

INTRODUCTION

Trees and shrubs can be planted around poultry houses to provide shelter from winter winds; reduce particulates, ammonia, and other odors from ventilation fans; create visual screens; and provide shade to reduce extreme summer heat.

This fact sheet provides instructions for installing and maintaining trees and shrubs so that they can serve their intended purpose. Using proper installation and management, especially during establishment, will significantly improve plant health and survival.

SITE PREPARATION

Site conditions, including soil quality and the type and density of existing vegetation, will determine the amount of site preparation you will need to do before planting. Around buildings and other structures, soil may be heavily compacted or contaminated with construction debris, gravel, and other fill material that can severely hinder plant rooting and survival.

If grasses or weeds are tall, you should mow or brush hog the planting strips. It is recommended that the planting strips either be tilled up or treated before planting with a non-selective herbicide, such as glyphosate, following all label directions.

INSTALLATION

Always check for utility lines (gas, water, cable, electricity) before planting. Don't plant on top of buried utility lines or below overhead lines.

Planting Design

Every poultry house will differ as to the location of ventilation fans, access roads, drainage ditches, etc., so each planting design will need to accommodate these features. Where vehicle access is needed, locate the planting a minimum of 50 feet from the sidewall and 80 feet from the end of the house. If the house does not have tunnel ventilation and has a south or west exposure, the minimum setback is 100 feet to provide for air movement.

Effectiveness for intercepting particulates and odors improves when hedgerows are oriented perpendicular to prevailing winds. Wider (deeper) and taller plantings are more effective than narrower, shorter ones. Long,



Figure 1. Deciduous trees planted primarily for shade.

uninterrupted hedgerows (at least 10 times as long as high) are more effective than shorter ones with gaps.

The closer the hedgerow is located to the poultry house, the more effectively the odor, dust, and ammonia will be trapped and dispersed. Particulate trapping efficiencies may be significantly reduced beyond 100 feet, depending on height of trees, wind speed/direction, and atmospheric conditions. Proximity of the plants for trapping efficiency must be balanced with plant survival, which decreases the closer the plants are to the ventilation fans.

Plantings in fan impact areas. For plant survival in fan impact areas, the nearest row of tree/shrub plantings must be set back from the fans by a distance that is at least 10 times the exhaust fan diameter. (For example, if the ventilation fan has a diameter of 4 feet, then the first line of plants needs to be planted at least 40 feet away.) Where multiple fans are used in one location, this planting distance formula may be increased a minimum of 5 feet for each fan, depending on the number of fans that are likely to be running at the same time (e.g., bank of two 4-ft. diameter fans may need a 50-foot setback, four fans may need a 60-foot setback, etc.).

If needed, some tree and/or shrub species may be planted closer to the fans (see Table 2), provided at least one row of stiff-stemmed warm-season grasses is

Program Participation – If you are enrolled in a program that provides financial assistance for your hedgerow, specific restrictions and requirements may apply. Refer to the program guidance provided in addition to this fact sheet.



planted in front of the trees/shrubs. The species selected and planting design must be approved in advance by the State Resource Conservationist.

In front of ventilation fans, plant at least two rows of trees and/or shrubs. For the first row (nearest the fans), select deciduous trees or shrubs, or a waxy-leaf evergreen shrub, such as 'Manhattan' Euonymus (*Euonymus kiautschovicus*). The second row of woody plants must be evergreen or deciduous species at least 10 feet tall at maturity that are tolerant of ammonia and particulates. 1- to 2-gallon container plants are recommended because they generally survive better in fan impact areas than seedlings or balled-and-burlapped plants.

Using one or more rows of stiff-stemmed warm-season grasses in front of the tree/shrub planting is recommended to provide an initial filter for ventilation fan emissions, and to slow wind speed and provide shelter for the subsequent rows of shrubs and trees. Alternatively, two rows of warm season grasses may be substituted for the trees/shrubs where space is limited. Refer to the Maryland NRCS fact sheet *Warm-Season Grasses for Poultry Houses* for additional information.

