

Rubus spp.

TYPE OF PLANT: A deciduous broad leaf trailing or erect cane plant. Plant types can be thorny or thornless depending upon the cultivar.

SEASONAL COLORS: The blackberry leaves are quite large and in the autumn they change to a burgundy color amongst some green. The foliage drops by winter and spring flowers are pink or white depending on the cultivar. By mid summer the large black fruits hang on long clusters.

PLANT USES: These plants are used mainly as an edible fruit for fresh use or for making marmalades, pies and juices. You can also freeze them to eat during the off season months.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: Sandy, sandy loam and clay loams are best.

LIGHT REQUIREMENTS: Full sun is best for fruit production and optimum growth.

PLANT SPACING: In row spacing can be 3 feet up to 6 feet. Aisle spacing should be 10 to 12 feet. Three feet of row will be lost due to outward growth of the plant, so a 10 foot aisle will result in a 7 foot usable aisle.

GROWTH RATE: Plants are vigorous. A normal size plant to plant in the soil will be 1 year tip layer grown or potted. In one growing season the plant tops will be 1 to 3 feet tall with 2 to 6 stems on each plant. The second growing season the plant will be developed to produce fruit the third year.

MULCHING: Not needed.

WATER REQUIREMENTS: When the plants are newly planted keep the soil moist the first year. Usually once the roots are well established they are hardy and will find water. It is good to apply water to attain the best fruit crops and growth year after year.

FERTILIZER REQUIREMENTS: Use medium rate non acid fertilizer.

PRUNING: There are 3 types of Blackberries. Trailing thornless, trailing thorny and erect thornless. See pages 76-80 for example.

A. Trailing Thornless: There are 2 parts to the plant; a cane that grows from the ground upward and fruiting laterals that grow along the cane which produces fruit. The first year or two the canes of the blackberry will tend to grow, trailing the ground. The second or third year stronger canes will take over and produce more of an upright growth. As the canes grow upward, they should be tipped. The level of which they are tipped depends on the climate where they are grown. In cold winter climates of Zones 4 and parts of Zone 5 tip at 24 inches tall. In warmer zones tip higher up to 5 feet. The fruiting laterals will grow from the pinched tip of the cane and need to be trained or tied to a wire by late autumn. In the spring the fruiting laterals need to be pruned back to and shortened to about 18 inches long. The amount of canes recommended will depend on plant spacing. The 3 foot spacing 2 canes per plant with the more distant in row spacing grow up to 8 canes per plant.

B. Trailing Thorny: These plants are more vigorous and hardier in cold climates. Tip these plants at a 4 foot level and trim the fruiting laterals in the spring to 12 inches long. It is best to remove excess canes leaving two canes per every running foot. Canes can be mowed to the ground level for a pruning method but 1 crop year will be lost unless each alternate year a section of the blackberries are cut.

C. Erect Thornless: There are two main parts to these types of Raspberry. One is the cane and the other is the fruiting lateral. Canes grow from the ground upward while fruiting laterals grow from the top of the canes producing fruit. For good production grow 3 to 6 canes per plant. When the canes reach a height of 26 to 28 inches tall cut about 2 to 4 inches of growth from the top of the cane. Make the cut just above a bud. These canes will then produce fruiting laterals at the end of a growing season. This growth could occur the first year if the plants grow vigorously. It is good to trellis the lateral branches in the early autumn. The new fruiting laterals will be long, sometimes up to 3 feet. These laterals should be pruned back to no more than 10 inches long. This can be accomplished any time the plant is dormant. In cold areas where winter temperatures could kill buds, the best time to prune the laterals is in the early spring. At the end of a harvest season the canes that supported fruit are usually pruned out because production will be lower.

TRELLISING: For all Blackberries at least two wire trellis systems should be used. Choose the type that suits the garden or production area best. The wires should be 24 inches from the soil level and one at 4 feet above the soil level.

INSECTS: Aphids, sucking insects, cane or crown borers, fruit worms and mites can be problems. These are not problems in all growing regions and sometimes small garden plantings will not be affected by them.

FUNGUS: Botrytis on stems, Anthracnose on leaves and Fruit and Crown Gall can be problems. Some of these fungi can be controlled by cultural methods of keeping debris from the base of the plant, pruning and keeping the plant healthy. Root fungus such as Verticillium Wilt and Phytophthora can be controlled by providing good drainage, no over watering and no over fertilization. Blackberries can be planted amongst black, red or yellow raspberries without spreading diseases or inhibiting cross pollination. The thorny type blackberries will sucker so it is not a good idea to plant these types in the same row with other types of brambles.

USDA ZONES
3-8

HALF HIGH HYBRID BLUEBERRY

Vaccinium corymbosum x angustifolium

TYPE OF PLANT: Hybrids of Lowbush and Highbush attaining a height of 20 inches to 48 inches at maturity. Deciduous fruiting low growing shrubs.

SEASONAL COLORS: Autumn: Yellows, Oranges, Reds, Fluorescents, Burgundy and Dark Green. Spring: Naked of foliage but pink to white with flowers.

PLANT USES: Use these plants as border plants along walkways, rock gardens, patios, mass plantings and fruit production. Fruits contain high amounts of vitamins and are highest in Anti-oxidents of any fruit or vegetable.

pH REQUIREMENTS: 4.0 to 5.5

SOIL TYPES: Well drained, sand or sandy loam. Clay loam and clay soil both need amendments.

LIGHT REQUIREMENTS: Full sun best to filtered sun.

PLANT SPACING: Plant 12 to 24 inches in a row and 24 inches to 6 feet for aisle spacing.

GROWTH RATE: Medium 12 to 24 inches per year per cane. New cane development of 1 to 4 canes per year.

MULCHING: Beneficial but not needed. Mulch is recommended in southern parts of the U.S. where extreme heat slows down growth and in the north where the temperatures are low without snow cover.

WATER REQUIREMENTS: Moist during the growing season. Rule of Thumb is 1 inch per week during the growing season and until the plants become dormant.

FERTILIZER REQUIREMENTS: Medium rate acid type fertilizer.

PRUNING: See chart on pages 76-80. Prune 1 time per year during the dormant stage.

INSECTS: Control aphids and chewing insects with Malathion or Sevin. Spray after flowering and re-apply only when the insects are doing damage.

FUNGUS: Phytophthora Root Rot, Anthracnose, Alternaria and Botrytis can be controlled sometimes without chemicals. Keeping the plants healthy by pruning, watering, fertilizing and keeping them weed free has shown to be effective.

USDA ZONES
4-10

HIGHBUSH BLUEBERRY

Vaccinium corymbosum

TYPE OF PLANT: Highbush blueberry-height varying between 4 to 12 feet. Deciduous fruiting shrub.

SEASONAL COLORS: Autumn: Yellows, Oranges, Reds, Fluorescents, Burgundy and Dark Green. Spring: Naked of foliage but pink to white with flowers.

PLANT USES: Highbush Blueberry is one of the Original Native Fruit Plants in North America, so when you plant you are replacing our native species. You can use them as a



USDA ZONES
3-8

LOWBUSH BLUEBERRY

Vaccinium angustifolium & vacillans

TYPE OF PLANT: Low growing deciduous fruiting Blueberry. Plants range in height from 12 inches to 36 inches.

SEASONAL COLORS: Autumn Colors: Burgundy, Fluorescent Reds, Yellows, Oranges and Deep Greens. Some cultivars will have leathery leaves and most of them are narrow and slender. Spring Colors: Fantastic with the planted area pure white. Summer Colors: Colors are variations of Greens.

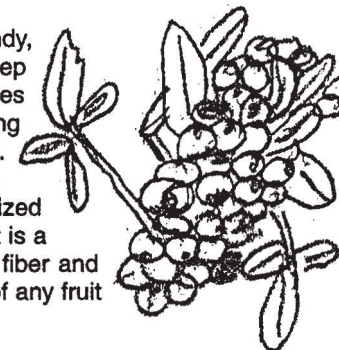
PLANT USES: Commercial production of small sized fruit. Ground cover to beautify any landscape. It is a good hideaway for small wildlife. Fruits contain fiber and vitamins and are have the highest Anti-oxidents of any fruit or vegetable.

pH REQUIREMENTS: 4.0 - 5.5

SOIL TYPE: Well drained, sand or sandy loam. Clay loam and clay soil both need amendments.

LIGHT REQUIREMENTS: Full sun best to filtered sun.

PLANT SPACING: A plant in a 2 1/2 inch container should be planted 6 inches apart and each row staggered if planted in mass plantings to create a solid cover of plants. When plant size is increased by 2 inches (example 4" container) the plant spacing can be increased another 6 inches (12 inches apart).



GROWTH RATE: Spreads by underground rhizomes 4 to 12 inches per year and spreading in an area many square feet, unless they are controlled. Rhizomes are easily controlled just by cutting the outside boundaries with a shovel or by using a border. The plant is not evasive.

MULCHING: Beneficial but not needed. Mulch is recommended in southern parts of the U.S. where extreme heat slows down growth and in the north where the temperatures are low without snow cover.

WATER REQUIREMENTS: Moist during the growing season. Rule of Thumb is 1 inch per week during the growing season and until plants become dormant.

FERTILIZER REQUIREMENTS: Medium rate acid type fertilizer.

PRUNING: Prune by mowing but leave 1 to 1 1/2 inches of growth above the soil line.

INSECTS: Control aphids and chewing insects with Malathion and Sevin. Spray after flowering and re-apply only when needed to control insects.

FUNGUS: Phytophthora Root Rot, Anthracnose, Alternaria and Botrytis can be controlled by keeping the plant healthy. Proper pruning, fertilizing, correct watering and being free of weeds are all effective.

USDA ZONES
8-10

RABBITEYE BLUEBERRY

Vaccinium ashei

TYPE OF PLANT: Tall growing 6 to 15 feet at maturity. Deciduous, almost evergreen in the deep south.

SEASONAL COLORS: Autumn: Yellows, Oranges and Reds. Spring: Pink to White Flowers. Summer: Grayish Green, Powder Green, Light Green to Dark Green.

PLANT USES: Rabbiteye Blueberry is one of the Original Native Fruit Plants in North America, so when you plant you are replacing our native species. Use as a fruiting fence or food for wildlife. The blueberry is a very nutritious fibrous fruit containing the highest amount of Anti-oxidents of any fruit or vegetable. It is also a four season ornamental.

pH REQUIREMENTS: 4.0 - 5.5

SOIL TYPES: Well drained, sandy and sandy loam. Clay loam and clay soils need amendments.

LIGHT REQUIREMENTS: Full sun preferable, but filtered sunlight okay.

PLANT SPACING: Plant 4 to 6 feet in row and 6 to 12 feet for aisles.

GROWTH RATE: 12 to 36 inches per year on canes with 1 to 4 new canes per year.

MULCHING: Beneficial but not needed. This type of blueberry will survive higher temperatures than Highbush, so mulch isn't important.

WATER REQUIREMENTS: Moist during the growing season. Rule of Thumb is 1 inch per week during the growing season and until plants become dormant.

FERTILIZER REQUIREMENTS: Medium rate acid type fertilizer.

PRUNING: See example on pages 76-80.

INSECTS: Control aphids and chewing insects with Malathion or Sevin. Spray after flowering and re-apply only when needed to control insects.

FUNGUS: Phytophthora Root Rot, Anthracnose, Alternaria and Botrytis can be controlled by keeping the plant healthy. Proper pruning, fertilizing, correct watering and being free of weeds are all effective.

USDA ZONES
3-8

BUNCHBERRY

Cornus canadensis

TYPE OF PLANT: A low growing herbaceous groundcover, erect stems appear from the ground roots. Grows two to four inches tall.

SEASONAL COLORS: Spring: the prettiest time of the year for the Dogwood. Bright lime-green leafy, erect stems appear from the crown followed by 4 pure white petal like bracts above the leaves. The flower inside the bracts are tiny and yellow-green. Summer: berry type fruits form, changing from green to orange in late Summer to bright red in autumn. Autumn: foliage color changes to burgundy.

PLANT USES: Mainly as a groundcover. Since it is a plant of the Dogwood family the foliage and flowers are reminiscent of the outstanding and popular Dogwood tree.

pH REQUIREMENTS: 5.0 to 6.8.

SOIL TYPE: Well drained sandy or sandy loam. Any poorly drained soil should be amended or prepare a raised bed.

LIGHT REQUIREMENTS: Full shade is best. Filtered shade is good; full sun is okay with adequate moisture.

PLANT SPACING: Using a plant grown in a 2 1/2" pot, plant them 6 inches apart and stagger each row if planting a mass planting. When plant size is increased by 2 inches (example: 4" container) the plant spacing can be increased another 6" (12" apart).

GROWTH RATE: The first year is slow, 2 inches. The second year and subsequent years 4"-12" of spreading per year. The plants are not invasive and when they move into an area where they are not wanted, cut the outside roots with a shovel during the growing season and that will stop the growth.

MULCHING: Very beneficial the first year after planting. It is good to let the fallen leaves of autumn remain on the plants as it will protect them from cold temperatures and keep the organic matter high.

WATER REQUIREMENTS: Natively, the plant grows in cool moist woodland areas: 1/2" of water per week is important. For establishment of plants, apply water more often until new roots form. This has been a difficult plant to establish, but 4 weeks after establishment it will grow vigorously.

FERTILIZER: Low rate to none, use non acid.

PRUNING: Mow in the late autumn if desired.

INSECTS: None

FUNGUS: Phytophthora root rot caused by over fertilization, heavy soils or over watering.

USDA ZONES
4-8

BUSH CHERRY

Prunus japonica x jaquemonti

TYPE OF PLANT: A fruit producing bush, growing to 4 to 5 feet at maturity. The species of the plant are considered plums but the two combined species hybridized produce tart cherry flavored fruits.

SEASONAL COLORS: Spring is the most outstanding time of the year when thousands of flowers cover the plant. New leaves emerge lime green and change to darker green as they mature into summer. Fruits are harvested between August to October depending upon the cultivar. The bright red fruits stand out and most are

borne on the outside stems. In the autumn the green foliage changes to yellows and oranges. The deciduous plant has an interesting artwork of gray to black colored branches.

PLANT USES: Bush cherries are the only cherries ripe in August to October in North America. They can be planted as a landscape plant, patio plant in a pot or for commercial production of late summer to autumn fruits. The fruits can be used as anyone uses tart cherries.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: Sandy, sandy loam and clay loam; but with good drainage.

LIGHT REQUIREMENTS: Full sun to partial shade.

PLANT SPACING: If planting them in rows to make a hedge, space them 2 feet apart. If planting for commercial or garden production plant them 36 inches apart in rows and at least 6 foot aisles or larger depending upon machinery width. In the landscape the plant will grow up to 4 feet high and 6 feet wide. Plant 2 cultivars within 30 feet for pollination.

GROWTH RATE: The first year the plant will grow roots mainly and the tops will grow upward 12 inches depending on growing conditions. The second year after roots are established the top growth will start growing and 2 to 6 shoots will be formed at the base attaining a height of 12 to 24 inches each. The third year the plant should be 36 inches tall with another 2 to 6 new stems from the ground as well as the growth from the previous years growth. The plant is fairly vigorous for a woody plant. The third year flowers should form and produce every year thereafter.

MULCH: Good, but not needed.

WATER REQUIREMENTS: The first year of establishment apply water every 7 to 10 days when the soil is dry. After the plant is established very little water is needed.

FERTILIZER REQUIREMENTS: Medium rate, non acid.

PRUNING: In the first and second planting year remove any horizontal growth at the base of the plant. This will promote upright stem growth. The third and fourth year prune only to shape the plant. The fifth and future years prune the canes that become unproductive. Canes that are 5 to 6 years old are usually unproductive and are removed close to the base of the plant. There should be 12 to 16 productive branches per plant (2 years to 5 years old) and 4 to 6 new one year stems growing from the basal crown of the plant.

INSECTS: Aphids and chewing insects can be controlled with available insecticides.

FUNGUS: Brown Rot is a problem in some climates so control with lime sulphur. Spray in early spring and autumn during the dormant period. Clean up any plant debris near the plant and keep the plant pruned well. Do not over fertilize the plant at any time and stop all fertilizer 12 weeks before the first normal frost date.

USDA ZONES
10 (Indoors)

CITRUS *Citrus spp.*

TYPE OF PLANT: Sub-tropical and tropical fruiting trees and small shrubs. The citrus encompasses varieties of Grapefruit, Orange, Tangerine, Pummelos, Kumquats, Limes, Limequats and Calamondin Oranges.

SEASONAL COLORS: Plants are evergreen and will produce flowers and fruits at the same time, depending on the cultivars. Bright green foliage is outstanding on all of the citrus.

PLANT USES: Mostly used as a fruit crop, for juice and eating fresh. The gardener in the cold areas will be pleased to grow the citrus plant indoors. The plants are

adaptable in lower light conditions. At flowering time fragrance will encompass the area that the plant decorates. The flowers are sometimes used to place in an ice cube tray so when the cube is used to cool a drink the aromatic flavor is enjoyed. The foliage of citrus is used to make teas or potpourri. The rind is used to make a tea or flavor food. The lime is used to tenderize and flavor meats. The fruits contain high amounts of Vitamin C.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: Sandy or sandy loam are best. Soil for pot growing indoor use should be well drained. A good mixture would be pine bark and peat moss. Drainage is important; if the soil is poorly drained the plant leaves will change from dark green to yellow and fall prematurely, ultimately causing death to the plant.

