The Illinois Windbreak Manual was developed jointly by the Illinois Department of Conservation, the Cooperative Extension Service and the Soil Conservation Service to be used as a guide for all agencies and organizations involved in planning or designing farmstead and residential windbreaks in Illinois.

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Chapter 1. Introduction

This manual was developed in order to increase the quantity and improve the quality of windbreak plantings.

A well designed, well maintained windbreak will be appreciated for its usefulness and beauty. Plantings made without thought to basic design principles, soils, and species selection often function and grow poorly. Such windbreaks may not protect key areas; they may deposit drifted snow on buildings, lanes, roads, feeding areas, and elsewhere, causing damage, expensive removal operations, blocked access roads, or soil wetness problems. They can also be difficult to maintain. Improper selection of plant species for the soils at the site may result in poor survival, slow growth, and plant stress. These conditions make the plants susceptible to pathological disorders, and ultimately the landuser is dissatisfied.

The objective of this manual is to provide the guidance and information needed to enhance the windbreak program in order to achieve better home protection, wildlife habitat, esthetics, energy conservation, recreation, and livestock protection. It is intended to be used as a guide by all agencies in the State of Illinois dealing with windbreak design and establishment. The manual contains general recommendations and options that can be used for specific sites according to landowner objectives.
Chapter 2. Windbreak Principles

A windbreak is a barrier composed of trees and shrubs that redirects and modifies the force of the wind. Part of the air current is diverted over the tops of the trees and part of it filters through the trees.

Windbreaks reduce average wind speed in three ways. First, they absorb some of the wind's energy by means of frictional drag as the moving air passes through and around them. Second, they deflect wind to higher levels. And third, windbreaks redirect relatively smooth, horizontal airflow into random directions. That is, more turbulence is created, as shown in Figure 1. These three processes work differently with windbreaks of various structures.

Height, density, and orientation are the major factors determining the protection a windbreak provides, but other factors such as width, cross-sectional shape, length, and composition are also important.

Windbreak Height

The effectiveness of windbreaks in reducing average horizontal wind has been investigated in many studies. Most have shown that the extent of windbreak protection is proportional to the height of the windbreak. When windbreak effects are described, in fact, distance from the windbreak is often expressed in units of windbreak height: (H).

A windbreak usually begins to exert a measurable influence on airflow between 3 and 10H from the upwind edge. Windspeed is sharply reduced near the windbreak, and a minimum is reached within 10H of the downwind (leeward) edge. Minimum windspeed may be as low as 10 percent of open wind. Wind recovers to the open speed gradually and reaches open speed between 15 and 20H downwind.

The tallest row of trees or shrubs in a windbreak determines the H unit distance downwind (leeward), that is, the distance of the area that can be protected. A windbreak can provide varying degrees of protection, as shown below, with H equal to the height of the tallest row in the windbreak. The optimal desired effectiveness is usually observed up to a distance from the windbreak equal to 10 times its height.

| Good: | Adjacent to 10H |
| Fair: | 10 to 15H |
| Poor: | 15H or more |

Windbreak Density

Reduction of wind velocity is closely related to windbreak density. An impermeable windbreak provides the maximum reduction in horizontal wind speed, while less dense windbreaks provide proportionately smaller reductions. The distance between the windbreak and the point of maximum reduction is small for very dense or impermeable windbreaks, as well as for very porous or loose windbreaks, as shown in Figure 2. The distance is greatest for medium-density windbreaks, as shown in Figure 3.

Instead of being concerned about the density of the species being planted, the tendency has been to be concerned about the number of rows planted. Research and experience have shown that medium-dense windbreaks, those with 65 to 85 percent density, provide the most adequate protection from wind and drifting snow around buildings, feedlots, and so forth. Therefore, the density of the species planted should be more important than the number of rows.

Since trees and shrubs are living things and since living things are subject to insect and disease problems, three rows of trees are recommended for
Windbreak Length

As shown in Figure 5, the length of a planting directly affects the amount of area that will be protected downwind. As a general rule, doubling the length of a planting will increase the area protected by four times. The protective effect decreases by about half if a windbreak is only twice as long as it is high. Maximum efficiency is achieved when length is 11.5 times the height at maturity.