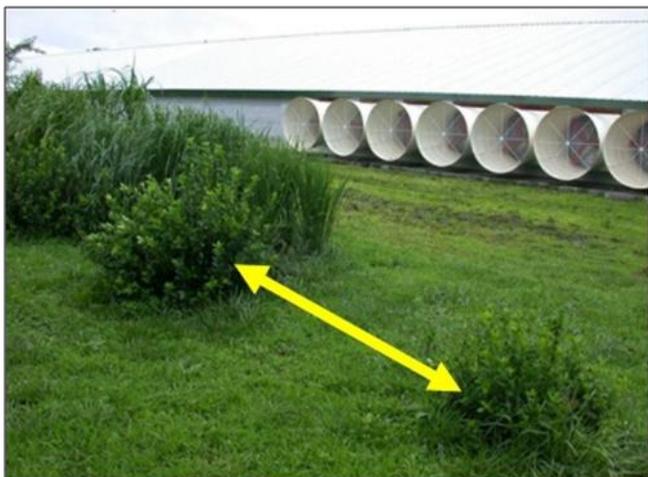


Figure 2. The 'Manhattan' Euonymus plant on the left has grown almost twice as large as the more exposed plant on the right. This additional growth is most likely due to the buffering effect of the grasses planted in front of the shrubs.

Plantings for visual screening, shade, and shelter.

For these purposes, a single row of trees or shrubs can be utilized, although a minimum of two rows is recommended. For year-round visual screening, use at least one row of evergreens. Alternatively, one row of densely branched deciduous species may be sufficient to provide the desired amount of screening, but this must be approved in advance by the State Resource Conservationist.

See Table 2 for additional information concerning recommended species for various purposes.

Plant Availability and Planting Dates

Containerized and balled-and-burlapped plants are usually available throughout the year. The preferred planting times are in the fall or spring, but plants can also be installed during the summer months if irrigation will be used. Planting during the dormant period (winter and early spring) is also an option if the ground is not frozen.

In ventilation fan impact areas, planting 1- to 2-gallon container stock in the spring, along with irrigation and good weed control, should produce the best results for plant survival and growth. Contact your local NRCS Service Center to obtain recommended planting dates for the different types of woody plant materials.

Storing and Planting Techniques

Containerized and balled-and-burlapped stock can be stored for extended periods if they are protected. Store the plants in partial to full shade and water as needed to keep moist.

Trees and shrubs can be planted either by hand or by machine, depending on site conditions and available equipment. Lift and carry plants by the container or root ball, not by the branches or trunk. See Figure 3 for instructions on hand planting smaller containerized stock. Larger stock is more expensive, and is typically used when it is not feasible to wait for smaller plants to reach a desired size (such as for visual screens). Because larger stock is more difficult for most people to handle, installation by a professional landscaping contractor is recommended.

Soil Amendments

Adding sand, peat, compost, or other materials to a planting hole is generally not recommended unless the soil is excessively compacted or otherwise has very poor quality. Trees and shrubs planted in natural soil without soil amendments are more likely to develop root systems that extend well beyond the planting hole. If planted in improved soil, roots tend to remain confined in the original hole for a longer period of time.

If soil amendments are needed, the best approach is to rip or deep-till a wide planting strip and add the materials to the entire strip. If this is not feasible, then dig a wide planting hole (at least two or three times the diameter of the root ball) and mix the excavated material with the soil amendments. A mixture of three parts soil to one part compost is recommended for each prepared hole.