LIGHT REQUIREMENTS: Plants grow in full sun but are adaptable to lower light.

PLANT SPACING: Spacing is dependent on the variety. Check with local growers or cooperative extension for the chosen cultivar that will be planted.

GROWTH RATE: Plants are considered medium growers. They will continue their growth 12 months per year providing they have good soil nutrients and drainage.

MULCHING: Mulch is not necessary but beneficial in sandy soils.

WATER REQUIREMENTS: The plants do not mind being on the dry side. Too much water, especially if the soil is slow to drain will damage the plants roots. Keep the plants medium moist and let the soil become fairly dry before applying more water. When growing indoors over watering the plants is easily done, and a sign of over watering will be yellow leaves and then premature leaf drop.

FERTILIZER REQUIREMENTS: Medium fertilizer requirements. Use non-acid type.

PRUNING: Prune to shape the plant and thin out the plant yearly so light and air can penetrate the inside of the tree.

INSECTS: Indoor growing, possible aphids or white fly can be problems. Outdoor growing depends on what area they are growing in. There are different pests in all areas. Check with your local County Extension office.

FUNGUS: If over watering occurs root rotting fungus will occur. There may be some problems with leaf spots if leaves cannot dry out for long periods of time. For outdoor growing check with your local County Extension office for recommendations for controlling fungus.

USDA ZONES
4-7

DAWN REDWOOD *Metasequoia glyptostroboides*

TYPE OF PLANT: An ornamental conifer resembling the coastal Redwood. Fossils of the 50,000,000 year old species were known to exist in the North America but plants were found in 1944 in China.

SEASONAL COLORS: The autumn is a smash hit. Bronze to burgundy foliage colors adorn the plant for 4 to 6 weeks. When winter arrives the maroon, gray, brown and black bark on the artistically formed branches and trunk will create a beautiful image in any landscape or forest. In the spring delicate green foliage appears and lasts through the summer. The leaves are very fine textured and the green cones are tiny and will appear in late summer.

PLANT USES: Grow as an accent tree or around ponds, it loves moisture and is not invasive. A row of the trees is eye catching and will act as a wind break.

pH REQUIREMENTS: 4.5 - 6.5.

SOIL TYPE: Sandy, sandy loam, clay loam or clay may be used.

LIGHT REQUIREMENTS: Full sun.

PLANT SPACING: To create a row, space the trees at 5 feet apart.

GROWTH RATE: The first year expect 24 inches of growth. After the first year the plants will grow 6 to 8 feet per year.

MULCHING: Mulching is beneficial on sandy soils.

WATER REQUIREMENTS: Keep moist the first two years.

FERTILIZER REQUIREMENTS: Medium rate of fertilizer required. Use non-acid.

PRUNING: Prune only to shape the plant to the form desired.

INSECTS: None.

FUNGUS: None.

USDA ZONES

3-8

DECIDUOUS HOLLY (Winterberry)

Ilex verticillata

TYPE OF PLANT: A deciduous multi-stemmed shrub growing to a height of 4 feet to 15 feet depending upon the cultivar.

SEASONAL COLORS: Autumn and early winter are the seasons when Holly shows off. Bright red fruits become outstanding as the leaves fall. The beginning of spring the fruits are all gone and new leaves emerge. Small insignificant white flowers bloom in June and green foliage and new stems remain bright green until autumn when the foliage turns to burgundy reds and yellows.

PLANT USES: There are many!! Used as a landscape plant, accent against evergreens or dark areas. Also used in rejuvenating wetlands. Commercial production of the beautiful cut branches with fruits are sold during the autumn and winter holidays. The fruit is good for wildlife food and it attracts all songbirds.

pH REQUIREMENTS: 4.0 to 6.0.

SOIL TYPE: The natural habitat for the plants is the wetlands of America. The plants are usually found in the higher areas or growing on top of mounds of sphagnum or natural organic matter. The plant also adapts well to upland soils such as homesites and well drained soils. They have been known to establish in dune sand, providing there is adequate moisture when the soil becomes dry. As long as the pH is correct the plant adapts to all soils.

LIGHT REQUIREMENTS: Full sun is best, filtered sun is okay. As more shade is given the plants become leggier and less fruit is produced.

PLANT SPACING: The dwarf cultivars are low growing to 4 feet at maturity. Plant them no closer than 3 feet apart and 5 feet in the aisles. The taller growing cultivars reach 6 to 15 feet, so plant them 5 feet apart and 10 to 12 foot aisles. An important characteristic is the *Ilex verticillata* needs a pollinator in order to produce fruit. The industry calls the pollinators males. One male can pollinate at least 15 females. For an abundance of fruit plant 1 male to 6 females. For landscape use plant the male within 500 feet of the females. For commercial production stagger the males within the rows of females.

GROWTH RATE: The first year the plants' roots grow, so the top growth will be slow to come. The second year the plants will grow upward producing new stems 12 to 36 inches long and usually 2 to 6 new stems per year.

MULCH: Mulch is beneficial the first year. If the plants are planted in well drained sandy soil mulch should be added every second to fourth year depending on decomposition of the mulch.

WATER REQUIREMENTS: If 2 inches of soil are moist the plant will be happy. One half inch per week during dry weather is sufficient.

FERTILIZER: Medium rate acid fertilizer.

PRUNING: In the landscape prune the plants to the shape desired. There will be many 1 year stems produced some years after pruning, so it is best to remove at least 70% of the 1 year suckers. Growth that is 7 years or older may show signs of stress because of their age. These should be removed at the base of the plant. A plant should have an average of 8 to 12 fruit producing growing canes and 6 to 8 one year stems growing from the base, for a very showy productive plant.

INSECTS: Aphids and chewing insects may be a problem but it is normally not bothered by too many insects.

FUNGUS: Occasionally powdery mildew can attack the plants in late summer or early autumn, but it doesn't have a bad effect on the growth for the upcoming season.

USDA ZONES

3-11

ELDERBERRY

Sambucus canadensis

TYPE OF PLANT: A smooth stemmed multi-branched shrub growing up to 12 feet tall and wide. Height and width can be controlled with pruning.

SEASONAL COLORS: Spring is magnificent, white flat topped clusters of tiny flowers appear from mid-way to the the top of the plant. New leaves emerge during flowering and the edible fruits ripen in late summer. Fruits are shiny black when fully ripe. Autumn foliage is bronze to burgundy and showy for a 4 to 6 week period. Winter shows the intertwining of grayish branches.

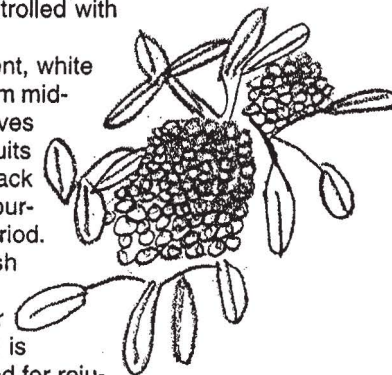
PLANT USES: Elderberry preserves or juices are made from the fruits. The plant is considered a native wetland plant and is used for rejuvenation projects. One specimen plant will provide enough fruit for a family. The unopened flower buds are used as a substitute for capers. The roots and root bark, leaves and flowers have medicinal qualities. The fruits offer nutritious fruits for wildlife and the plants large canopy of branches and foliage offers protection for wildlife.

pH REQUIREMENTS: 4.5 to 6.8.

SOIL TYPE: Plant will grow in any soil type. If planting in sandy soils apply water as needed during the growing season.

LIGHT REQUIREMENTS: Full sun to 50% shade is good. The plants are found in the wild in full sun but occasionally they are found in full shade. In full shade the plants are shorter with less branches than if grown with more sunlight.

PLANT SPACING: For commercial use plant them 6 feet in a row and 10 to 12 feet aisle spacing. As specimen plants keep them at least 12 feet away from other plants. If plants are planted under a landscape fabric they will become stoloniferous and send new runners of plants up to 20 inches away from the mother plant, so do not use a landscape fabric to plant them into the landscape.



GROWTH RATE: Plants are vigorous. A small one year old plant will produce fruit the third year. Plants will reach 12 feet wide and tall with up to 20 stems at maturity.

MULCH: Not needed except in sandy soils.

WATER REQUIREMENTS: Apply water weekly for the first 6 to 8 weeks until the plant is established. The plants' vigorous root system will find water. In sandy soils apply water as needed during a dry spell. The plants are found in their native habitat near wetland areas so they can survive in high moisture areas.

FERTILIZER REQUIREMENTS: Low rate non-acid.

PRUNING: Prune out stems that produced 2 crops of fruit. Pruning is done when the foliage is off of the plant in the late autumn or early spring. Thin out or shape the plant to the desired appearance.

INSECTS: None.

FUNGUS: None.

USDA ZONES

6-9

FIGS

Ficus carica

TYPE OF PLANT: A large fruiting shrub, growing in cooler sub-tropic areas. Stems are soft woody texture and the plants are deciduous.

SEASONAL COLORS: Summertime is fruiting time and the egg size fruits are extremely sweet. The leaves of the fig are extremely large and they hide the plants branches. The foliage looks very tropical so it can make a nice accent plant in the garden or in a container. The bare twigs in the winter months are brown and grayish in color and have a sturdy statured appearance.

PLANT USES: Fruits are the main reason to plant figs.

pH REQUIREMENTS: 5.0 - 7.5.

SOIL TYPE: Sandy, sandy loam and clay loam may be used. Sandy soils should be amended. When planting in clay soils prepare a raised bed and use soil amendments.

LIGHT REQUIREMENTS: Full sun.

PLANT SPACING: In row spacing should be 3 foot. Aisle spacing depends on the equipment. The plant canopy will spread outward to 42 inches wide. No closer than 6 feet and no further than 12 feet aisle spacing should be used.

GROWTH RATE: Figs grow fast. Stems will reach 4 feet to 6 feet in one season once the plants are established, so keep them pruned yearly.

MULCHING: Mulch is beneficial in all soils, especially sandy soils.

WATER REQUIREMENTS: The first year is critical as with most plants. After the first year the roots grow deep and wide and find moisture, so only apply water if the soil becomes dry.

FERTILIZER REQUIREMENTS: Medium to high fertilizer requirements. Use a non-acid fertilizer.

PRUNING: During the dormant season when foliage falls, prune out stems that are non-productive, usually the 6 and 7 year old canes which start to become unproductive. New canes will replace the older canes. Make the cuts 1 inch above ground level. Prune out any horizontal growth at the base of the plant. Remove horizontal growth within the body of the shrub in order to open the inside of the plant for air movement and sunlight to penetrate easier in the next growing season. If the plant's branches are too high for harvesting, remove the top portion of the branch to where it is more desirable. Where winter temperatures are cold below 10 degrees

Fahrenheit, plant canes can become damaged. The shrub will need protection. There are several ways to do this. (1.) Dig up one side of the shrub and bend the entire plant to the ground covering it up with a white plastic, burlap, white blanket or any overwintering material made for plants. (2.) Prune the plant to a desired height in the autumn. Tie the branches together as close as they can be pulled inward to form a cone. Wrap an overwintering material around the plant as discussed above. Leave the top of the cone open and fill the entire cone with an insulation, such as fresh wood shavings, newsprint or cedar mulch. After filling the cone, cover the hole. Remove any protective material when the danger of a freeze is over. In Zone 5 this will usually occur in late March or early April. If the protective covering remains around the plant too long the plant can start growing and any frost will damage the stems; so remove the protection late enough in the early spring when the danger of freezes are finished. Temperatures of 15 degrees Fahrenheit could damage the plant after being protected all winter.

INSECTS: Aphids and chewing insects attack foliage and soft stems.

FUNGUS: The plant can be susceptible to root rotting fungus if the plants are planted in poorly drained soil.

USDA ZONES

3-7

GOOSEBERRY

Ribes spp.

TYPE OF PLANT: An upright fruiting shrub with thorns. Growth will be 4 feet to 7 feet tall and 3 to 4 feet wide.

SEASONAL COLORS: The summer is the best for showing off the plants; bright green foliage and attractive fruits. The autumn foliage changes to yellow with some orange leaves. In the winter the leaves fall and the plants are deciduous until spring when the tiny pendulous yellow flowers appear before the new leaves form.

PLANT USES: The fruits are consumed fresh or in marmalades, juices, pastries and wine. The gooseberry fruits make the best marmalades and pies. The sweet-sour flavors of the fruit is a taste anyone will remember and will want to eat again.

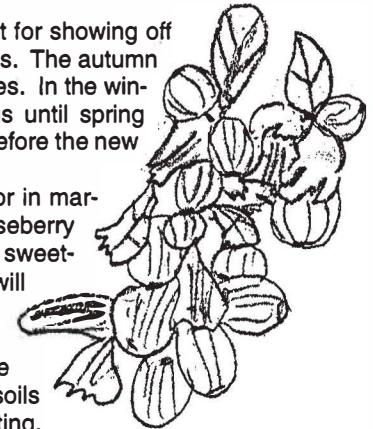
pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPES: Sandy loam and clay loams are best. Clay soils should be amended and sandy soils should be amended and mulch added after planting.

LIGHT REQUIREMENTS: Full sun is best. Filtered light is okay but yields will be less and fruits will ripen over a longer period.

PLANT SPACING: Plant spacing for mechanical harvest: The plant can be grown as a bush if mechanical harvesting methods are used. Space plants 3 feet in a row and select an aisle spacing that will be comfortable for equipment. The plant will spread 42 inches wide so make aisle spacing according to the equipment. Normally a 9 foot aisle spacing is adequate for 60 inch machine width.

Plant spacing for hand harvesting: For hand harvesting the plants will be best using a fan type trellis system. See page 79. Training is simple and will increase production by 50%, compared to a bush trained plant. Normally 2 or 3 canes should



be chosen to train on each plant. Plant spacing is designated as to how many canes the grower chooses to train. For each branch a 9 inch space is needed. For 2 branches per plant, space the plants 18 inches apart in the row; 3 branches per plant, space the plants 27 inches apart in a row. Aisle spacing will be designated by the field equipment that is used. A minimum of 4 feet for the aisle and maximum should be 9 feet. The plant spread will be 2 feet wide.

GROWTH RATE: The plants will be slow growing the first year and sometimes the second year. Do not ever let the plant become stressed by under watering during the growing season because it will stop growing until the next season. The second or third year after roots are developed the growth can grow 24 inches to 48 inches tall in one season.

MULCHING: Mulch is beneficial in all soils.

WATER REQUIREMENTS: Keep the soil moist at all times during the growing season.

FERTILIZER REQUIREMENTS: Optimum amounts of fertilizers should be used to grow the plants fast to the wires. Nitrogen at the rates of 100 ppm daily can be used or apply granular Ammonium Nitrate, Calcium Nitrate or Ammonium Sulphate. In early spring apply small amounts of any Nitrogen fertilizer to the plant using 1 ounce per plant every 2 weeks during the growing season. Other nutrients should be added according to soil tests. The first two or three years will be needed to do nothing but grow the plant. Special attention should be given to Nitrogen applications. At maturity, the fourth year, apply Nitrogen at rates of 60 pounds and 90 pounds per acre of plants, broadcasting around the root growing area.

PRUNING: The Gooseberry needs only winter or dormant pruning. Pruning consists of removing the fruiting laterals that produced fruit the prior season. The fruiting laterals should be spaced 4 inches to 5 inches apart on the trained support branch. Always select the strongest lateral with the largest fruit buds, pruning off any excess growth on the ends of laterals so laterals are 6 inches to 8 inches long. Since there will be no adventitious buds on the supporting branch, 1 or 2 buds should remain close to the support branch after pruning so a new branch can develop the following summer to produce a crop for the second year. See pages 76-80 for pruning and training diagram.

INSECTS: Mites and aphids are two of the known pests.

FUNGUS: Premature leaf drop and mildew disease are fungal diseases to be aware of. A spray of Lime Sulphur and or Copper can be used to slow down the growth of the fungus. It is easier to control all diseases if you keep improving cultural methods.

USDA ZONES

5-9

GRAPES

Vitis spp.

TYPE OF PLANT: A deciduous broad leaf trailing vine producing clusters of fruit. There are four types of grapes. They are Wine grapes, Seedless Table grapes, Seedy grapes and Raisin grapes.

SEASON COLORS: The most spectacular show for these plants is in the late summer and early autumn when the large clusters of grapes appear along the sturdy vines of the plants.

PLANT USES: Use the plants to train for an arbor, a natural fence. The fruits are used for fresh eating, juices, wine making, jellies or raisins.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPES: Sandy, sandy loams or clay loam. Drainage must be excellent when planting on clay soils.

LIGHT REQUIREMENTS: Full sun is best but the plants will grow in partial shade.