Windbreaks tend to affect wind currents by forcing increased amounts of wind around the ends of the windbreak. This increases the wind velocities at these points. As the wind passes the ends of the windbreak, reduced pressures on the downwind side of the windbreak create wind eddies (Figure 6). Because of these eddies and the fact that wind currents are not always perpendicular to the belt,

![Diagram of windbreak](image)

**Figure 4. Effects of different windbreak densities on the distribution of snow.**

the windbreak should be extended in both directions 50 feet beyond the area to be protected to ensure maximum effectiveness.

Generally, heat loss reduction with a windbreak increases with the length of the windbreak. A longer windbreak will protect a longer perimeter of a building, and it will protect it from winds coming from more directions.
Windbreak Orientation

Windbreaks and wind barriers are most effective when oriented perpendicular to the most troublesome or prevailing winds.

The number of legs in a windbreak planting will depend upon the number of directions from which troublesome or problem winds originate. Windbreaks with one leg can be effective for controlling troublesome winds and drifting snow coming only from one direction.

Figure 7 illustrates the effect of a one-legged windbreak on north winds. For most windbreak plantings, all primary objects and areas in need of protection should be within the shaded area. Remember that farmstead, feedlot, and residential windbreaks with one leg are not effective against problem winds from more than one direction. In this instance, the area to be protected would still be vulnerable to winds coming from other directions.

The primary purpose of most windbreaks is to reduce the velocity of the wind, thus raising the comfort level on the leeward side of the trees and reducing cold air infiltration into the home. The prevailing winter winds come predominantly from the north and west in Illinois, as illustrated in Figure 8. Information on this subject is also available from the Illinois State Water Survey in Urbana.

If troublesome winds or blowing snow from more than one direction are a problem, two or more legs will be needed for adequate protection. Figure 9 illustrates the area protected by two primary windbreaks arranged in an L shape. One is planted on the north and the other on the west side of objects and areas in need of protection. Again, all primary objects or areas in need of protection should be within the shaded zone and no more than 10H leeward.

Figure 5. Effects of windbreak length on the size of the protected area.

Figure 6. Wind eddies formed as increased wind velocities pass the ends of the windbreak. In this example, the house is outside the fully protected area.
Using this approach, one can readily see that two primary windbreaks, one on the west side and one on the north side, would be needed to protect most sites adequately, particularly farmsteads and feedlots.

![Diagram of a one-legged windbreak]

**Figure 7.** Area protected by a one-legged or primary windbreak. The protected area would still be vulnerable to winds from other directions.

Windbreak Shape

The shape or cross-sectional profile of a planting affects air currents passing over the protected area. Some studies indicate that triangular or rounded plantings reduce air turbulence in the protected area.

For many years, windbreaks with smooth, inclined roof shapes were generally believed to be most effective for reducing leeward wind velocities. Other studies imply that windbreaks with nearly vertical sides are most effective. Others believe that windbreak density is more important than shape and that shape need not be a concern.

All shapes perform satisfactorily if they are of the proper density for the intended purpose. Since windbreaks are composed of trees and shrubs that can change in height, density, and longevity, shape and other properties of windbreaks can change significantly over time.

Windbreak Width

The cross-sectional width-to-height ratio and the shape of the windbreak as a whole may affect performance, although it is much less important a factor than density. Windbreaks of different widths afford the same protection if the density is the same. In general, wind reduction actually decreases when the windbreak exceeds a certain width.

A study at Princeton University by D.T. Harrje found that a conifer windbreak two rows wide was nearly optimum for efficiency and that additional rows did not significantly increase its effectiveness.

Such studies have encouraged a general reduction in the number of rows in windbreaks over the years. More emphasis is being placed on obtaining windbreaks of desired densities rather than on a certain number of rows.

![Map of Illinois showing wind patterns]

**Figure 8.** Prevailing winter wind patterns in Illinois.
Windbreak Composition

The species used for windbreaks can significantly affect longevity, appearance, effect, and usefulness. Long-lived species should be selected. This eliminates the need to re-establish plantings periodically. Species diversity is also advantageous to wildlife and minimizes insect and disease problems. Species that have the least effect on adjacent crops or yards are preferred over those that drastically affect the performance of adjacent crops or yards. Appearance is generally of more concern with farmstead, feedlot, or residential windbreaks. Wider belts than necessary for the protection of homes, crop, soils, and livestock are especially useful for enhancing wildlife and landscapes. This is particularly true in areas subject to severe winter storms.