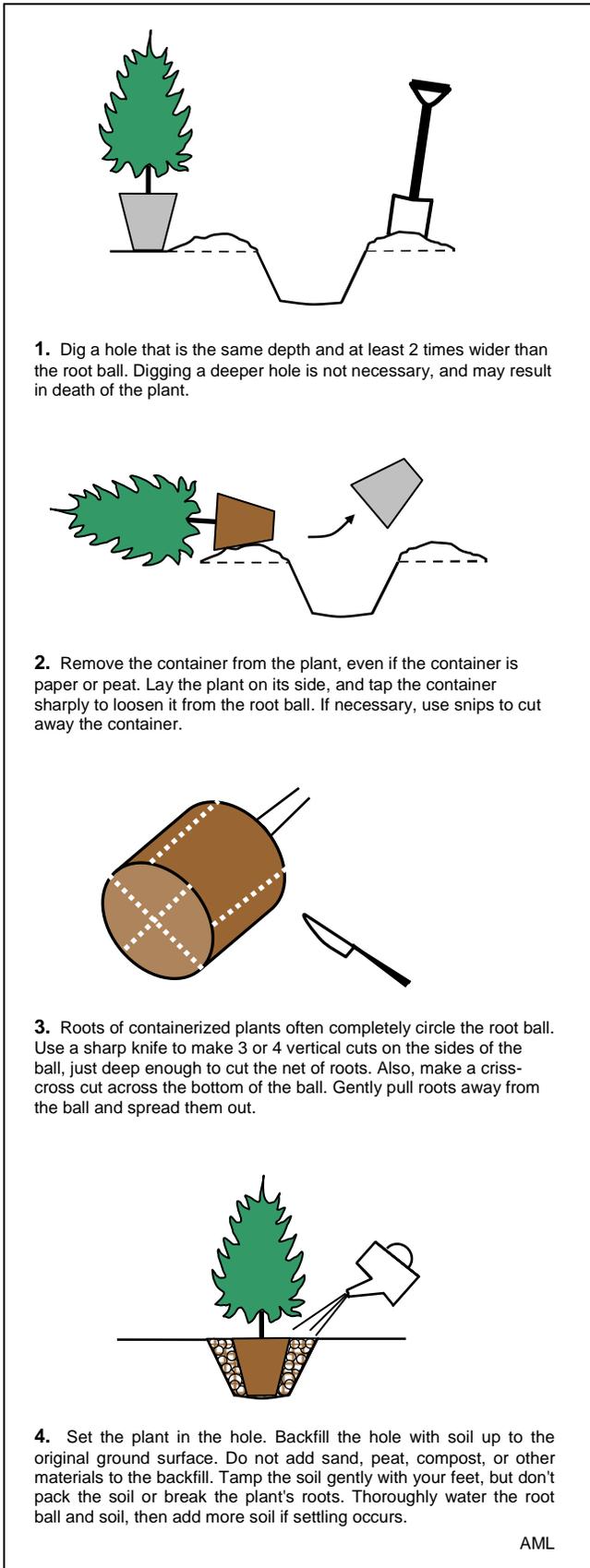


Figure 3. Hand planting containerized trees and shrubs.

Staking

Trees may need to be staked if they have dense crowns, are more than 5 feet tall, have slender stems, or will be planted in windy locations. Use guy lines that won't damage the bark. Leave some slack in the lines so that the trees will have a slight amount of flex. Remove all stakes and guying materials after one year.

Lime and Fertilizer

Newly planted trees and shrubs should not be limed and fertilized, unless soil tests show that pH and nutrients are extremely low. For most sites, it's best to allow the root systems of new plantings to become established before applying lime and fertilizer.

Irrigation

Installation of a trickle or emitter irrigation system is highly recommended for all plantings and is a requirement if receiving NRCS financial assistance. For the irrigation line, use ½-inch polypropylene with 0.5 gallon per hour emitters placed at each tree and shrub. A 15 mil thickness drip tape with 12-inch dripper spacing may be appropriate for closely spaced plantings.

Contact your local NRCS Service Center for a list of suppliers or irrigation companies. Be careful where you tap into your water system. Many integrators meter the water consumption for each poultry house.

Weed Control Barriers

Wood products, such as shredded or chipped hardwood bark, pine bark, bark chips, and wood chips, can be used as mulch around the plants, but will not provide long-term weed control unless more mulch is periodically added. Apply mulch to a depth of 3 to 4 inches, keeping 3 inches away from trunks and stems. Use a minimum 3-foot wide strip of mulch in the planting row, or at least a 3-foot diameter circle of mulch around each plant.