PLANT SPACING: In rows spacing 5 feet to 8 feet apart. Aisle spacing can vary depending upon the trellis system that will be used. Use 10 feet to 16 feet aisle spacing.

GROWTH RATE: A two year old plant will produce fruit in the fourth season. The sixth year it will reach full production. The vines will remain robust for many years.

MULCHING: Mulching is beneficial in sandy soils.

WATER REQUIREMENTS: It is important to keep the soil moist after planting the new plants. Irrigation should be applied at least weekly on the young plants if the soil is sandy. In loam soil types less water will be needed the first year. After the first year of establishment the roots will travel deep and will find adequate moisture for survival without irrigation in most growing areas.

FERTILIZER REQUIREMENTS: Use medium rate non acid fertilizer.

PRUNING: Pruning and training are important. Use a single wire trellis or double T-Bar as shown on page 81. In order to have clean fruit the vines must be supported on a trellis in order to keep them off of the ground. Pruning is accomplished to remove excess wood and stems from the plant to keep the plant manageable. Thin the stems so the plant will produce the largest clusters of fruits and thin so sunlight can penetrate through the canopy and ripen the fruits. It is always important to keep the fruit bearing stems closest to the original trunk or head of the vine.

EXAMPLE: A cane that grows in year one will produce buds. The second season shoots will appear from those buds and near the base of the buds the fruit clusters will form. The parts of the plant are as follows: A. Main trunk, B. Horizontal arms, which are permanent, C. Shoots that are growing from the arms, which will produce the fruit. These shoots are to be renewed every year.

INSECTS: Sucking insects and chewing insects and fruit worms can be a problem, so good insect control methods should be used.

FUNGUS: Mildews and Botrytis are two main diseases to control.

USDA ZONES
4-8

HONEYBALL BUSH *Cephalanthus occidentalis*

TYPE OF PLANT: A large spreading woody shrub growing 6 feet to 10 feet tall and 4 feet to 8 feet wide.

SEASONAL COLORS: The 3 to 6 inch leaves are glossy dark green in summer, followed by 2 inch diameter creamy white flower balls. Once pollinated, soft nut-like round fruits appear that will last through the winter. Fall foliage color is yellow to light orange.

PLANT USES: Plant to attract butterflies and other nectar loving insects and birds. Plant is wet or moist areas preferably in full sun. It will grow in heavy clay soils well as where other plants have difficulty. It is an excellent wetland plant.

pH REQUIREMENTS: 4.0 – 6.8

SOIL TYPE: Any soil type with adequate moisture.

LIGHT REQUIREMENTS: Full sun is best, partial shade okay.

PLANT SPACING: For a hedge plant, plant 4 feet apart, or use it as a specimen plant.

GROWTH RATE: It will grow fast in the right conditions. A one year plant will mature in 2 years.

MULCH: Not needed, but beneficial the first year or in dry soils.

WATER REQUIREMENTS: The plants love water and will grow more vigorously if moisture is available.

FERTILIZER: Medium non-acid types of fertilizer.

PRUNING: At maturity, pruning out branches 5 years and older at ground level is recommended to rejuvenate new growth. Prune to shape the plants to your desired appearance.

INSECTS: Sucking or chewing insects, but these seem to be no problem to the plants.

FUNGUS: Occasional leaf spots will form during low light, high humidity times. Not a major concern.

USDA ZONES
10-11

LEMON GRASS *Cymbopogon citratus*

INDOOR USE

TYPE OF PLANT: A tropical grass spreading by crown stolens. Not invasive in the tropics. Growing to a height of 3 feet.

SEASONAL COLORS: The grass is bright green when new blades form but as the blades have age the bright green changes to grayish green. This is the year round color.

PLANT USES: Any kind of cooking in meats, soups, salads or meals. The plant produces citronella. Citral, which is the ingredient, is available up to 76% oil. Most of the natural vitamin D is extracted from Lemon Grass. Ornamental house plant with a pleasant lemon fragrance. This species is the original Lemon Grass that is used for these purposes. There are other species but they do not share the same attributes as this, so watch out for the imposter of lemon grass.

pH REQUIREMENTS: 5.5 to 7.5.

SOIL TYPE: Any soil is suitable. Well drained is best.

LIGHT REQUIREMENTS: Full sun best, but it will grow successfully in 50% shade.

PLANT SPACING: Normally it is pot grown in the north. In a 6 inch pot a plant can grow up to 30 stems for use. The stems may be divided and used or replanted.

GROWTH RATE: Outdoors a plant that is purchased in a 2 1/2 inch pot should be planted in a 6 inch pot to grow 30 stems within 3 months. Stems will run 12 to 18 inches tall and blades will wisp outward up and down making the plant 36 inches tall.

MULCHING: Not needed.

WATER REQUIREMENTS: Low to high depending on soil used.

FERTILIZER REQUIREMENTS: Medium rate.

PRUNING: Remove stems at the base when they are 1/2 to 3/4 inches in diameter.

INSECTS: None.

FUNGUS: None.

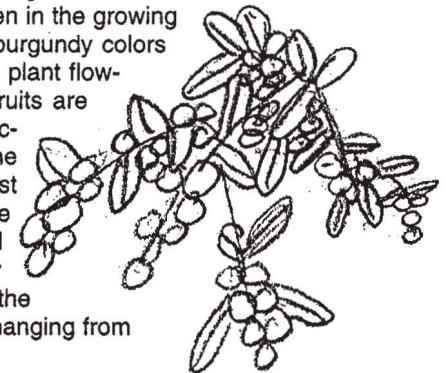
USDA ZONES
3-8

LINGONBERRY *Vaccinium vitis idaea(majus)*

TYPE OF PLANT: Low growing evergreen woody shrub that is stoloniferous.

SEASONAL COLORS: The plant is evergreen. The leaf color changes from bright emerald green in the growing season to a deeper green with some burgundy colors in the autumn lasting until spring. The plant flowers one time in the early spring and fruits are set.

In the beginning of summer a second set of flowers appear along with the red fruits that were set from the first flower. The second set of flowers are more abundant and the show of small red fruits appear in late summer to early autumn. The most spectacular time of the year is when the abundance of fruit is hanging from the branches of the plant.



PLANT USES: The fruit is used to make preserves, juices, liqueurs and wine. The ornamental value of the plant is an asset to a gardener or landscaper that wants a rare plant that is low growing and has edible fruit.

pH REQUIREMENTS: 4.0 - 6.0.

SOIL TYPE: Well drained sandy to sandy loam. Native plants are found growing in the composted pine needles and rotted organic matter. The main roots and older roots are found growing only 1 to 2 inches into the soil where moisture levels are never high. Planting areas should be prepared to duplicate the native environment. Amendments such as acid peat moss, composted pine bark or other organic materials should be used to prepare a raised bed for commercial or landscape planting.

LIGHT REQUIREMENTS: Full sun to 50% shade is best for crop production. Plants are found in the middle of a dense pine forest in their natural habitat, where sunlight is less than 50%; so they will grow in full shade successfully although fruit production will be less.

PLANT SPACING: For commercial growing, plant 12 inches in row and 4 to 6 feet aisles depending on the machine width that will be used.

GROWTH RATE: Plants are slow to develop top growth the first year. New roots and stolins from the plant are developing in year one. The second year top growth should appear growing 6 to 12 upright stems 4 to 12 inches tall. The same amount of growth will develop the third year and the fourth year. Years after a multitude of new growth appears it will attain the mature height of 8 to 18 inches depending upon the cultivar.

MULCH: Very beneficial in year one. As the plant reaches maturity it will be less dependent on a mulch but in areas where the snow cover is low and temperatures are 10 degrees Fahrenheit or less mulch is recommended. Mulch will also keep the tiny roots cool and conserve moisture.

WATER REQUIREMENTS: Over watering will kill these plants. If the soil drains well more water can be applied. Only water when the soil moisture level is low. When the first 2 inches of soil is medium moist to the touch it's time to water. The soil should never hold enough water so the water can be squeezed out with ones' hand.

FERTILIZER REQUIREMENTS: Low acid fertilizer, use only water soluble. When using granular fertilizers be careful because granules can be disbursed too close to the crown area of the plant resulting in death.

PRUNING: Prune by mowing in late autumn until early spring. When plants are dormant mow by leaving 1 1/2 inches of growth above the soil level.

INSECTS: Occasionally aphids will attack the plant. Use a recommended insecticide.

FUNGUS: Phytophthera cinnamoni will attack the roots. Phytophthera is a result of over fertilization, over watering, poor drainage or planting too deep. It can also be caused by winter damage due to no winter protection or low moisture level in winter months.

USDA ZONES

3-8

MICHIGAN HEATHER

Calluna vulgaris

TYPE OF PLANT: Evergreen soft needle type groundcover growing 6 to 12 inches and spreading by under ground rhizomes.

SEASONAL COLORS: June through late August is the most spectacular season when the tiny bell shaped lavender flowers appear along the stems of the plant. In the autumn through spring the plant remains green to burgundy depending on the cultivar. The soft needle like foliage has a pleasant touch when it is touched or walked on.

PLANT USES: Heather is an indestructible ground cover. It can be walked on without damaging the limber canes. It is extremely hardy in cold climates and in warm climates it is not sensitive to high temperatures. It is a good shelter for small wildlife and protects them from predators and extreme climates. Plant the plants in mass plantings as a ground cover or as border plants. Dense root hairs make it good for erosion control. It can also be used as a potted plant for a patio or grown indoors.

pH REQUIREMENTS: 4.0 - 6.0.

SOIL TYPE: Well drained sandy to clay loam.

LIGHT REQUIREMENTS: It will adapt well in heavy shade to full sun. In total shade the growth will become leggy and have less flowers.

PLANT SPACING: Using a plant grown in a 2 1/2 inch pot, plant them 6 inches apart and stagger each row if planting a mass planting. When plant size is increased by 2 inches (example: 4" container) the plant spacing can be increased by another 6 inches (12 inches apart).

GROWTH RATE: The first year the plants will grow upward 4 to 6 inches and outward 2 inches. The second year the tops will grow to 6 to 12 inches and outward 6 inches or more. Twelve inches is the mature height and the plants will continue to spread outward and become fuller in future years. Flowers will appear the second year after planting.

MULCH: Beneficial the first year, but not important in future years as the plant will make its own mulch.

WATER REQUIREMENTS: Keep the first inch of the soil moist the first year until new growth develops. After the first growing season water does not need to be applied unless the weather becomes very dry.

FERTILIZER REQUIREMENTS: Use only water soluble fertilizer. Granular fertilizers tend to damage the stems, leaves and crowns of the plants. Use a medium rate of fertilizer.

PRUNING: Only prune if the plants become over grown or if the foliage looks rough. Mow or cut down the plant leaving 1 1/2 inch of growth above the ground level.

INSECTS: None.

FUNGUS: Verticillium Root Rot or Phytophthera Root Rot will occur if the soil is poorly drained or if fertilizer is applied at more than the medium rate.

USDA ZONES
4-8

BIRD FEEDER VINE
Ampelopsis brevipedunculata

TYPE OF PLANT: A woody vine bearing ornamental fruits and handsome foliage.

SEASONAL COLORS: In spring leaves and tiny flowers appear. The fruits form and color up quickly making a beautiful display of color in late summer into autumn. The foliage changes to yellow-orange in the autumn and the branches are light gray in the winter.

PLANT USES: Plant to climb a trellis, low walls or to establish a living fence for decoration and wildlife.

pH REQUIREMENTS: 4.5 – 6.8

SOIL TYPE: Plants are adaptable to any soil type. It will grow best in well drained non-clay soils.

LIGHT REQUIREMENTS: Partial shade but full sun is best.

PLANT SPACING: To establish a living fence, plant vines 6 feet apart.

GROWTH RATE: Plants grow fast once established. Fruits will appear in the second or third year depending on how well the plant grows.

MULCHING: Beneficial the first year of establishment.

WATER REQUIREMENTS: The first year of establishment keep the plants moist. The plant will be very tolerable to dry conditions once it is established.

FERTILIZER: Medium non-acid fertilizer.

PRUNING: Prune only to shape the vine to a trellis or fence.

INSECTS: Chewing or sucking insects will be a minor problem to the vigorous vine.

FUNGUS: There are no major problems with fungus.

USDA ZONES
3-8

MOUNTAIN JADE
Pachistima Canbyi

TYPE OF PLANT: Evergreen groundcover growing 6 to 8 inches in height and spreads by above ground runners.

SEASONAL COLORS: This is a beautiful low growing groundcover shrub with year around beauty. The leathery bright green foliage in the autumn and winter look like jewels amongst the first snows. In the summer when dry weather is drying out other plants, Mountain Jade will retain its luminescent green color. Flowers are tiny and insignificant.

PLANT USES: A thick intertwining mat of branches that will cover some unsightly slopes or rocky areas. Use as an accent plant in rock gardens or near a deciduous shrub. Excellent protection for small animals. This is one plant that I have found that rabbits do not devour.

pH REQUIREMENTS: 5.0 to 6.8.

SOIL TYPES: They grow in all types of soil as long as the soils are never water logged. This plant will thrive without moisture once it is established.

LIGHT REQUIREMENTS: Preference is full sun but it does well in filtered shade. The plants are not as compact as plants grown in full sun.

PLANT SPACING: Using a plant grown in a 2 1/2" pot, plant them 6 inches apart and stagger each row if planting a mass planting. When plant size is increased by 2 inches (example: 4" container) the plant spacing can be increased another 6" (12" apart).

GROWTH RATE: The first year 2 to 4 inches of outward growth. Every year after that can double in the width. The plant is easily controlled by pulling the rooted branchlets up and cutting them off to the desired width.

MULCHING: Is beneficial the first year of planting but not needed after the first year.

WATER REQUIREMENTS: Apply water weekly after planting for establishing the plants. After the plants grow they can survive with very little to no water.

FERTILIZER REQUIREMENTS: Low rate non acid.

PRUNING: Not needed, only to remove any dead branches if they appear.

INSECTS: No problems.

FUNGUS: Phytophthora root rot only is a problem in heavier water logged soils or when plants are over fertilized.

USDA ZONES
4-8

MOUNTAIN LAUREL *Kalmia latifolia*

TYPE OF PLANT: A shrub that is iron clad hardy. Emerald evergreen with the most intricate of flower design. The attractive shrubs grow to a height of 12 feet or more. The plants are in the family of Ericaceae.

SEASONAL COLORS: The most fantastic time of year is at bloomtime in late spring to early summer. Thousands of 1 inch flowers cover the evergreen branches of the shrub making it the most outstanding shrub in most landscapes. The other seasons the plant is always bright shiny green thick foliage. Of all the plants this one grows foliage from bottom to top.

PLANT USES: The best shrub to use in a landscape. The foliage can be commercially grown to use as florists' greens. Since they are native to North America they will fit in any landscape and they love the soil types they are native to.

pH REQUIREMENTS: 4.0 - 6.0.

LIGHT REQUIREMENTS: They will grow in full sun to shade. In full shade they will tend to grow toward the sun and flowering will be less in heavier shade.

PLANT SPACING: If planting as a specimen plant give the plant room. It will spread outward 15 feet and grow to over 12 feet tall. They can be mass planted and the array of different colors on each cultivar will give an outstanding show of colors, shapes and sizes of flowers. Mass plantings are recommended to be planted 3 feet apart.

GROWTH RATE: The first year the plant wants to grow roots and little to no top. The second year the plants will double in size and will continue this growth until about year 5 when it will slow down somewhat and concentrate on more flowers, which means slower growth.

MULCH: Very beneficial the first year and in future years.

WATER REQUIREMENTS: When the plants are planted apply water to soak the planted area thoroughly. After a few days apply more water to moisten the soil well to a depth of 3 inches. Reapply water as needed the first growing season so the first inch of the soil stays moist. The second and future years the plants will be happy if the moisture level in the first inch of the soil stays moist to the touch.

FERTILIZER REQUIREMENTS: Medium rate of acid type fertilizer.

PRUNING: Only prune to shape the plant and remove dead growth that may appear after a drought or harsh winter. Prune in the early spring.

INSECTS: None.

FUNGUS: Spots of Anthracnose may appear if the growing season is extremely humid and rainy but it is not necessary to apply fungicide. The plant will overcome the disease.

USDA ZONES
4-7

PAPAW *Asimina triloba*

TYPE OF PLANT: A fruiting pyramidal shaped native tree growing to a mature height of 50 feet.

SEASONAL COLORS: The most outstanding season for Papaw is in the autumn. The extremely large tropical appearance of the leaves change from light green to bright yellow. The fruits are hard to see because the leaves hide them. In order to harvest the fruits, merely shake the tree, don't look up and be sure to wear a hard

hat because the fruits will start falling. After the leaves drop the dark gray pyramidal shaped form of the tree and its branches are art forms of nature. In the late spring the flowers emerge; each are perfect 3 petaled deep burgundy 1 inch flowers. After pollination small green fruits form and the leaves grow rapidly up to 12 inches long and 4 inches across. Foliage is a light green and leaves are so thick the trunk and branches of the tree cannot always be seen until the fall after autumn.