Effect on Windchill

Nearly everyone knows that it seems cooler when the wind blows or when a fan is turned on. The actual temperature is not changed by the presence or absence of the wind or the use of the fan. Yet it seems cooler for warm-bodied creatures because increased wind velocity causes heat to leave the body at a higher rate. This in turn causes a cooling effect. This cooling effect is appreciated on hot summer days. However, on cold winter days, the opposite is true. During periods of cool or cold temperatures, windbreaks are appreciated for reducing the heat loss from warm bodies. This is accomplished by the reduction in wind velocities produced by windbreaks.

The windchill index for various wind velocities at different temperatures can be determined by using Table 1. For instance, if on a given day the outside temperature is 20°F and the wind velocity is 20 miles per hour, a bare, warm body or exposed flesh will lose heat at the same rate as on a calm day with a temperature of -9°F. Assuming a 75 percent reduction in wind velocity immediately leeward of a dense or moderately dense windbreak, which is easily obtainable, the wind velocity would be 5 miles per hour. This would give a windchill index of 16°F. The heat losses from a warm, exposed body or exposed flesh would be the same as in a temperature of 16°F with no wind. Although exposed flesh may encounter serious problems at 16 and 20°F, they are drastically less than at -9°F. Reduced windchill reduces stress and the need for food by warm-bodied animals, all of which contribute significantly to good health and comfort.

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Chapter 3. Siting the Windbreak

Most farmstead or residential windbreaks are intended to reduce the forces of winter winds, thus raising the comfort level on the leeward or downwind side of the windbreak and reducing heating costs for homes and other buildings.

Since most prevailing winter winds come from the north and west in Illinois, windbreaks should be on the north and west sides of the farmstead or the area to be protected. On occasion, the prevailing winter winds may come from a direction other than the north or west. In these cases, place the windbreak on the side or sides that will provide maximum protection.

Any potential site must be reviewed before steps are taken to design a farmstead or residential windbreak. During the review, a sketch should be drawn of the area. Note all primary objects or areas in need of protection, as well as existing windbreaks, other groves or clumps of trees and shrubs, soil problems, utilities, direction of the prevailing or most troublesome winds, property lines, and roads or access lanes. Figure 10 illustrates the type of information that should be in the sketch, and it should be studied carefully in planning the layout and planting of the windbreak.

Exercise care in establishing a windbreak in directions other than north/south. Homeowners should also consider the direction of prevailing summer winds. The benefit of these breezes can be lost if a windbreak interferes with the cooling effect they have on the home and its surroundings. A windbreak established in the wrong place can cause dead air pockets and stifling temperatures during summer months.

Several general planning guidelines should be taken into account in the siting and layout of a windbreak.

1. Position the windbreak perpendicular or as nearly perpendicular as possible to the most troublesome winds.

2. The windward row of a windbreak, that is, the first row the wind encounters, should be located approximately 100 feet from the primary areas or objects in need of protection.

3. The soils of the potential planting site must be known. More than one soil type at the site might make it necessary to plant different tree and shrub species on each soil type or to plant around areas of problem soils.

4. The location of property lines, subsurface drain fields, and septic fields must be known. Property lines can severely restrict the location of plantings. In cases where severe snow drifting can be a problem and space is insufficient to locate a planting properly, it might be advisable not to plant all or a portion of a windbreak. Subsurface drain lines or septic fields should be relocated or avoided unless sealed conduit is used. Where subsurface drains or tile lines cross through a windbreak site, sealed conduit should be installed for a minimum of 50 feet from the rows of trees.

Figure 10. Sketch of an area in need of protection by a windbreak.
5. Any existing windbreaks, clumps, groves of trees or shrubs, and in some cases, large individual trees should be outside the boundaries of new windbreak plantings. New plantings should not be located within 50 feet of any existing trees if space is available. Where space is limited, existing plantings should be incorporated into the design of new plantings or they should be removed.