Black polyethylene sheeting (6 mil thickness) or woven plastic landscape fabric can also provide an effective weed barrier. Black poly is generally cheaper than landscape fabric and works well if trickle or emitter irrigation is also implemented. Be aware that woven plastic fabric can be difficult to remove after plants are established because roots will grow into the material. Additional drawbacks to these artificial weed control barriers include increased soil temperatures that may limit beneficial microbial activity, and the inconvenience of disposing of the materials when they are no longer needed.

Natural or synthetic fabric weed mats may also be used around individual tree and shrub plantings to

suppress weeds and conserve soil moisture. Mats should be at least 3 feet square, or 3 feet in diameter if round, and installed according to the manufacturer's instructions.

Treatment of the site with a pre- and post-emergent herbicide before planting is also helpful for controlling weed growth.

ESTABLISHING AND MAINTAINING THE PLANTING

Establishing the Planting

Planting year. After planting, keep plants watered during dry periods. It can take up to 5 years before a tree or shrub develops a root system extensive enough to sustain itself, especially in harsh conditions. Sufficient moisture during this period is important for plant survival and overall plant health.

On well-drained loamy soils, new plantings usually need at least 1 inch of water per week from rainfall or irrigation in summer and fall and also during the spring if there is little rainfall. On sandy soils, plants may need at least 2 inches of water per week, preferably in two separate 1-inch waterings. On heavier soils or wet sites, plants may need less water. Watering should be sufficient to moisten the soil to the depth of the root ball—usually 1 to 2 feet deep.

Control weeds around plants by mowing, hand pulling, treating with an appropriate herbicide, or a combination of these methods. Weed control is extremely important to the establishment and longevity of hedgerows. For hedgerows that will be maintained with mowing, consider that plant spacing will need to accommodate mowing equipment. Mowing should be done with extreme caution to avoid damaging the stems or bark of plantings.

Pre- and post-emergent herbicides may also be used if weeds are abundant. Herbicides can be spot-sprayed around plantings or applied to the planting strip. Follow specific label instructions to reduce or eliminate damage to trees and shrubs. Do not apply herbicides

when ventilation fans are active or on windy days because spray drift can damage nearby plantings.

Control noxious weeds at all times according to Maryland state law. Noxious weeds are johnsongrass, shattercane, bull thistle, Canada thistle, musk thistle, and plumeless thistle. Contact your local University of Maryland Extension office or county weed control specialist concerning recommendations for spot-treating the weed problem.

For hedgerows that are planted to reduce particulates from ventilation fans, a build-up of particulates on leaves may threaten to smother and kill the plants. If feasible, periodically remove the accumulated particulate matter from the leaves by hosing the plants with water. Excessive accumulation of particulates may require installation of additional barriers such as fencing or netting to protect the plants. Unlike dust, particulates from chick down and feathers do not wash off easily, so the planting distance and type of plant materials opposite fans is critical.

Second year after planting. Continue to water plants, as needed. Control weeds by mowing, hand pulling, or treating with an herbicide. Always avoid damaging the plantings during mowing and herbicide application. If using wood mulch around plants, do not exceed a total thickness of 4 inches (new mulch, plus any remaining old mulch). Replace any dead trees and shrubs until the barrier is functional.

Maintaining the Planting

By the third year, the trees and shrubs should be adjusting to the site and becoming well-established. Continue to water plants as needed, and monitor the planting for any problems that need to be treated. See Table 3 for a monthly summary of maintenance activities.

If an artificial barrier was used for weed control, the openings will need to be enlarged as the trees and shrubs grow so that the weed barrier does not constrict growth. The weed barrier should be removed after 3 growing seasons.