PLANT USES: Use as a landscape plant to accent and give a tropical appearance. Remember this is a native to North America so the tree will fit in any natural landscape. Use of the fruits are becoming more popular. The flavor and texture of the fruits are similar to a tropical species such as Cherimoya, a favorite fruit for people in the Americas and Asia. The bark of the tree has medicinal qualities.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: Any soil type but sandy loam and clay loams are best. Incorporation of organic matter 12 inches deep and wide will benefit the growth of the plants.

LIGHT REQUIREMENTS: Any type of shade or full shade is best for the growth of the plant. The heavier the shade the less fruits will be produced. Natively the trees are found as understory trees such as maples, beeches and hemlocks near moist areas of streams and ravines. The plant will grow in full sun as well but protect them when they are young from direct sun.

PLANT SPACING: For commercial orchard space 8 feet in rows should be the farthest in row spacing and 14 feet for aisles should be the farthest. The plants can be grown high density for commercial. For landscape use plant them under taller trees or for specimen plantings keep them at least 30 feet from other tree canopies as they can spread up to 3 feet wide. Two varieties of seedlings should be planted within 50 feet to ensure pollination.

GROWTH RATE: Slow growing tree. It is recommended to use a growing tube to place over the tree. The tube should be 4 to 6 inches in diameter and 26 to 48 inches tall. Place tube over the plant at planting time and leave on the tree until the top growth begins to branch, up to 2 to 4 years. The tube encourages the tree to look for light, protects the delicate new foliage and keeps it warm in the early part of spring. Make sure the growing tube is anchored to the ground so it doesn't damage the tree.

MULCH: Beneficial until the tree is mature.

WATER REQUIREMENTS: High, especially when the plants are young. Do not let the plant dry out especially when they are young or they will stop growing. This is one plant that will be difficult to kill by over watering.

FERTILIZER REQUIREMENTS: Low to medium. It is hard to make the plant respond to fertilization. The best time to fertilize is early spring about 15 days before green tips will form on other trees. Mycorrhizal Fungi is important for this tree. It is always best to purchase a tree that is not bare root. A container grown tree will usually have some mycorrhizal activity in the soil.

PRUNING: The only branches to prune off are unwanted side branches as it grows upward. Start branching where you desire.

INSECTS: None.

FUNGUS: None.

USDA ZONES
11-INDOORS

PASSION FRUIT

Passiflora edulis

TYPE OF PLANT: A climbing tropical vine.

SEASONAL COLORS: Vines are evergreen year round. Flowers appear in the spring and fruits ripen in 60 days. The most interesting ornamental value of the plant are its' flowers. Colors of violets, yellows, whites and blues protrude from all of the flower parts making an excellent flower for decorations. Commercial production of fruits for juices and fresh produce are becoming popular.

PLANT USES: Plants are used for indoor pot plants. Commercial fruit growers sell the fruits to be processed into juices for fresh markets. In the tropical growing areas the plant is good for making trellis gardens and to climb on fences. The flowers are grown commercially because of its' medicinal qualities.

pH REQUIREMENTS: 5.0 to 7.5.

SOIL TYPES: Sandy soils to clay loams. Prefers good drainage. Use a potting soil for indoor growing.

LIGHT REQUIREMENTS: Full sun is best for flower and fruit production. 50% shade is okay, but flowering will be at least 40% less than full sun. For indoor growing place near a sunny window and bring outdoors in the non-frost months to encourage more flowers.

PLANT SPACING: Commercial growing 3 feet in rows with 10 foot aisles.

GROWTH RATE: A 3 inch small plant will be over 10 feet tall in 3 months if grown where temperatures are not below 50 degrees F.

MULCH: Not needed.

WATER REQUIREMENTS: Moisture needed in the first 2 inches of the soil. For indoor growing let the soil become dry almost to the point of the leaves drooping before applying water. Excess water will kill the plant.

FERTILIZER REQUIREMENTS: High rate non-acid preferably water soluble.

PRUNING: Prune to shape the plants for asthetic beauty. Commercial growers prune for ease of harvest. The plants can be pruned to 3 inches above the line if they become too unsightly and they will regrow very rapidly.

INSECTS: Aphids and chewing insects can be controlled with Sevin or Malathion.

FUNGUS: None.

USDA ZONES
3-11

EVERBEARING RED & YELLOW RASPBERRIES

TYPE OF PLANT: A broadleaf cane plant. Deciduous in zones north of 9. Plants grow upward to 6 feet producing the stems from rhizome growth from the roots.

SEASONAL COLORS: The plants can be considered as ornamental. The autumn foliage stays green for a long period and later changes to oranges and reds. The canes in the winter are deciduous and have colors of gray, burgundy, yellow or maroon depending upon the cultivar. If the plants are pruned to produce in late summer to early autumn new green growth appears in the spring and by mid summer flowers will appear.

PLANT USES: Grown mainly for fruit production of berries. The foliage has benefits as a health herb, usually by making a tea. Wildlife like the raspberry plant as the stems are strong and abundant and make good hiding places for birds and small animals.

pH REQUIREMENTS: 5.0 - 7.5.

SOIL TYPE: Sandy, sandy loam and clay loam. Heavy clay soils are not recommended.

LIGHT REQUIREMENTS: Full sun is best for plant and fruit development.

PLANT SPACING: In row spacing of 18 to 24 inches apart and aisle spacing can be as close as 4 feet and no further than 10 feet. When planning the aisle spacing keep in mind there will be 24 inches lost in the aisle because of outward plant growth. Example: 4 foot aisle spacing will result in 2 foot walk aisles at plant maturity.

GROWTH RATE: Plants are normally planted in the early spring in most areas. The first year roots will form a solid mat along the entire row and at least 24 inches wide. Cane growth the first year will be minimal at 12 to 18 inches tall. After pruning the canes in the late autumn or early spring after the first season, the new mature growth will emerge the second season producing fruit in late summer through autumn. The third season will actually be the mature year for the plants and production of canes and berries should double that the second year.

MULCHING: Good to apply for weed control the first year, but it is not needed.

WATER REQUIREMENTS: Since the raspberry plant likes good drainage, the plants do not require large amounts of water. Growth for the crop is produced in late spring through the summer. If the weather is dry, keep the moisture level of the plant so the canes can develop fast to the 3 to 5 foot height. Usually if there is sufficient moisture in the first inch of soil the plant will perform well.

FERTILIZER REQUIREMENTS: Use medium rate non acid fertilizers. Apply Nitrogen in early spring when new growth begins to break or 2 inches of new growth appears. Reapply more Nitrogen fertilizer four weeks later, banded in the row.

PRUNING: This is the easiest raspberry to prune. After there has been 5 days of temperatures below 27 degrees Fahrenheit the plants can be mowed or cut down so there is only 1 inch of growth above the soil line. Make sure mowing is done before spring growth occurs. After growth resumes in the spring another light pruning can be done if it is desired. Let the new growth attain 6 to 10 inches tall. Select the strongest and healthiest looking stems to be the fruit producers and cut out any small and weak growths around the selected growth. A good rule of thumb is to have 12 to 18 fruit producing canes every 3 feet. The plant canes need support. A simple support system is a 2 wire trellis system. Trellis system displayed on page 82.

INSECTS: Aphids, sucking insects, cane or crown borers, fruit worms and mites may be problems. These are not problems in all regions and sometimes small garden plantings will not be affected.

FUNGUS: Botrytis on stems, Anthracnose on leaves and fruit and crown gall are some of the fungi that can affect the plants. Fungi can be controlled by cultural methods of keeping debris from the base of the plant pruning and keeping the plant healthy. Root fungus such as Verticillium Wilt, Phytophthora can be controlled by providing good drainage, no over watering and no over fertilization.

BLACK & PURPLE RASPBERRIES

TYPE OF PLANT: A broad leaf deciduous cane plant. Plants grow erect upward to 6 feet tall producing cane growth from a central crown near the base of the plant.

SEASONAL COLORS: These types of Brambles could be considered ornamental. The canes, once the foliage has fallen, are purplish to gray in color all winter until leaves emerge in the spring and flowers decorate the canes. Fruits ripen in early to mid summer and they are fairly decorative. The blacks are like jewels amongst the unripe red fruits and the purples are attractive with their green to red fruits.

PLANT USES: These plants are used mostly as a fruit crop. The blacks have a distinctly strong Raspberry flavor. The purples taste similar to most red cultivars. Fruits can be eaten fresh or in pies, marmalades or juice.

pH REQUIREMENTS: 5.0 - 7.5.

SOIL TYPE: Sandy, sandy loam, clay loam. Clay soils not recommended.

LIGHT REQUIREMENTS: Full sun is best for fruit production and development.

PLANT SPACING: Plant 3 feet in row spacing. Aisle spacing should be wide enough to accommodate machinery, usually at least 8 feet. Since these types of Brambles produce lateral branching 3 feet will be lost in the aisle. Example: 8 feet aisles will give 5 feet aisle space at maturity.

GROWTH RATE: Plants are vigorous. A normal size plant to plant in the soil will be 1 year tip layer grown or potted. In one growing season the plant tops will be 1 to 3 feet tall with 2 to 6 stems on each plant. The second growing season the plant will be developed to produce fruit the third year.

MULCHING: Not needed, but may be beneficial in pure sand soils.

WATER REQUIREMENTS: When the plants are newly planted keep the soil moist the first year. Usually once the roots are well established they are hardy and will find water. It is good to apply water to attain the best fruit crops and growth year after year.

FERTILIZER REQUIREMENTS: Use medium rate non acid fertilizer.

PRUNING: There are 2 main parts to these types of Raspberry. One is the cane and the other is the fruiting lateral. Canes grow from the ground upward while fruiting laterals grow from the top of the canes producing fruit. For good production grow 3 to 6 canes per plant. When the canes reach a height of 26 to 28 inches tall cut about 2 to 4 inches of growth from the top of the cane. Make the cut just above a bud. These canes will then produce fruiting laterals at the end of a growing season. This growth could occur the first year if the plants grow vigorously. It is good to trellis the lateral branches in the early autumn. As the laterals are trained on the trellis in the autumn and laterals that are unwanted can be pruned off, making the cut close to the cane. The fruiting laterals will be long, sometimes up to 3 feet. These laterals should be pruned back to no more than 10 inches long. This can be accomplished any time the plant is dormant. In cold areas where winter temperatures could kill buds, the best time to prune the laterals is in the early spring. At the end of a harvest season the canes that supported fruit are usually pruned out because production will be lower and in the summer a new cane would have been tipped to produce new laterals. See pages 76-80 for example.

INSECTS: Aphids, sucking insects, cane or crown borers, fruit worms and mites can be problems. These are not problems in all growing regions and sometimes small garden plantings will not be affected by them.

FUNGUS: Botrytis on stems, Anthracnose on leaves and Fruit and Crown Gall can be problems. Some of these fungi can be controlled by cultural methods of keeping debris from the base of the plant, pruning and keeping the plant healthy. Root fungus such as Verticillium Wilt and Phytophthora can be controlled by providing good drainage, no over watering and no over fertilization. There seems to be many disease problems but these are only problems that might occur on the plants. Black raspberries can be planted amongst any of the other bramble types without spreading diseases or inhibiting cross pollination.

GROUND COVER RASPBERRY

Rubus articus x stellatus

TYPE OF PLANT: A fruiting herbaceous woody plant growing to 6 inches tall and spreading by rhizomes outward to form a dense ground cover.

SEASONAL COLORS: There are 3 striking seasons for this raspberry. In the spring the pinkish lavender flowers emerge 1 per stem, but roots in a 10 foot square area. Once they are pollinated by wind or insects the fruits form to a bright shiny red color and are ready to eat. When cool weather approaches all of the trifoliate leaves change from bright green to deep burgundy. This color is outstanding. After a few hard freezes the herbaceous stems melt into the soil and the roots go to sleep until the next spring.

PLANT USES: In the native growing regions, the fruits are gathered by people by the thousands of pounds to make juices, marmalades and to eat fresh. The plants make a beautiful ground cover that is easy to care for. It grows in most soil types.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: High organic soils are best. They will also flourish in sand, sandy loams and clay loams.

LIGHT REQUIREMENTS: Full sun is best but they will grow in partial shade.

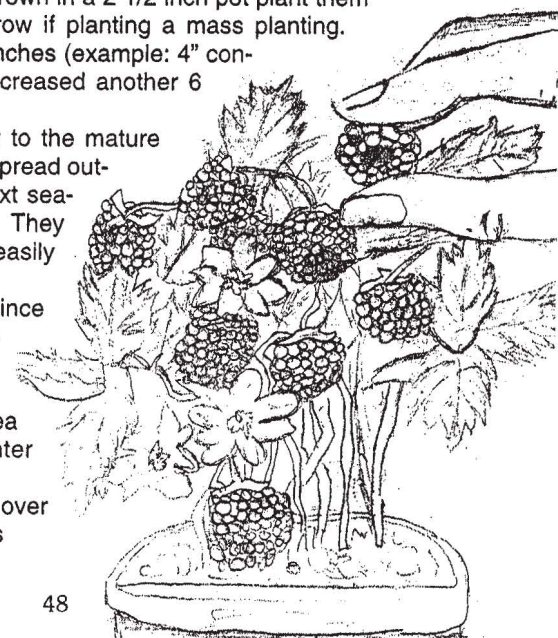
PLANT SPACING: Using a plant grown in a 2 1/2 inch pot plant them 6 inches apart and stagger each row if planting a mass planting.

When plant size is increased by 2 inches (example: 4" container) the plant spacing can be increased another 6 inches (12 inches apart).

GROWTH RATE: Plants will grow to the mature height in 1 season. The plants will spread outward meeting the next plant the next season, if the correct spacing is used. They are not invasive at all and can be easily controlled to one location.

MULCHING: Not needed but since these are herbaceous plants a decorative mulch would be a nice accent for the ground cover planting. Mulch will cover up the bare area the plants will leave in the winter months.

WATER REQUIREMENTS: Do not over water. Small amounts of moisture is sufficient.



FERTILIZER REQUIREMENTS: Use low amounts of non acid fertilizers.

PRUNING: Prune by mowing only if the plants need it, to clean up the site they are planted on. To keep them from spreading outward simply make a cut with a hoe or shovel around the perimeter growing area.

INSECTS: None.

FUNGUS: None.

USDA ZONES
3-9

SUMMER BEARING RED RASPBERRIES

TYPE OF PLANT: A broadleaf deciduous cane plant. Plants grow upward to 6 feet producing cane growth from rhizome growth from the roots.

SEASONAL COLORS: The plants can be considered as ornamentals. The foliage in summer is bright green and the red fruits are showy. In the autumn foliage changes to red and shades of yellow. Winter stems are gray, maroon, yellow and burgundy depending on the cultivar. In the spring the terminals of the fruiting canes will have new leaves and white flowers.

PLANT USES: Grow mainly for fruit production in the summer months. The foliage has benefits as a health herb usually by making a tea. Good cover for wild life.

pH REQUIREMENTS: 5.0 - 7.5.

SOIL TYPE: Sandy, sandy loam, clay loam. Clay soils not recommended.

LIGHT REQUIREMENTS: Full sun is best for plant and fruit development.

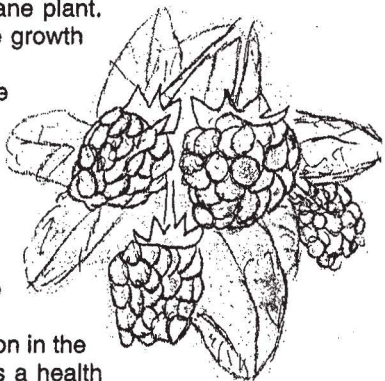
PLANT SPACING: In row spacing of 18" to 24" apart. Aisle spacing can be as close as 4 feet but no further than 10 feet. When planning the aisle spacing keep in mind there will be 24" lost in the aisle because of outward plant growth. (Example: 4 feet aisle spacing will result in a 2 foot walk aisle space at plant maturity.)

GROWTH RATE: Plants are vigorous. The fruits will be produced the third year after planting. Year 1 the roots will grow forming a thick mat down the row and at least 24 inches wide. Year 2 the new canes will be formed by Autumn. The second year canes will form fruit buds in late summer of the second year so by the third spring flowers appear and fruits are produced in the summer. The fourth season is a higher production year and could be considered maturity.

MULCHING: Good for weed control but not needed.

WATER REQUIREMENTS: Since the plant likes good drainage the plants do not require large amounts of water. Growth for the crop is produced in late spring through the summer so if the weather is dry keep the moisture level of the plant so the canes can develop fast to the 3 to 5 foot height. Usually if there is sufficient moisture in the first inch of soil the plant will perform well.

FERTILIZER REQUIREMENTS: Use non acid fertilizers. Use the medium rates recommended. Apply Nitrogen in early spring when new growth begins to break or attains 2 inches of new growth. Reapply more Nitrogen fertilizer 4 weeks later, banded in the row.