Location: Relation to Buildings and Travel Lanes

In addition to reducing wind velocity, a windbreak can also be an effective tool in redirecting snow accumulation. The windbreak has the same effect as a snow fence placed along the highway. Most snow accumulation will occur within the first 50 feet of the innermost row of trees. Depending on the storm, this could be a very large and heavy volume of snow. For safety purposes, we therefore recommend that the windward row of a windbreak be planted no closer than 100 feet from the nearest building (Figure 11). To minimize problems associated with deep drifts, it is important to position the most windward row properly. In southern Illinois, south of I-64, the potential for drifting snow is greatly reduced, so the distance between the windward row of the windbreak and the buildings can be reduced to 50 feet.

Driveways, equipment lanes, and field access must also be considered when establishing the windbreak. Similar rules apply here: the inside or leeward row of trees should be at least 50 feet from any travel lane that will be used during the winter. Locating it any closer may cause drifting problems.

Where access is necessary to a field bounded by the windbreak, avoid directing travel lanes through the belt. Leaving an opening for machinery will create a wind tunnel and destroy the effectiveness of the tree barrier. Field access lanes should be routed around the ends of the windbreak, or where this is impossible, the leg should be broken and overlapped to minimize wind and snow penetration (Figure 12). Under no circumstances should the point of an L-shaped windbreak be broken for field access.

Location to Maximize Protection

Maximum benefits of the windbreak will be felt up to a distance of 8 to 10 times the height of the tallest row of trees (10H) up to a maximum of about 300 feet. Beyond 15 to 20 times the height, the wind velocity picks back up as though no windbreak existed. Therefore, for optimum protection, the windbreak should be established within 100 to 150 feet of the building requiring protection, depending on the final height of the windbreak. The height of the windbreak will depend on the species selected.

One or more rows of multi-stemmed shrubs planted 50 to 100 feet away from the windbreak on the windward side will significantly reduce snow deposited on the leeward side of the windbreak. This row of shrubs is referred to as a “snow tripper.” It will allow you to move the primary windbreak closer to areas requiring protection because the snow tripper reduces snow drifting or accumulation on the leeward side.

![Figure 11. Cross section of a windbreak showing the minimum distance of the windward row from the object or area to be protected.](image-url)
Soil and Site Relationships

Trees achieve their best growth on specific soils and sites. If they are planted in unfavorable conditions, their growth will be severely retarded and death may occur. Trees subjected to unfavorable growing conditions are more prone to insect and disease attack because they are under constant stress. Special attention should be given to the internal drainage of the soil and to feedlot drainage problems. Some sites may have to be tile drained before any tree planting. Feedlot runoff that passes through a proposed windbreak planting site must be diverted or it will cause severe stunting and rapid death of the trees. Soil moisture conditions should be considered in locating the windbreak, as illustrated in Figures 13 and 14. Refer to Chapter 10 for soil and site recommendations for specific tree species.

Chapter 4. Site Preparation

Good site preparation is imperative for successful windbreak establishment. Proper site preparation will increase the survival rate and the growth rate of trees and shrubs and reduce the competition from grasses and weeds for sunlight, water, space, and nutrients. Where weed competition is severe, a high percentage of trees may die in the first few years. Many surviving trees may be stunted and deformed.

Experience has shown that a landowner will benefit by delaying the planting one year rather than planting into an improperly prepared site. At the end of five years, the planting delayed one year and planted into a properly prepared site will show better growth and vigor than the planting made a year earlier in an improperly prepared site.

Either mechanical or chemical weed control methods can be used in tree plantings. Proper chemical control is more effective and less expensive than mechanical control. However, improper use of herbicides can be hazardous not only to the trees, but also to the user and the environment.

Always select and use herbicides with care and of course, always follow the label directions.

Chemicals that control weeds for a full growing season will eliminate hand labor or the need for special equipment. However, no single weed-killing chemicals will kill all annual weeds and grasses as well as perennial weeds without injuring or killing young trees. Therefore, if chemical weed control is chosen, select the herbicide(s) best suited to the current and future conditions in the area based on the kind and density of weeds present.