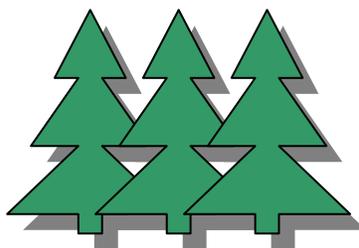


Table 1. Recommended spacing of trees and shrubs within and between rows.^{1/}

Plant Type	Spacing (feet) Within Rows		Spacing (feet) Between Rows
	Single Row	Multiple Rows	
Small Shrubs (4 – 12 feet tall)	2 - 4	4 - 6	10 - 15
Large Shrubs and Small Deciduous Trees (12 – 30 feet tall)	6 - 8	8 - 10	10 - 20
Large Deciduous Trees (more than 30 feet tall)	10 - 12	12 - 14	15 - 20
Evergreen Trees (columnar form)	6 - 8	8 - 10	10 - 20
Evergreen Trees (conical and broad forms)	8 - 10	10 - 14	15 - 20

Note:

1. Use spacings at or near the lower end of the range to create a dense barrier in a shorter period of time. Spacing between rows shall be at least four feet wider than the mechanized maintenance equipment used and may be increased beyond what is shown in this table to accommodate the equipment. Where space (width) is limited and a two-row planting is needed to meet density requirements, the same spacing within and between rows may be used, with staggered plantings. Maintenance during plant establishment may be more difficult with close spacing between rows.

Table 2. Recommended trees and shrubs for odor control, visual screening, shade, and shelter around poultry houses. If the tree/shrub planting distance will be less than 40 feet from the ventilation fans, use at least one row of stiff-stemmed warm-season grasses in front of the trees/shrubs.

Plant Names	Height at 20 Years ^{1/}	Growth Rate ^{2/}	Density ^{3/} - Summer	Density - Winter	Planting Distance from Fans	Remarks
DECIDUOUS TREES						
CYPRESS, BALD <i>Taxodium distichum</i>	30 ft.	Fast	Medium to High	Low	≥25 feet	Naturally occurring on streambanks and in swamps. Fine-textured leaves are highly efficient for trapping dust and odors.
ELM, AMERICAN <i>Ulmus americana</i> 'New Harmony' and 'Valley Forge'	35 ft.	Fast	Medium to High	Low	≥30feet	Prefers moist soil but will tolerate drier sites. The New Harmony and Valley Forge cultivars are Dutch Elm disease-resistant. Careful pruning is recommended to insure upright growth.
HACKBERRY, COMMON <i>Celtis occidentalis</i>	25 ft.	Fast	High	Low	≥30 feet	Adapted to a wide range of soil and site conditions. Fruits are attractive to birds. Proven effective for odor control (passive ammonia absorption).
HACKBERRY, SMALL'S <i>Celtis laevigata</i> var. <i>smallii</i>	25 ft.	Fast	High	Low	≥30 feet	Very hardy; adapted to a wide range of soil and site conditions. Fruits are attractive to birds. Proven effective for odor control (passive ammonia absorption).
HONEYLOCUST <i>Gleditsia triacanthos</i> var. <i>inermis</i>	40 ft.	Fast	Low to Medium	Very Low	Use formula ^{4/}	Prefers well-drained sites but will tolerate brief inundation. Drought-resistant and somewhat tolerant of salinity. Small leaves are highly efficient for trapping dust and odors. Proven effective for odor control (passive ammonia absorption).
LOCUST, BLACK <i>Robinia pseudoacacia</i> Steiner Group	30 ft.	Fast	Low to Medium	Very Low	≥30 feet	Adapted to a wide range of soil and site conditions, except very wet. Small leaves are highly efficient for trapping dust and odors. The Steiner Group of black locust consists of three cultivars: 'Appalachia,' 'Allegheny,' and 'Algonquin.' Tolerant of locust borers.