PRUNING: Pruning of these plants is done mainly in the late autumn to early spring. For fresh berry production leave 12 to 18 fruiting canes in every 3 feet. The plants will grow in a 24 inch wide row; half of the canes should be trained on one side of the row and half the canes should be trained on the other side of the row. When selecting the fruiting canes in the autumn choose the strongest cane with the largest fruit buds; these will produce the best fruits. The selected fruiting cane should be topped to a 4 1/2 to 5 foot level. The reason for removing the top is to remove the small fruit buds because the larger buds will produce the best fruits. All growth besides these selected fruiting canes should be removed in the autumn. The selected fruiting canes should be tied to the wire on each side of the row. The most important growth to remove is the cane that supported fruit that year. Pruning must be accomplished every year. Early summer pruning is important but some growers prefer not to do this. This type of pruning is easy and will make it easier in the autumn. When growth emerges from the soil at 6 inches to 8 inches tall cut out the weakest leaving the strongest looking growth. At this time pre-selection of the 12 to 18 fruiting canes is done. By completing the early summer pruning the fruit will be larger and the next year fruiting canes will become more vigorous producing larger and more fruit buds. A sketch of the training trellis is on page 82.

INSECTS: Aphids, sucking insects, cane or crown borers, fruit worms and mites can be problems. These are not problems in all growing regions and sometimes small garden plantings will not have the problems.

FUNGUS: Botrytis on stems, Anthracnose on leaves and fruit and Crown Gall can be problems. Some of these fungi can be controlled by cultural methods of keeping debris from the base of the plant, pruning and keeping the plant healthy. Root fungus such as Verticillium Wilt and Phytophthora can be controlled by providing good drainage, no over watering and no over fertilization.

USDA ZONES
3-7

RED CURRANTS

Ribes spp.

TYPE OF PLANT: A fruiting upright shrub growing to 7 feet tall and 4 feet wide depending on the cultivar.

SEASONAL COLORS: In the spring the pendulous flowers appear covering each of the fruit laterals. The most striking time is when the clusters of fruit turn bright red and droop downward, ready to be harvested and eaten. Autumn color of the foliage will vary with yellows, oranges and reds lasting until the beginning of winter. The stems are uniquely colored with grays and browns with the effect of the bark flaking from the stems.

PLANT USES: Mainly used as a fresh fruit, which is popular in European countries. The fruits are used in marmalades, jellies and even just as dessert decorations on the side of the dinner plate.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: Sandy loam and clay loams are best. Clay soils should be amended and sandy soils should be amended and add a mulch after planting.

LIGHT REQUIREMENTS: Full sun is best. Filtered light is okay but yields will be less and fruits will ripen over a longer period.

PLANT SPACING: For mechanical harvest the plant can be grown as a bush. Space plants 3 feet in a row and select an aisle spacing that will be comfortable for

equipment. The plant will spread 42 inches wide so make aisle spacing according to the equipment. Normally a 9 foot aisle spacing is adequate for 60 inch machine width.

For hand harvesting the plants will be best using a fan type trellis system. See page 79. Training is simple and will increase production by 50% compared to a bush trained plant. Normally 2 or 3 canes should be chosen to train on each plant. Plant spacing is designated as to how many canes the grower chooses to train. For each branch, a 9 inch space is needed, 2 branches per plant, space the plants 18 inches apart in the row. For 3 branches per plant space the plants 27 inches apart in a row. Aisle spacing will be designated by the equipment that is used. A minimum of 4 feet for the aisle and a maximum should be 9 feet. The plant spread will be 2 feet wide.

GROWTH RATE: When using a 2 year plant; the first year new growth will grow up 24 inches tall. The second year the growth will double in size so the plants are very vigorous.

MULCH: Use mulch for sandy soils. It is beneficial for the plant the first 2 years.

WATER REQUIREMENTS: Keep plants moist during the first two years to encourage growth. After the first 2 years plants will not need as much water because the roots will be well established in the soil.

FERTILIZER REQUIREMENTS: Optimum amounts of fertilizer should be used to grow the plants fast to the wires. Nitrogen at the rates of 100 ppm injected through drip irrigation daily can be used or apply granular Ammonium Nitrate, Calcium Nitrate or Ammonium Sulphate. In early spring, apply small amounts of any Nitrogen fertilizer to the plant using 1 ounce per plant every 2 weeks according to soil tests. The first 3 years are critical to apply the much needed Nitrogen because the 2 or 3 stemmed growth needs to grow fast up the trellis in order to produce a crop the third or fourth season after planting.

PRUNING: Red Currants need summer (vegetative) and winter (dormant) pruning. In the summer, remove any growth that is hiding the fruits that will be harvested. Without sunlight the fruits will not ripen evenly. Leave new growth that will produce the fruit for the next years crop. Space the new laterals 4 to 5 inches apart. Another step in summer training is to bend the newly formed fruiting lateral that is attached to the supporting branch. This step should be performed before the wood on the stem becomes mature because bending a succulent lateral could cause it to break. The reason for bending the fruiting lateral is because the fruits that will be formed the next year will be in the open air and not hidden by foliage, so sunlight will ripen the fruits and the fruits will not be damaged by newly formed laterals during the next growing season. The laterals should be bent so they are almost horizontal with the soil. Fruiting could occur as low as 12 inches from the soil and space the laterals 4 to 5 inches up each side of the supporting branch. See pages 76-80 for pruning and training examples.

INSECTS: Mites and aphids are two of the known pests.

FUNGUS: Premature leaf drop and mildew disease are fungal diseases to be aware of. A spray of Lime Sulphur and or Copper can be used to slow down the growth of the fungus. It is easiest to control all diseases if you keep improving cultural methods.

TYPE OF PLANT: Evergreen or deciduous flowering shrubs. The most commonly grown Rhododendrons by gardeners and landscapers are evergreen.

SEASONAL COLORS: The most outstanding season is late spring to early summer when the colorful trusses of flowers cover the plants. In the autumn there is no change in the foliage. Some cultivars will change the color of foliage from green to burgundy in autumn and winter and then back to green again once spring and summer approach.

PLANT USES: Mainly used as landscape shrubs for the evergreen beauty and outstanding floral colors.

pH REQUIREMENTS: 4.0 - 5.6.

SOIL TYPES: Sandy, sandy loam or clay loam may be used. When plants are to be grown in heavy soils, soil amendments should be used to make the soil looser. Sandy soils tend to be well drained with low moisture in the summer months, so use a soil amendment for these soil types.

LIGHT REQUIREMENTS: Full sun is good to partial shade. The heavier the shade the least compact the branching will be. Flowering will be diminished in heavy shade as well.

PLANT SPACING: The spacing depends upon the cultivars used. There are so many different species it is best to obtain information on the particular variety or species when planning the landscape.

GROWTH RATE: The first year the plants will grow roots and very little branches. After the first or second year new growth will come mostly from the main branches of the plants, growing outward mostly. Rhododendrons are considered slow to medium growth plants.

MULCHING: Mulch is beneficial in all soils.

WATER REQUIREMENTS: Plants like moist soil but it must have excellent drainage. Plant roots are very fine and they do not grow deep, but spread outward so they can be subject to death if the surface water cannot drain down.

FERTILIZER REQUIREMENTS: Use a low acid rate fertilizer.

PRUNING: Sometimes new growth can be encouraged by removing the older stems and the lower horizontal growth from the plant. Always make pruning cuts close to the soil line or close to the branch if it was being cut from a branch. Prune during the dormant season or prune right after flowering occurs.

INSECTS: Chewing insects can sometimes be a problem and occasionally aphids can attack new growth.

FUNGUS: Leaf spots will occur on the foliage if plants are grown in heavy shade where there is little air movement and plant foliage cannot dry out completely during the day. Root fungus will occur if the plants are over watered, planted in poorly drained soil, over fertilized or have been planted too deep.

USDA ZONES
3-7

RHUBARB

TYPE OF PLANT: Herbaceous Perennial.

SEASONAL COLORS: Red stems sometimes 12 inches long will support the large green leaves in the late spring and summer.

PLANT USES: Mainly as a food crop, using only the stems.

pH REQUIREMENTS: 6.0 - 7.0.

SOIL TYPE: Well drained soils are important to grow them successfully. A clay soil should be amended or mounded with soil amendments.

LIGHT REQUIREMENTS: Full sun to 50% shade.

PLANT SPACING: In row spacing plant 24 inches apart. Row width will be 18 inches wide, so choose the row spacing that accommodates the equipment width.

GROWTH RATE: Plant the root crown into the soil so the top of the crown is level with the soil. Do not plant too deep. Let the plant grow for 2 years before beginning the harvest. Harvesting should not prolong more than 12 weeks per season. It is best to keep 50% of the growing stems throughout the summer and early autumn because these will give strength to the roots the next season.

MULCHING: Mulching is not required.

WATER REQUIREMENTS: Water after planting and keep the first 2 inches of the soil moist.

FERTILIZER REQUIREMENTS: Medium rate of fertilizer required. Use non-acid.

PRUNING: Cut the old stem in late autumn or early spring before new growths emerge.

INSECTS: No insects.

FUNGUS: Root rot fungus will occur with over watering.

USDA ZONES
3-8

ANGEL VINE
Clematis virginiana

TYPE OF PLANT: A graceful climbing vine.

SEASONAL COLORS: Foliage is light green and delicate. Flowers are white and borne in leafy panicles. Fruits are plumose and can be 10 to 12 inches long in the fall of the year. In the winter months the vines are a golden brown.

PLANT USES: Use the plant to climb fences or trellis for its autumn show of feathery fruits.

pH REQUIREMENTS: 4.0 – 6.5

SOIL TYPE: Sandy to heavy non-clay soils. Can be grown in wet areas.

LIGHT REQUIREMENTS: Full sun to shade. The plant is found growing under the forest trees.

PLANT SPACING: If planting for a fence, plant 3 feet apart.

GROWTH RATE: Moderately fast, even the first year.

MULCH: Not needed.

WATER REQUIREMENTS: The first year keep moist; once it is established it will grow on its own.

FERTILIZER: Medium rates of non-acid fertilizers.

PRUNING: Does not need pruning unless it needs to be shaped to the landscape.

INSECTS: Sucking or chewing insects but there seems to be no problem to the plants.

FUNGUS: None.

USDA ZONES
3-10

SHRUB ROSES
Rosa moschata and\spp.

TYPE OF PLANT: There are two types of Shrub Roses. The first types are known as Old Garden Roses growing 2 feet to 8 feet in height. The second types are the ground cover or spreading roses growing less than 2 feet but their sprawling branches cover the ground.

SEASONAL COLORS: There are 2 outstanding seasons for these plants. Summer time when flowers appear is the most adored season. As autumn approaches Bright Red to Orange fruits appear and depending on the cultivar will last through the winter season. The fruits will vary in size being small at 1/4 inch up to 2 inches across.

PLANT USES: They can be used as fences, plant borders, specimens featuring the outstanding single shrub. The ground cover types can be planted just to cover the ground. The Rose Hips (fruits) contain high amounts of Vitamin C and are used in vitamins and tea.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPE: Sandy loam and clay loams are best. Soil amendments should be used in sandy soils. Raised beds and soil amendments are recommended for clay soils.

LIGHT REQUIREMENTS: Full sun is best. Heavier shade will promote fungal diseases.

PLANT SPACING: If planting for Rose Hip production, space plants 5 feet in a row and use 10 foot aisles. For Borders or Fences the distance of plants should be 3 feet or more. Ground cover plants can be planted 12 inches apart and stagger each row.

GROWTH RATE: Once the plants roots are established in the soil new growth is fast. The first year 2 to 6 new growths can appear growing 12 inches to 24 inches tall. The second season 2 to 6 more growths will appear growing 24 inches to 48 inches tall.

MULCH: Mulch is important in sandy or well drained soils.

WATER REQUIREMENTS: Moisten the plants so the first 2 inches of soil remain moist.

FERTILIZER REQUIREMENTS: Medium fertilizer requirements. Use non-acid.

PRUNING: When the plants are young promote upright growth to be the support canes for flowers and to form the shape and height desired. After the plants are mature, prune mainly to shape the plant. The older canes will become less productive with flowers and fruits. These canes, usually 6 years old or older, should be removed at the base of the plant. Since the plants are normally rooted on their own roots and are not grafted, there is no danger in making a pruning cut too close to the base of the plant.

INSECTS: Aphids and chewing insects can be a problem.

FUNGUS: The shrub roses are the least susceptible to disease. There will be minor leaf spots and mildews, which will occur during over cast days, but these can be easily controlled, with watering practices or other fungal recommended products.

USDA ZONES

3-6

ARCTIC PINK ROSEMARY*Andromeda glaucophylla*

TYPE OF PLANT: Low growing evergreen shrub growing 12 inches tall and spreading outward.

SEASONAL COLORS: Evergreen foliage is dark green above and white underneath, lined with fine hairs. A multitude of pink flowers cover the plant in May and June followed by shiny light brown seeds.

PLANT USES: Can be planted with any plant as an accent plant or plant in masses to create a solid ground cover. The foliage and branches are dense and make a great cover for animals and birds in the winter.

pH REQUIREMENTS: 4.0 – 5.5

SOIL TYPE: Prefers sandy to sandy loam. Well drained soil is recommended.

LIGHT REQUIREMENTS: Full sun to 70% shade.

PLANT SPACING: If planting as a ground cover, space the plants 12 inches to 15 inches apart.

GROWTH RATE: Once the roots are established the plants will spread 6 inches to 10 inches per year. Height will maintain at 12 inches. This is not an evasive plant, it contains itself very well.

MULCH: Beneficial but not needed.

WATER REQUIREMENTS: Keep the plants' roots moist the first growing season. It will adapt to most conditions after the first year.

FERTILIZER: Low rate acid type.

PRUNING: Prune the branches at the plants base to rejuvenate new branches or just shape at the top and sides to keep the plant within its' planted area.

INSECTS: Possibly only chewing or sucking insects. Foliage is very leathery, so most insects do not feed on the plant.

FUNGUS: None.

USDA ZONES

1-11

STRAWBERRIES*Fragaria spp.*

TYPE OF PLANT: There are three main types of strawberries. Summer bearing will bear the crops in early summer and are normally planted in designated rows for ease of harvest. Day neutral or everbearing cultivars start bearing in mid summer through early autumn. Alpine strawberries bear the fruits in the mid summer; some cultivars will flower and fruit from mid summer through autumn and in warm climates will fruit 12 months per year.

SEASONAL COLORS: Bright green foliage will cover the planted areas from spring until autumn. Since they are herbaceous plants there is nothing but stubble left in the winter months. White flowers are delicate looking and contrast nicely with the green leaves. In the case of Alpine and everbearing cultivars the flowers will appear with green and red fruits.

PLANT USES: Mostly used as a fruit crop. Ornamental use is very nice with the Alpine types. These types are more disease resistant and have ornamental foliage.

pH REQUIREMENTS: 6.0 - 7.0.

SOIL TYPE: Well drained soils are best. Sandy loam and clay loams are best. In sandy soils moisture levels must remain constantly moist.

LIGHT REQUIREMENTS: Full sun is best but they will grow in partial shade. The Alpine cultivars will accept more shade than the other 2 types of strawberries.

PLANT SPACING: For summer bearing and everbearing cultivars plant in rows 38 to 48 inches apart. For wide aisles in row spacing should be 12 to 18 inches apart. The Alpine type cultivars can be planted the same as the others but sometimes they are used to grow in a container. Fraises Des Bois, our Alpine strawberry, loves the container. The Alpine cultivars also are attractive if they are used as a ground cover, planting 6 to 8 inches apart.

GROWTH RATE: The plants will develop and produce runners soon after planting and they will fill in all the spaces in the row that are between each plant. Plants will be ready to harvest a year after they are planted. Planting depth is critical with the plants. The crown of the plant should be level with the top of the soil.

MULCHING: Mulch is good to use in the summer so berries stay off of the soil and are clean when harvested. It is beneficial to the plants if mulch is used as an over winter protection. Mulch for over winter should be applied when the plants are fully dormant, but it must be removed from the plants at bud break in the spring. Fresh straw is the main mulch used for both purposes.

WATER REQUIREMENTS: Water requirements are high in sandy type soils. Sandy loam or loam type soils should be kept moist.

FERTILIZER REQUIREMENTS: Medium amounts of non acid fertilizer should be used. The Alpine types will require low amounts of non acid fertilizer.

PRUNING: When the harvest is finished it is best to mow off the leaves but do not mow too deep otherwise the crown of the plants will be injured. After mowing till the soil to make the row narrowed to 12 inches wide. It is also advisable to thin excess plants in the row leaving at least 3 inches around each plant so new plants can grow more vigorously. Low rates of fertilizer can be applied at this time.

For everbearing cultivars the runners should be removed as they grow. By removing the runners it will promote flowering. The plant crown will grow larger as summer progresses and more fruits will be harvested throughout the summer. Mow the

plants when they become dormant, being careful not to injure the crown. The Alpine strawberries can be mowed in the late autumn, early winter or they can be left to grow without ever mowing.

INSECTS: Aphids and chewing insects can be a problem.

FUNGUS: Botrytis and leaf spot fungus can be problems.

USDA ZONES
10-11 or Indoor

SWEET LEAF

Stevia rebaudiana

TYPE OF PLANT: A broadleaf perennial in tropical climates, an annual in cold climates. It grows 2 to 3 feet wide and tall.