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Plant Names	Height at 20 Years ^{1/}	Growth Rate ^{2/}	Density ^{3/} - Summer	Density - Winter	Planting Distance from Fans	Remarks
DECIDUOUS TREES (continued)						
MAPLE, RED <i>Acer rubrum</i>	35 ft.	Fast	Medium to High	Low	≥30 feet	Adapted to a wide range of soil and site conditions.
OSAGE-ORANGE <i>Maclura pomifera</i> 'White Shield'	20 ft.	Moderate	High	Low	Use formula ^{4/}	Adapted to a wide range of soil and site conditions. Trunk is usually short and divides into several prominent limbs. Fruits are messy, so select male plants. 'White Shield' may be the most thorn-free cultivar.
REDWOOD, DAWN ^{5/} <i>Metasequoia glyptostroboides</i>	35 ft.	Fast	High	High	≥30 feet	Prefers moist soil but will tolerate drier sites. Similar in appearance to bald cypress. Fine-textured leaves are highly efficient for trapping dust and odors. <u>Test data are from sidewall fans only.</u>
WILLOW, HYBRID ^{5/} <i>Salix matsudana x alba</i> 'Austree'	60 ft.	Very Fast	Medium to High	Medium	Use formula ^{4/}	Sterile hybrid. Due to its extremely fast growth (>3 ft/yr), can provide visual screen in 1 – 2 years. Dense branch structure. Proven effective for odor control (passive ammonia absorption).
WILLOW, PURPLEOSIER ^{5/} <i>Salix purpurea</i> 'Streamco'	20 ft.	Fast	Medium to High	Low	≥40 feet	Shrub/small tree. 'Streamco' is a male clone, does not root sucker, and does not spread readily beyond the planting site. Proven effective for odor control (passive ammonia absorption).
EVERGREEN TREES						
ARBORVITAE <i>Thuja occidentalis</i>	25 ft.	Slow	Very High	Very High	Use formula ^{4/}	Frequently planted statewide as an ornamental. Prefers moist, well-drained soil, but tolerates a wide range of conditions. Prone to bagworms.
ARBORVITAE ^{5/} <i>Thuja plicata x standishii</i> 'Green Giant'	40 ft.	Fast	Very High	Very High	Use formula ^{4/}	Prefers well-drained soil, but tolerates a wide range of conditions. Bagworms are potential pests. Proven effective for odor control (passive ammonia absorption).
CEDAR, ATLANTIC WHITE <i>Chamaecyparis thyoides</i>	20 ft.	Moderate	Very High	Very High	Use formula ^{4/}	Prefers moist soil. Similar to Arborvitae in growth form.
CEDAR, EASTERN RED <i>Juniperus virginiana</i>	20 ft.	Moderate	Very High	Very High	Use formula ^{4/}	Growth rate and size is site dependent and can be variable. Should not be planted near apple orchards; alternate host of cedar-apple rust. Proven effective for odor control (passive ammonia absorption).
HOLLY, AMERICAN <i>Ilex opaca</i>	20 ft.	Slow	High	High	N/A	Need male and female plants for fruit production. Fruits are attractive to birds. Shade tolerant; very slow-growing. Suitable for visual screens and similar uses. <u>Not recommended for planting in fan impact areas.</u>
HOLLY, NELLIE STEVENS ^{5/} <i>Ilex cornuta x aquifolium</i> 'Nellie Stevens'	20 ft.	Fast	High	High	N/A	Shrub/small tree. Need male and female plants for fruit production. Fruits are attractive to birds. Tolerates partial shade. Plants may be multi-stemmed or pruned to have one main stem when young. Suitable for visual screens and similar uses. <u>Not recommended for planting in fan impact areas.</u>