SEASONAL COLORS: The plants' leaves remain green year round. Bloomtime occurs when day length shortens. In Michigan this occurs in late September or early October. Plants remain green until frost, unless taken indoors where it remains green.

PLANT USES: The leaves and the soft stems produce a natural sweetener called steviol. The steviol can be extracted into powder form, dissolved in spirits for liquid or simply pick the leaf from the plant, dry the leaf in 12 hours or less and pulverize the dried leaf to use as a sweetener. The dried leaf may be added directly to anything that needs to be sweetened. Depending upon how the leaf is dried, it will give 10 to 100 times more sweetener than sugar weight by weight.

pH REQUIREMENTS: 5.5 to 7.5.

SOIL TYPE: Any soil.

LIGHT REQUIREMENTS: Full sun is best but will also grow in partial shade. If growing the plant indoors just place it in any window and it will acclimate itself to the light.

PLANT SPACING: When garden or commercial growing, plant them 8 inches in row and aisle space large enough to accommodate the equipment that will be used. Usually an 18 inch aisle width is adequate.

GROWTH RATE: Three months of growing outdoors will produce a minimum of 4 stems, 24 inches tall per plant. Using organic fertilizers the plants are vigorous and adaptable to any growing environment.

MULCH: Not needed but may be beneficial.

WATER REQUIREMENTS: Low compared to other crops. Sandy soils apply water 1 or 2 times per week during a dry period for best growth. In heavy soils use water sparingly. If the plants are to be grown indoors very little water is needed to keep the plant alive. Water will be the killer of the plant if it is over applied.

FERTILIZER REQUIREMENTS: High rate. Since it is an edible leafy plant organic fertilizers are recommended, although water soluble type fertilizers can be used.

PRUNING: To make the plant branch more quickly at the base pinch back the growing tip. Do not prune until harvest and then cut back to ground level.

INSECTS: With organic fertilizer there will be no insects.

FUNGUS: With organic fertilizer there will be no fungus.

USDA ZONES
10- INDOORS

TREE DAISY

Chrysanthemum

TYPE OF PLANT: Trainable tree form, Daisy plant. Annual in the north or house pot plant and perennial in areas where temperatures do not exceed freezing.

SEASONAL COLORS: Foliage is evergreen, buds and flowers are continuous year round but put their best show on in the spring through early autumn months.

PLANT USES: Good accent in perennial gardens, decks, patios and in homes.

pH REQUIREMENTS: 5.0 to 6.8.

SOIL TYPES: Sandy loams to clay loams or potting soils.

LIGHT REQUIREMENTS: Full sun is best; shade is okay. In heavier shade the plants become greener and then will show signs of yellowing leaves until the correct sunlight is given to them.

PLANT SPACING: The plants will grow up to 3 feet in diameter and as tall as the grower desires, so space accordingly.

GROWTH RATE: Plants are vigorous and in 2 months a small 3 inch plant will reach mature height and width. The plant is long lived, known to grow vigorous at 8 years old.

MULCH: Not necessary, but beneficial.

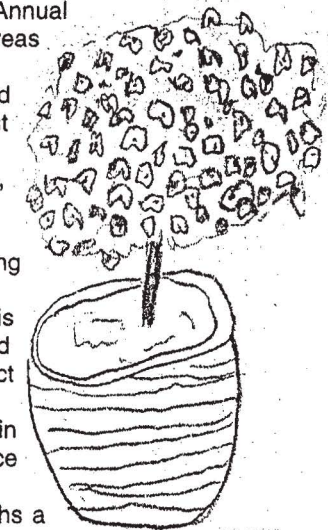
WATER REQUIREMENTS: If growing in full sun keep the top inch of the soil moist to the touch and plant will be happy with light waterings on the foliage. If growing indoors water sparingly usually letting the soil become dry to the stage just before the plant foliage will wilt or droop because of lack of water.

FERTILIZER REQUIREMENTS: High non-acid.

PRUNING: To create a bush form pinch the tip of the plant where the desired height of the branching is to start. Tree form, keep the side branches trimmed off from the base upwards to the tip leaving 2 inches of new leaf growth at the tip. As the plant grows repeat the first step until the desired height is reached. After the height is reached pinch the terminal tip off and let the plant branch normally, pinching whatever growth may be growing abnormally longer than the rest of the branch. See page 83 for example.

INSECTS: Aphids and chewing insects may be a problem so apply Malathion or Sevin as needed.

FUNGUS: None.



USDA ZONES
4-11

THYME

Thymus spp.

TYPE OF PLANT: Small sub shrubs or low growing ground covers known for their use as culinary plants.

SEASONAL COLORS: Most stay evergreen year round and produce tiny flowers that will be pink lavender to white in color.

PLANT USES: There are several types and flavors of Thyme. The *T. citriodorus* has the citronella that can be extracted from the foliage and stems to ward off insects. The culinary used as an herb produces an outstanding flavor. Other Thymes are known for their power of seasoning of foods. The plants can be used as solid groundcovers or ornamentally around water gardens and rock gardens and as border plants.

GROWTH RATE: The plants grow fast. A one year old plant of the ground cover type in a 2-1/2 inch container will grow outward 8 inches in one season. The sub shrub types will grow almost to maturity in one season.

MULCH: Mulch is beneficial in sandy soils but is not needed.

WATER REQUIREMENTS: Keep the soil moist until the plants are established in the soil. The Thymes need little water for survival but they will grow robustly with moisture.

FERTILIZER: Low rate fertilizer, non acid.

PRUNING: There is no need to prune them unless the plants begin to look bad. The prostrate ground cover type species can be rejuvenated by cutting the plant and leaving 2 inches of growth above the ground. This can be done with a lawn mower or hand shears. The sub shrub types species are just pruned severely to encourage new growths on the side branches of the main stem. It is best to remove any older side branches by making the pruning cut 2 inches from the main trunk. If the trunk is exhausted of energy look for a new bud at its base and make a cut one inch above the bud and it will grow upward vigorously.

INSECT: None

FUNGUS: None

Being that it is an edible crop no insecticide or fungicide should be used.

USDA ZONES
3-8

WILD GINGER

Asarum canadense

TYPE OF PLANT: A low growing herbaceous ground cover with large leaves produced on stems that grow only 2 to 4 inches tall.

SEASONAL COLORS: Early spring new leaves begin to appear from the bare ground. The kidney shaped pointed bright green foliage will soon cover the ground and as summer approaches flowers start growing underside of the foliage. The chocolate brown six lobed flowers hide, but the curious observer will be delighted to inspect the unusual shape and color of the delicate flowers. This flower attracts a rare butterfly. Autumn approaches and the bright green foliage changes to a deeper green. By the beginning of winter the stems and leaves melt into the ground and the plants rest until the next season.

PLANT USES: The main use of the plants are as a low maintenance ground cover. The roots can be harvested and dried to make ginger flavoring or may be used fresh.

pH REQUIREMENTS: 5.0 - 7.0.

SOIL TYPES: It is found growing wild in cool moist woods, but I also find it creeping out of the forest looking for sunlight. Soil type can vary with the best being clay loam or sandy loam. Amendments should be added to sandy or clay soils.

LIGHT REQUIREMENTS: Full shade to partial shade is best. In full sun the plants will not grow robustly.

PLANT SPACING: Using a plant grown in a 2-1/2 inch pot plant them 6 inches apart and stagger each row if planting in a mass planting. When plant size is increased by 2 inches (example: 4 inch container) the plant spacing can be increased another 6 inches (12 inches apart).

GROWTH RATE: The plants spread by underground rhizomes. In one season the plant will grow up to 8 inches wide and will continue every year, forming a dense mat of beautiful foliage and edible roots.

MULCHING: In the autumn it is best to leave any fallen leaves in the growing areas. This will protect the plants through the winter and in the spring the new growths will emerge through the rotted organic matter that was left in the autumn.

WATER REQUIREMENTS: Keep the soil moist the first year of establishment. After the first year the plants can be kept drier.

FERTILIZER REQUIREMENTS: Use low rate non acid fertilizer.

PRUNING: No pruning needed.

INSECT: None

FUNGUS: Root rot will occur if the plants become water logged during the summer.

USDA ZONES
3-8

WINTERGREEN

Gaultheria procumbens

TYPE OF PLANT: Evergreen Groundcover growing 2 to 6 inches at maturity and spreading outward.

SEASONAL COLORS: Autumn and Winter are the most outstanding months. Red fruits will appear before the first frost amongst the burgundy and deep green oval leaves. The fruits will stay on the plant throughout the winter into the next spring. In the spring white bell shaped flowers appear and during the later part of spring and summer the foliage changes to a bronze and green color.

PLANT USES: A beautiful and rare four season groundcover that is very hardy. The berry can be used to flavor teas, candy, in medicines and chewing gum. Creates an area in the landscape that never needs mowing. The leaves are used for making a refreshing minty wintergreen tea and the fruits can be eaten for a fresh flavor of wintergreen.

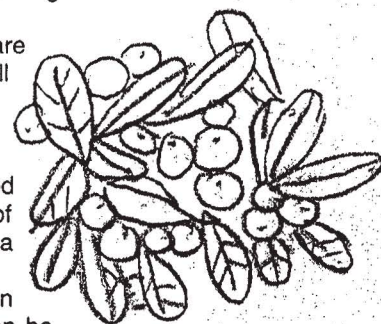
pH REQUIREMENTS: 4.0 to 6.0

SOIL TYPE: Best in sandy loams or sand. Clay loams or clay soils should be amended to provide drainage.

LIGHT REQUIREMENTS: Full shade to filtered sun is best, but if soils are kept moist, plants will thrive in full sun.

PLANT SPACING: Using a plant grown in a 2 1/2 inch pot plant them 6 inches apart and stagger each row if planting a mass planting. When plant size is increased by 2 inches (example: 4" container) the plant spacing can be increased another 6 inches (12 inches apart).

GROWTH RATE: Plants will spread 2 inches to 8 inches per year. The growth spreads by underground stolons.



MULCHING: Mulching is good the first year for establishment of the plants. After the rhizomes grow there will be no need to supply any mulch. It is best to let fallen leaves stay on the plant for added winter protection and organic matter.

WATER REQUIREMENTS: These are found in their native homes in moist woodland areas, so moisture for the shallow fine rooted plants is important. One half to one inch of water per week, but since the plants have waxy leaves, transpiration rate is slow, so over watering can be a problem. Check moisture and if the top inch of soil has an adequate moisture level do not apply water.

FERTILIZER REQUIREMENTS: Low acid type fertilizers.

PRUNING: Seldom necessary. If foliage becomes damaged or planted area becomes unsightly, just mow to 1 inch above soil line in the late autumn and plants will regrow in the spring.

INSECTS: No problems.

FUNGUS: Phytophthora Root Rot due to poor drainage or over-fertilization. There are no other fungal problems.

USDA ZONES
3-10

WINDBREAK TREE *Salix alba*

TYPE OF PLANT: An upright growing deciduous softwood tree.

SEASONAL COLORS: Spring is when new leaves appear. Since this *Salix* is a hybrid, female flowers are not present, so there is no mess. In the summer and autumn the thin leaves remain green and in the beginning of winter, the leaves fall and disintegrate quickly into the soil so there is little to no removal of leaves.

PLANT USES: As a wind break, shelter for wildlife, accent tree or used to shelter a home or building from winds. Good to stop wind and soil erosion as well.

pH REQUIREMENTS: 4.5 - 7.0.

SOIL TYPE: Any type soil may be used but they do best in loamy soils.

LIGHT REQUIREMENTS: Full sun.

PLANT SPACING: As a wind break space them at 5 feet apart and if a second row is to be used the second row should be planted 5 feet from the first and alternate the spacing of each tree with the first row of trees.

GROWTH RATE: A small 1 year old tree 8 to 12 inches tall will grow 4 to 8 feet every year until they reach maturity at 50 to 60 feet.

MULCHING: Mulch is not needed.

WATER REQUIREMENTS: Water two times after transplanting if soil is dry.

FERTILIZER REQUIREMENTS: No fertilizer is needed, but if it is used use medium rate of acid fertilizer.

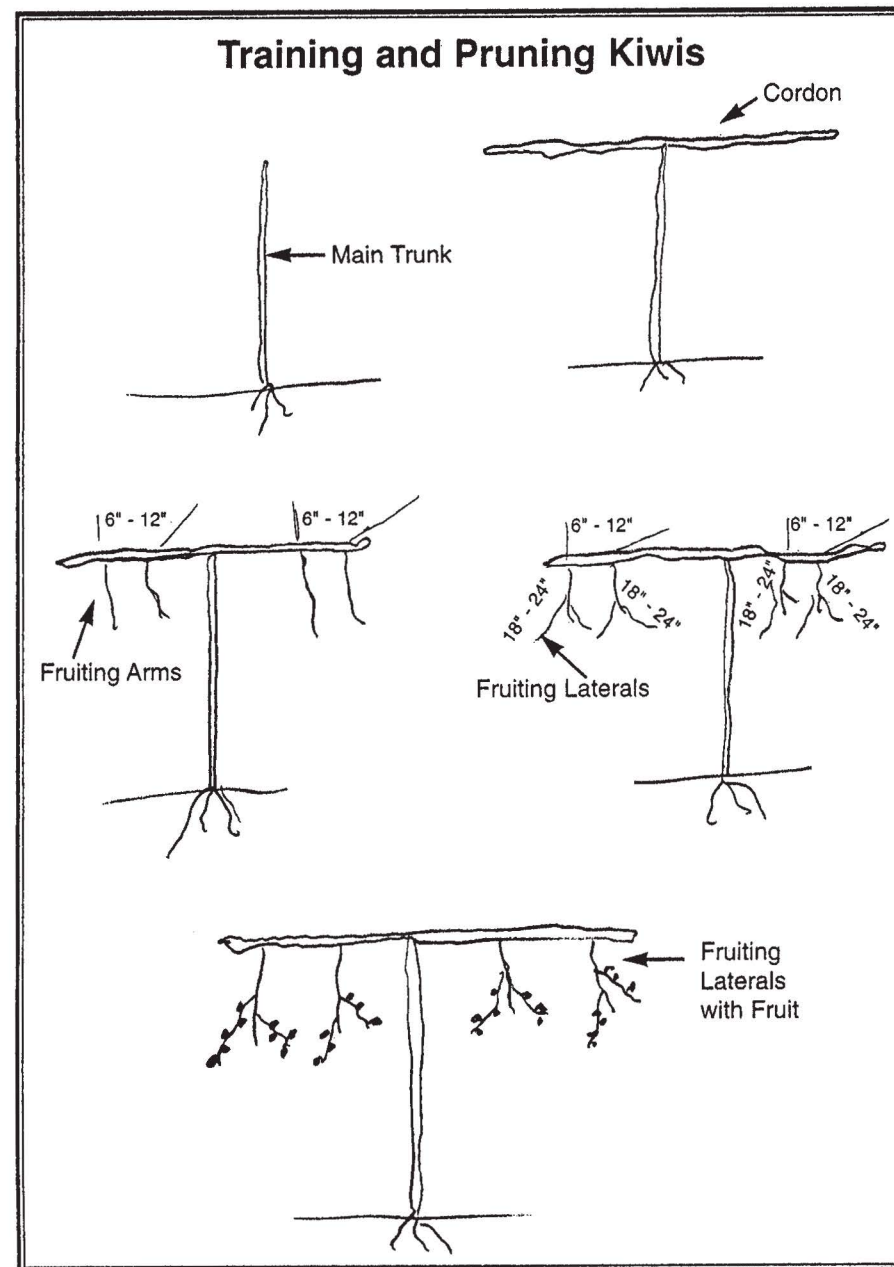
PRUNING: No pruning is needed.

INSECTS: No insects.

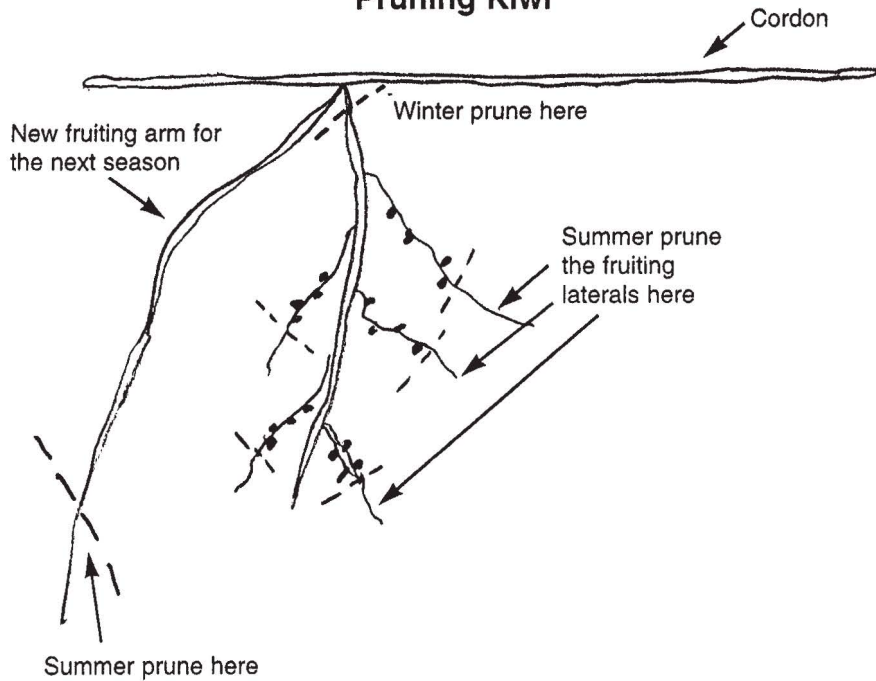
FUNGUS: In cool damp times of the summer there has been some fungus damage to the foliage but they recover fast when the weather warms up and the sun appears again.

Section 8

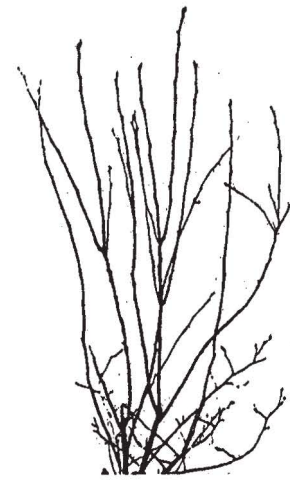
Trellis Systems & Pruning Plants



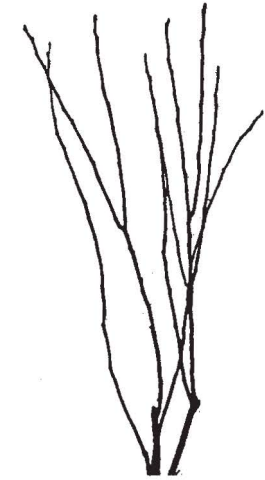
Pruning Kiwi



After the first 2 growing seasons in the field, prune out weak lower branches, lateral branches growing densely within the plant, and approximately 80% of the fruit buds that form on the tips of new canes. More upright vegetative growth will result, becoming the vigorous and healthy bush you need at maturity. After the second growing season, use the same technique but leave a higher percentage of buds to develop into berries.



Unpruned plant after 2 years in the field



Same plant after pruning

Pruning Blueberries Highbush and Rabbiteye and other upright species

Many of our customers, both new and old, call on us for advice on many subjects pertaining to growing blueberries successfully and profitably. With this, we'd like to share with you your recommendations for pruning that we have developed over our 53 years in blueberry production. Since now is the optimum time to prune, let's get you started.

New plants can be pruned before or after setting into the field. All horizontal or weak, spindly branches should be removed. Also, all flower buds should be removed to prevent fruiting. With pruning, more vegetative growth will be promoted which will produce a strong healthy bush.



New unpruned blueberry plant



Same plant after pruning

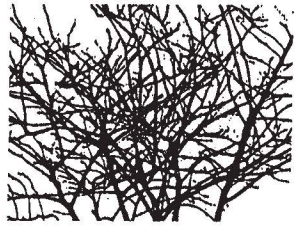
Pruning can be done from October through March. There have been tests done to try to determine the best time of year. The University of Rhode Island is running an experiment to conclude that pruning influences bloom time. Preliminary results indicate that plants pruned in the fall may bloom later than those pruned in the winter or early spring. Plants not pruned at all bloomed the earliest.

Different cultivars have different growth habits, too. An upright or erect cultivar should be pruned more from the center. A spreading cultivar should have drooping and lower branches pruned.

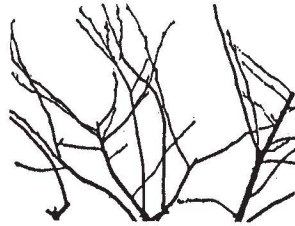
Some bushes produce an abundance of flower buds. Berries produced on these bushes will tend to be smaller and will ripen unevenly. The bush should be thinned so it is more open to sunlight; this will also aid in better pollination and more even ripening of the fruit.

The simple secret of pruning mature bushes? Regular yearly removal of broken, injured, unhealthy old wood. This consists of removing 2-4 of the oldest, blackest canes at the base of the bush. Branches 5 years or older have less vigor than those that are younger, so these should be pruned out. If the bush has not produced new vegetative canes, it is due to an excessive amount of old canes. By thinning the bush during the dormant period, new canes are stimulated to grow.

TRAINING THE RIBES



Bush with an abundance of buds before pruning



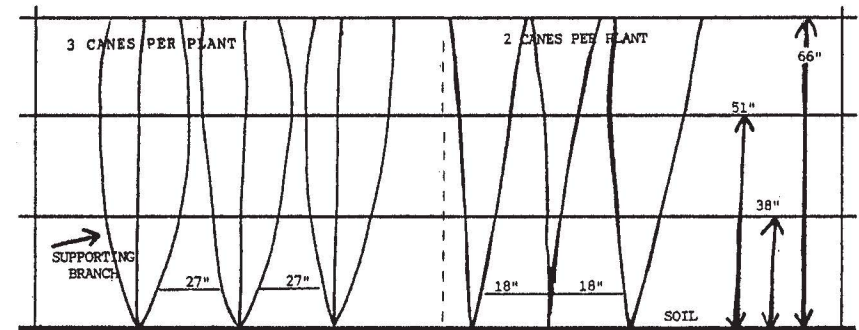
Same bush after pruning

Sounds too simple and easy, doesn't it? But the fact is regular, planned pruning combined with keeping your rows full by replanting the gaps can do the most to help you achieve your production goals. So much emphasis has been placed on chemical applications, but we feel that pruning is the only action you can depend on to consistently help you produce high-quality fruit.

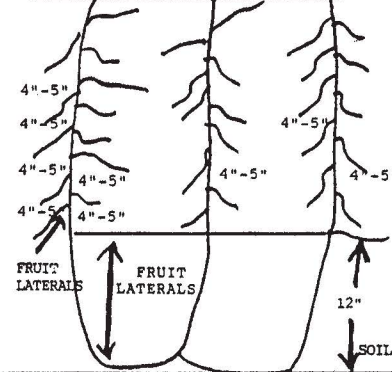
Even the small home gardener can benefit by this advice. As more and more people across the country look to blueberries as "edible landscaping," or keep a small plot of bushes strictly for home use, they will find that judicious yearly pruning is economical and healthy, as well as promoting beauty and grace in the bushes.

So there you have it — our first advice to the blueberry growers we supply with strong young plants. We at Hartmann's do not want to stop there, though, so someone is usually available to answer your questions whenever you call or write.

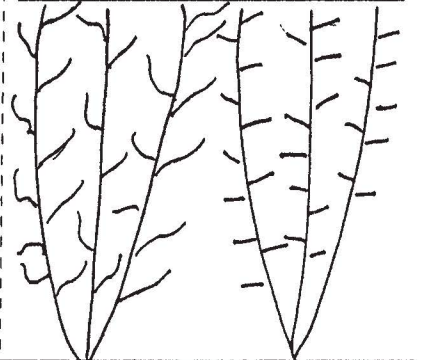
SHOWING SPACING OF RIBES ON TRELLISED FAN STYLE



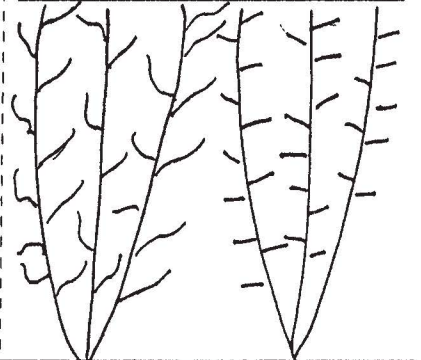
SHOWING FRUIT LATERAL DISTANCE



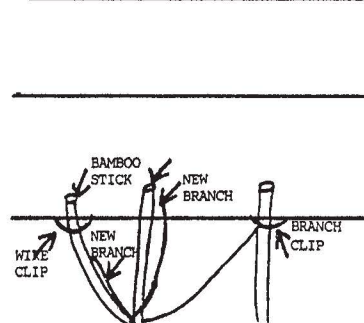
NATURAL GROWTH OF RED CURRANT



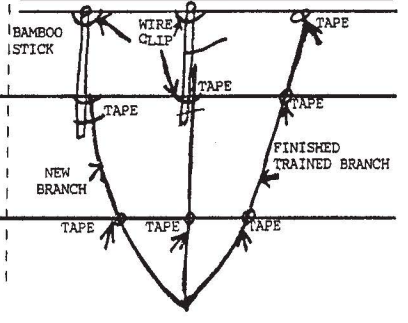
TRAINED LATERALS AFTER BENDING



TRAINING YOUNG PLANTS 1 - 3 YEARS

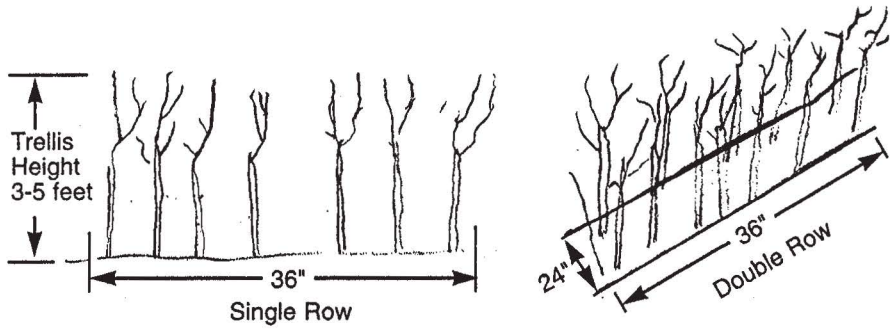


TRAINING NEW PLANTS MOVING BAMBOO UP

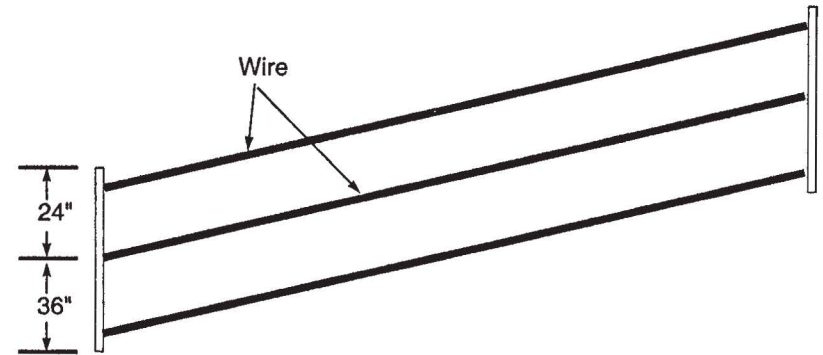


SUMMER BEARING RED RASPBERRY AFTER PRUNING

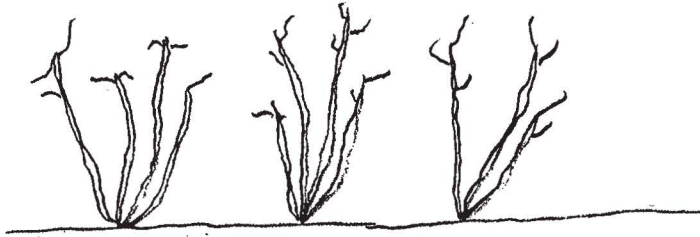
A double row is normally used in mild climates, in colder climates a single row is used. The description is typical of a plant that will be hand harvested



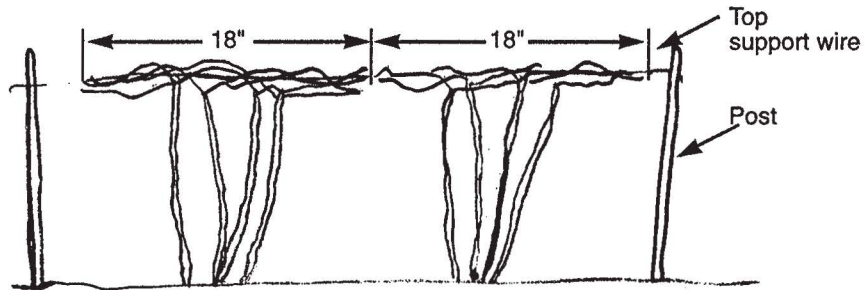
TRELLIS SYSTEM FOR BLACKBERRIES - SINGLE



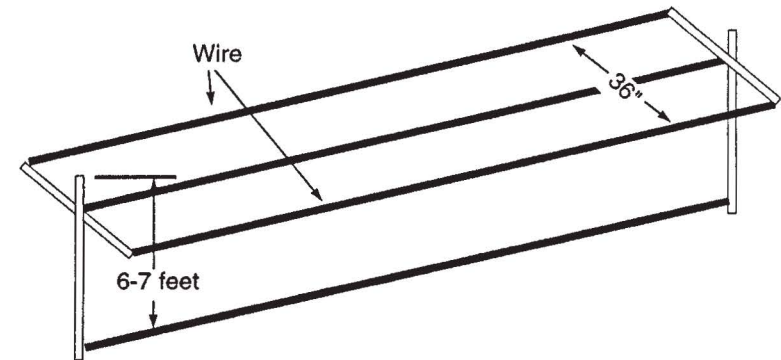
BLACK RASPBERRY OR PURPLE RASPBERRY AFTER PRUNING



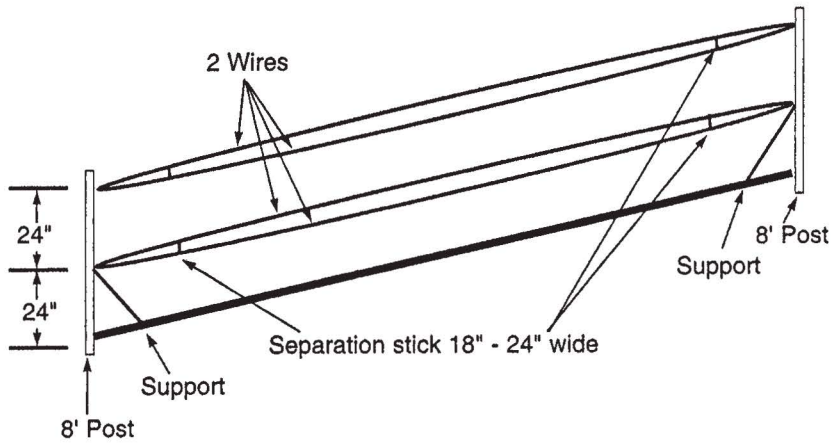
BLACKBERRY AFTER PRUNING



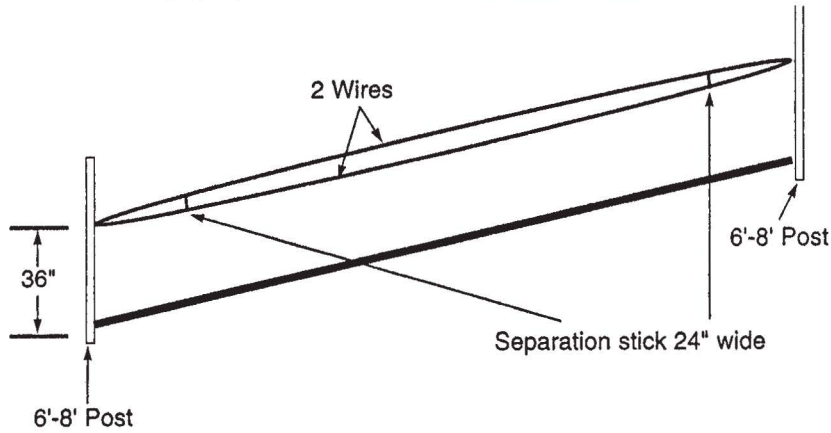
T-BAR DOUBLE WIRE TRELLIS SYSTEM FOR BLACKBERRIES & KIWIS