Plant Names	Height at 20 Years ^{1/}	Growth Rate ^{2/}	Density ^{3/} - Summer	Density - Winter	Planting Distance from Fans	Remarks
EVERGREEN TREES (continued)						
SPRUCE, NORWAY ^{5/} <i>Picea abies</i>	35 ft.	Fast	High	High	Use formula ^{4/}	Fast growth rate when young, slows down with age. Prefers moderately moist, well-drained soil. Fine-textured leaves are highly efficient for trapping dust and odors. Proven effective for odor control (passive ammonia absorption).
SHRUBS						
BAYBERRY, NORTHERN <i>Morella pensylvanica</i> (formerly <i>Myrica pensylvanica</i>)	10 ft.	Moderate	Medium	Low	N/A	Semi-evergreen foliage. Need male and female plants for fruit production. Salt tolerant (0-20 ppt.) Suckers to form colonies. Suitable for visual screens and similar uses. <u>Not recommended for planting in fan impact areas.</u>
EUONYMUS, SPREADING ^{5/} <i>Euonymus kiautschovicus</i> 'Manhattan'	6 ft.	Moderate	High	Medium	≥25 feet	Semi-evergreen foliage that may be damaged in cold winters. Not as susceptible to scale as other Euonymus. Performs well in fan impact areas; good for sites where space is limited.
HACKBERRY, DWARF <i>Celtis pumila</i>	15 ft.	Fast	High	Low	≥30 feet	Deciduous shrub/small tree. Adapted to a wide range of soil and site conditions. Fruits are attractive to birds.
HOLLY, JAPANESE ^{5/} <i>Ilex crenata</i> 'Steeds'	8 ft.	Fast	High	High	N/A	Evergreen. Need male and female plants for fruit production. Fruits are attractive to birds. Tolerates partial shade. Suitable for visual screens and similar uses. <u>Not recommended for planting in fan impact areas.</u>
WAXMYRTLE, SOUTHERN <i>Myrica cerifera</i>	10 ft.	Moderate	Medium	Medium	N/A	Evergreen. Need male and female plants for fruit production. Salt tolerant (0-10 ppt). Suitable for visual screens and similar uses. <u>Not recommended for planting in fan impact areas.</u>

Notes:

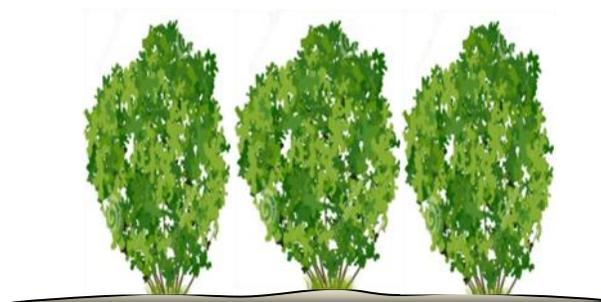
- 1. Height at 20 Years:** Actual height may be shorter than the potential height, especially in fan discharge areas.
- 2. Growth Rate:** Slow = less than 1 ft/year; Moderate = 1–2 ft/year; Fast = 2-3 ft/year; Very Fast = more than 3 ft/year.
- 3. Density:** For an individual plant species, defined as the amount of space that is occupied by foliage, twigs, and branches and can be estimated by the amount of light that can be seen through the plant. Low density – 25-35% of space occupied by plant material (with 65-75% open space through which air can travel); Medium density – 40-60% of space occupied by plant material; High density - 60-80% of space occupied by plant material; Very High – more than 80% of space occupied by plant material. The overall density of a hedgerow is affected by the species selected, number of rows, and spacing between plants.
- 4.** As a general rule for plant survival in fan impact areas, the nearest row of tree/shrub plantings must be set back from the fans by a distance that is at least 10 times the exhaust fan diameter. (For example, if the ventilation fan has a diameter of 4 feet, then the first line of plants needs to be planted at least 40 feet away.) Where multiple fans are used in one location, this planting distance formula may be increased a minimum of 5 feet for each fan, depending on the number of fans that are likely to be running at the same time (e.g., bank of two 4-ft. diameter fans may need a 50-foot setback, four fans may need a 60-foot setback, etc.).
- 5. Non-native plant;** not considered to be invasive.

Table 3. Tree and shrub planting, maintenance, monitoring, and evaluation calendar.

Activity ^{1/}	Recommended Time of Year											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Planting												
Seedlings (bareroot)												
Large Trees (containers)												
Maintenance												
Mulching												
Watering												
Monitoring ^{2/}												
Evaluation ^{3/}												

Notes:

- Activity** – Recommended during the time of year shaded in green.
- Monitoring** – Pay special attention during these months to mulching and watering needs, weeds to be mowed/sprayed, disease or insect infestations that need treatment, or animal damage (e.g., deer browsing, vole or beaver cutting) that may be controllable. Monitor for a minimum of the first three growing seasons. Frequent monitoring will help you to identify problems early, before damage becomes extensive.
- Evaluation** – Assess survival of the plants in the spring and the fall, and determine the need for replanting.



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