TRELLIS SYSTEM NORMALLY USED FOR SUMMER AND FALL, RED RASPBERRIES

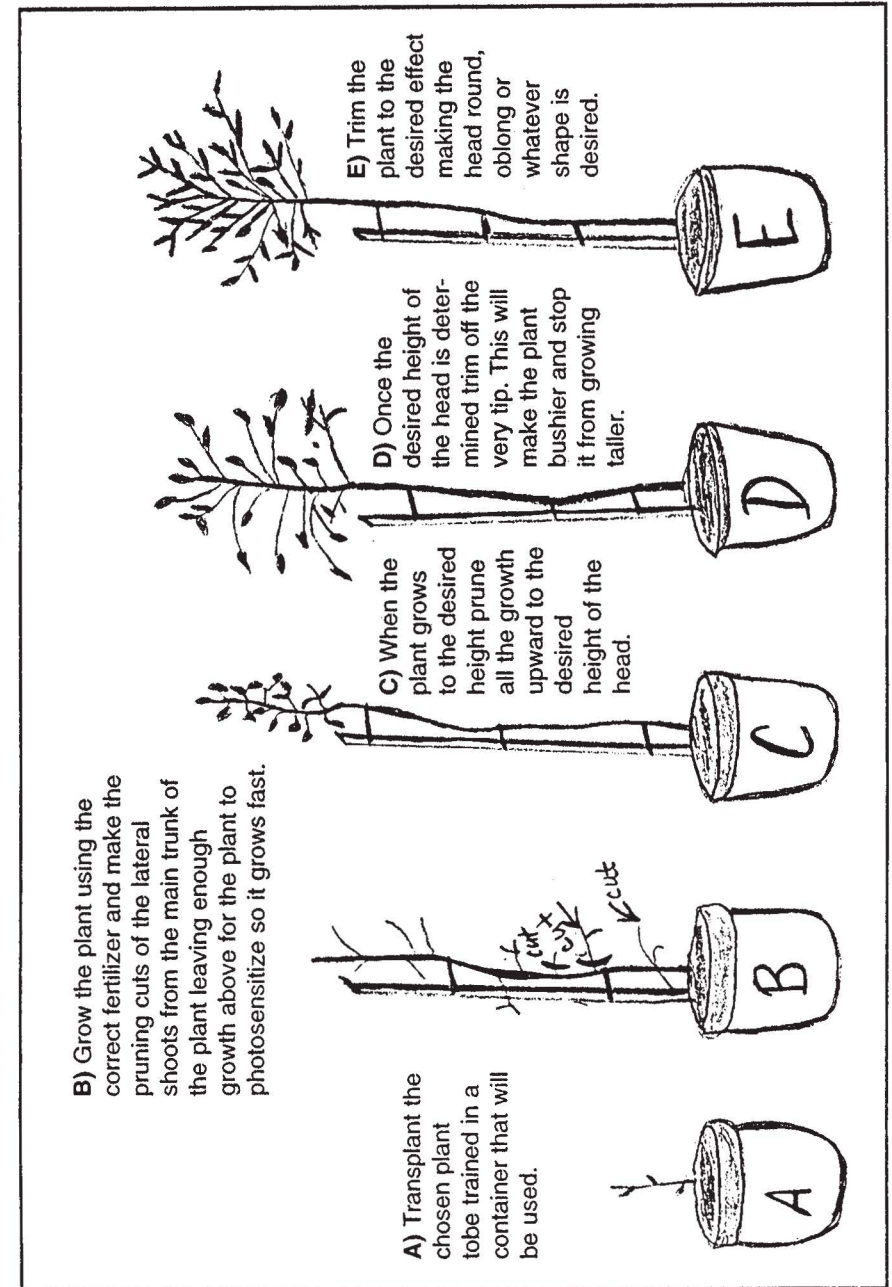


TRELLIS SYSTEM USED FOR BLACK & PURPLE RASPBERRIES



Trellis System & Pruning

Description for training plants that can be formed into tree standards. many herbs and indoor ornamental plants can be trained this way.



Section 9

CONVERSION CHARTS

AMOUNT (WEIGHT) OF POWDER REQUIRED TO PREPARE DIFFERENT AMOUNTS OF SPRAY MIXTURE AT DIFFERENT DOSAGE LEVELS

Recommended dosages per 100 gallons	Amount of material required to prepare spray mixture											
	lb.	oz.	gm.	50 gallons oz.	gm.	20 gallons oz.	gm.	10 gallons oz.	gm.	5 gallons oz.	gm.	1 gallon oz.
0.25	4	113	2	56	0.8	23	0.4	11	.20	6	0.04	1
0.50	8	227	4	113	1.6	45	0.8	23	0.40	11	0.08	2
1.00	16	454	8	227	3.2	91	1.6	45	0.80	23	0.16	5
1.50	24	681	12	340	4.8	136	2.4	68	1.20	34	0.24	7
2.00	32	908	16	454	6.4	182	3.2	91	1.60	45	0.32	9
3.00	48	1362	24	681	9.6	272	4.8	136	2.40	68	0.48	14
4.00	64	1816	32	908	12.8	363	6.4	182	3.20	91	0.64	18
5.00	80	2270	40	1135	16.0	454	8.0	227	4.00	113	0.80	23

CONVERSION CHARTS

METRIC AND ENGLISH EQUIVALENTS

Metric System

- 1 Kilogram (kg) = 1,000 grams (g.) = 2.2 pounds
- 1 gram (g.) = 1,000 milligrams (mg.) = 0.035 ounce avoirdupois
- 1 milligram (mg.) = 1,000 micrograms (mc.)
- 1 liter (l.) = 1,000 milliliters (ml.) = 1.058 fluid quarts
- 1 milliliter (ml.) = 0.034 fluid ounce
- 1 milliliter of water weighs 1 gram
- 1 liter of water weighs 1 kilogram

English System

- 1 gallon = 4 quarts
- 1 quart = 2 pints = 0.95 liter
- 1 pint = 16 fluid ounces
- 1 fluid ounce = 29.6 milliliters
- 1 pound = 16 ounces avoirdupois = 453.6 grams
- 1 ounce avoirdupois = 28.35 grams
- 1 pint of water weighs 1 pound
- 1 part per million (p.p.m.) = 1 mg. per 1.
= 1 mg. per kg.
= 0.0001 per cent
= 0.013 oz. by weight in 100 gal.
- 1 per cent = 10,000 p.p.m.
= 10 g. per 1.
= 1.28 oz. by weight per gal.
= 8 lb. per 100 gal.

To change temperature in degrees Centigrade to temperature in degrees Fahrenheit:

Multiply Centigrade temperature by 9/5 and add 32°

Example: 30°C. = 30 X 9/5 + 32 = 86°F.

To change temperatures in degrees Fahrenheit to temperature in degrees Centigrade:

Subtract 32 from Fahrenheit reading and multiply that figure by 5/9.

Example: 86°F. = 86

$$\begin{array}{r} 86 \\ -32 \\ \hline 54 \times 5/9 + 30^{\circ}\text{C.} \end{array}$$

CONVERSION CHARTS

TABLE OF USEFUL WEIGHTS AND MEASURES

Modern greenhouse operation calls for frequent, careful measurement of soils, fertilizers, and pest control chemicals. This collection of conversions should make your weighing and measuring easier and more accurate.

WEIGHTS

Sandy soil, dry

Cu. ft. = 90 pounds
 Cu. yd. = 2,430 pounds
 Bushel = 112 pounds
 Pint water =
 1.04 pounds
 Gallon water =
 8.34 pounds
 Gallon water =
 3,785 grams
 Pound = 7,000 grains
 Pound = 453 grams
 Pound = 16 ounces
 (Avoir.)

Loamy soil, dry

Cu. ft. = 80 pounds
 Cu. yd. = 2,160 pounds
 Bushel = 100 pounds
 Gram = 15.43 grains
 Grams = 0.035 ounces
 (Avoir.)
 Grams = 1,000
 milligrams
 Cu. ft. water =
 62.2 pounds

Clayey soil, dry

Cu. ft. = 75 pounds
 Cu. yd. = 2,025 pounds
 Bushel = 94 pounds
 Ounce (Avoir.) =
 437.5 grains
 Ounce (Avoir.) =
 28.35 grams
 Ounce (Avoir.) =
 0.06 pounds

Approximate Weights of Common Fertilizers, Dry,

(For use only when scale is missing)

- A.** Materials measuring 1-1/2 cupfuls per pound (24 tablespoons)
 Ground limestone Nitrate of soda, granular (15-0-0)
 Sulfate of potash (0-0-50)
- B.** Materials measuring 2 cupfuls per pound (32 tablespoons)
 Calcium nitrate (15-0-0)
- C.** Materials measuring 2-1/4 cupfuls per pound (36 tablespoons)
 Superphosphate (0-20-0) Muriate of potash (0-0-50)
 Treble superphosphate (0-45-0) Nitrate of potash (13-0-44)
 Complete (4-12-8) Complete (5-10-5)
- D.** Materials measuring 2-1/2 cupfuls per pound (40 tablespoons)
 Ammonium nitrate (granular) (33-0-0)
 Epsom salts (magnesium)
- E.** Materials measuring 2-3/4 cupfuls per pound (44 tablespoons)
 Ammonium sulfate (21-0-0) Ammonium phosphate (mono)
 Aluminum sulfate (Acidifying) (11-48-0)
 Borax, granular (Boron)
- F.** Materials measuring 4 cupfuls per pound (64 tablespoons)
 Lime hydrated (Calcium) Sulfur (Acidifying)

CONVERSION CHARTS

MEASURES

Capacity Measure, Dry

Peck = 0.25 bushel
 Peck = 16 pints
 Peck = 8 quarts
 Peck = 32 cups

Bushel = 4 pecks
 Bushel = 64 pints
 Bushel = 32 quarts
 Bushel = 128 cups
 Bushel = 41 seed flats (16 X 32 X 3)

Square Measure

Square foot = 144 sq. in.
 Square foot = 0.111 sq. yd.
 Square yard = 1,296 sq. in.
 Square yard = 9 sq. ft.

Acre = 43,560 sq. ft.
 Acre = 4,840 sq. yd.
 Mile, sq. = 640 acres

Cubic Measure

Cu. ft. = 1,728 cu. in.
 Cu. ft. = 0.037 cu. yd.
 Cu. ft. = 7.48 gallons
 Cu. ft. = 59.84 pints (liq.)
 Cu. ft. = 29.92 quarts (liq.)
 Cu. ft. = 25.71 quarts (dry)
 Cu. ft. = 0.804 bushels
 Cu. ft. = 28.32 liters

Cu. yd. = 27 cu. ft.
 Cu. yd. = 46,656 cu. in.
 Cu. yd. = 202 gallons
 Cu. yd. = 1616 pints (liq.)
 Cu. yd. = 808 quarts (liq.)
 Cu. yd. = 21.71 bushels

Bushel = 2150.4 cu. in.
 Bushel = 1.24 cu. ft.
 Bushel = approx. 1/20 cu. yd.
 Bushel = 35.24 liters

Gallon = 269 cu. in. (dry)
 Gallon = 3785 cu. cm.
 Gallon = 0.134 cu. ft.
 Gallon = 231 cu. in. (liq.)
 Peck = 537.6 cu. in.

Liter = 1,000 cu. cm.
 Liter = 0.035 cu. ft.
 Liter = 61.02 cu. in.

Ounce (liq.) = 1.805 cu. in.
 Pint (liq.) = 28.87 cu. in.
 Lb. water = 27.68 cu. in.

Qt. (dry) = 67.2 cu. in.
 Qt. (liq.) = 57.7 cu. in.
 Lb. water = 0.016 cu. ft.

CONVERSION CHARTS

Capacity Measure, Liquid

Fluid ounce = 2 tablespoons
 Fluid ounce = 6 teaspoons
 Fluid ounce = 29.57 milliliters
 Fluid ounce = 1.805 cu. in.

Cup = 8 fl. ounces
 Cup = 0.5 pint
 Cup = 236.5 milliliters
 Cup = 0.25 quart
 Cup = 16 tablespoons
 Cup = 48 teaspoons

Teaspoon = 5 milliliters
 Teaspoon = 0.17 fl. ounce
 Teaspoon = 60 drops
 Pint = 2 cups
 Pint = 16 fl. ounces
 Pint = 473 milliliters
 Pint = 28.87 cu. in.
 Pint = 0.125 gallon
 Pint = 0.473 liters
 Pint = 32 tablespoons

Tablespoon = 3 teaspoons
 Tablespoon = 15 milliliters
 Tablespoon = 0.5 fl. ounces
 Quart = 32 fl. ounces
 Quart = 2 pints
 Quart = 57.75 cu. in.
 Quart = 946 milliliters
 Quart = 0.25 gallons
 Quart = 0.94 liters

Cu. ft. = 29.22 liq. qt.
 Gallon = 128 fl. ounces
 Gallon = 231 cu. in.
 Gallon = 3,785 milliliters
 Gallon = 0.83 Brit. gallon

Liter = 2.1 pints (liq.)
 Liter = 1.06 quarts (liq.)
 Liter = 1,000 cu. cm.

TABLE OF CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.54
Feet	Meters	.305
Miles	Kilometers	1.609
Meters	Inches	39.37
Kilometers	Miles	.621
Square Inches	Square Centimeters	6.452
Square Yards	Square Meters	.836
Square Centimeters	Square Inches	.155
Square Meters	Square Yards	1.196
Cubic Inches	Cubic Centimeters	16.387
Cubic Yards	Cubic Meters	.765
Cubic Centimeters	Cubic Inches	.061
Cubic Meters	Cubic Yards	1.308
Fluid Ounces	Cubic Centimeters	29.57
Quarts	Liters	.946

CONVERSION CHARTS

To Change

Cubic Centimeters
 Liters
 Grains
 Ounces (Avoirdupois)
 Pounds (Avoirdupois)
 Ounces (Apothecary)
 Pounds (Apothecary)
 Grams
 Kilograms

To Multiply By

Fluid Ounces .034
 Quarts 1.057
 Milligrams 64.799
 Grams 28.35
 Kilograms .454
 Grams 31.103
 Kilograms .373
 Grains 15.432
 Pounds 2.205

Gals./Acre

1
 2
 3
 4
 5
 6
 7
 8
 9
 10

cc/sw. ft.

.0869
 .1738
 .2607
 .3476
 .4345
 .5214
 .6083
 .6952
 .7821
 .8690

cc/sq. rd.

23.66
 47.33
 70.99
 94.65
 118.31
 141.64
 165.64
 189.30
 212.97
 263.63

Lbs./Acre

1
 2
 3
 4
 5
 6
 7
 8
 9
 10

Grams/sw. ft.

.0104
 .0208
 .0312
 .0416
 .0520
 .0624
 .0728
 .0832
 .0936
 .1040

Grams/sq. rd.

2.84
 5.68
 8.52
 11.36
 14.20
 17.04
 19.88
 22.72
 25.56
 28.40

TO DETERMINE PPM

Multiply % of any element in any given fertilizer by 75. This gives ppm of one oz. of fertilizer in 100 gallons of H₂O

Ex: (NH₄)₂SO₄ = 20% N
 20% X 75 = 15 ppm in 1 oz.
 ((NH₄)₂SO₄ in 100 gals. H₂O

To determine the No. of oz. required to make up a 200 ppm solution divide 200/15 = 13-1/3 oz.

100 ppm = 100/15 = 6-2/3 oz.

**AMOUNT (VOLUME) OF LIQUID REQUIRED TO PREPARE
DIFFERENT AMOUNTS OF SPRAY MIXTURES AT DIFFERENT DILUTIONS**

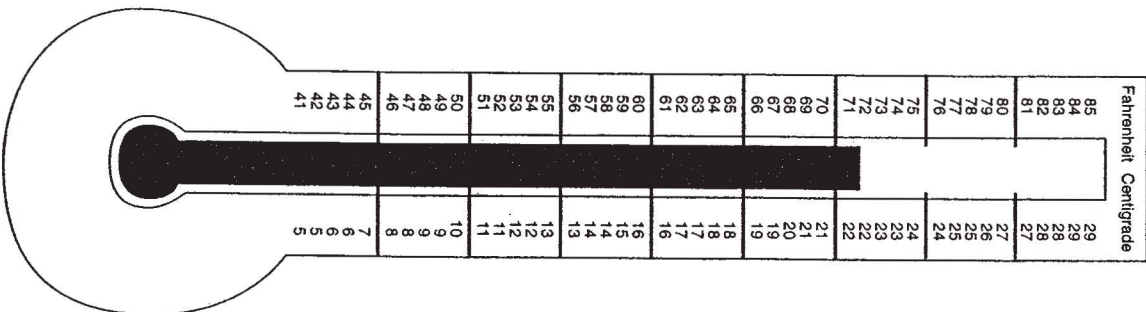
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Dilution of spray required	gallons		quarts	50 gallons pints	cc	20 gallons		10 gallons		5 gallons		1 gallon	
	cups	pints				pints	cc	cc	teasp.	cc	teasp.	cc	teasp.
1-3200	0.5	0.25	0.12	0.125	59.15	0.050	23.7	11.8	2.4	5.9	1.2	1.18	0.2
1-1600	1.0	0.50	0.25	0.250	118.30	0.100	47.7	23.7	4.8	11.8	2.4	2.37	0.5
1-800	2.0	1.00	0.50	0.500	236.6	0.200	94.6	47.3	9.6	23.7	4.8	4.73	1.0
1-400	4.0	2.00	1.00	1.000	473.2	0.400	189.3	94.6	19.2	47.3	9.6	9.46	1.9
1-200	8.0	4.00	2.00	2.000	946.4	0.800	378.6	189.3	38.3	94.6	19.2	18.93	3.8
1-100	16.0	8.00	4.00	4.000	1892.8	1.600	757.1	378.6	76.6	189.3	38.3	37.86	7.7
1-50	32.0	16.00	8.00	8.000	3785.6	3.200	1514.2	757.2	153.2	378.6	76.6	75.71	15.3
1-25	64.0	32.00	16.00	16.000	7571.2	6.400	3028.5	1514.2	306.4	757.1	153.7	151.42	30.6

TEMPERATURE CONVERSIONS

To convert Fahrenheit to Centigrade (Celsius): Subtract 32 and multiply by 0.55, thus 68°F equals 20°C.

To convert Centigrade to Fahrenheit: Multiply by 1.8 and add 32, thus 60°C equals 140°F.



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