Several methods or a combination of methods, both mechanical and chemical, can be used for good site preparation.

One method is to destroy existing vegetation on the entire windbreak area by cultivation. This is most successful during the late summer in anticipation of spring planting. Wet conditions often prevent cultivation in the spring, and it is usually harder to kill vegetation in the spring. If erosion is a potential problem, a cover crop can be sown in the
Chapter 5. Storage of Planting Stock

Many windbreaks never develop because the planting stock dies the first year. In all likelihood, the stock probably was dead before it was planted. The early success or failure of a windbreak is reflected in the care the stock receives prior to planting.

Most nurseries ship bare-rooted seedlings in a cardboard container lined with plastic. Some still use an open-ended crate lined with wet moss to keep the roots from drying out during shipping, but this method is becoming less common. Nurseries will request a shipping date when you order your windbreak stock. If your shipping date is early in the spring, the trees may be packaged and sent the same day they are lifted from the nursery bed. If you request a later shipping date, they may be held in cold storage. Either way, the stock is vulnerable to extreme heat build-up in the shipping container. The seedlings must be promptly removed from the shipping container, immediately dipped in a bucket of water, and rewrapped in moist packing material. If at all possible, seedlings should be planted within three to four days of delivery and preferably the day you receive them.

Any number of circumstances may prohibit you from planting promptly after delivery. The weather can create all sorts of planting troubles in the spring. Sickness or injury also may keep you from planting right away. If planting is delayed, the seedlings should be kept moist and stored in a cool environment out of direct sunlight and wind. If planting is delayed more than one week, the trees should be "heeled in" in a shaded location as shown in Figure 15. This will temporarily protect the seedlings until they can be planted permanently.

![Figure 15. "Heeling in" planting stock.](image)

Larger plants in containers or with balled and burlapped roots also need attention if they cannot be planted immediately. They should be kept moist and cool, out of direct sunlight and wind. Bailed planting stock can be held temporarily by placing soil or sawdust around the entire ball of the tree and keeping it moist.

A windbreak can be a large investment. You should make every effort to improve its chances for survival by storing the planting stock correctly.
Chapter 6. Planting Recommendations

A windbreak can be planted almost any time during the growing season, but to enhance its chances for survival, spring planting is recommended over any other season. Planting at this time of the year ensures that the plant will have one full growing season in which to become established prior to undergoing the rigors of winter. Fall planting would be the next best option. Planting a windbreak during the hot summer months demands the utmost of care, and soil moisture can be critical. Special efforts must be made to keep a newly planted windbreak watered. This can be quite an undertaking for a large farmstead windbreak.

Choosing the Right Planting Stock

Choosing the right planting stock to fit your needs will be another important key to the success or failure of your windbreak. Chapter 3 emphasized the importance of selecting the tree or shrub to the planting site, and Chapter 10 lists many of the important characteristics to consider prior to selecting the trees and shrubs for your windbreak. But this reference cannot cover the merits and drawbacks of every single tree or shrub that might be considered for a windbreak.

When purchasing planting stock, you must select from one of three options: balled and burlapped (B&B) or container-grown stock, transplant material, or seedling stock. Each has its own advantages and disadvantages.

Balled and Burlapped and Container-grown Stock

Of the three options, this is probably the most expensive. Higher labor costs have been invested in this type of planting stock, and they must be recovered by the nursery. All things being equal, you can expect the survival rate to be the highest of the three options. Since the roots are contained in soil, the plant is less susceptible to rapid drying and death. Soil-contained planting stock also will reach its effective height more quickly.

All stock undergoes transplant shock after it is planted. But B&B or container-grown material will respond much more quickly to its new environment because its root system has been disturbed less than that of bare-rooted plants. Faster growth may well build a case for the added cost of this type of material.

The optimum height for B&B windbreak stock is 18 to 24 inches. Larger plants can be used, but the cost increases substantially. The imbalance of the root to the top (foliage) ratio poses greater risk of mortality, and a large ball of soil is very difficult to move and expensive to prepare.

As with any planting stock, it is best to plant soil-contained stock within three to four days of delivery. A tractor-mounted auger large enough to accommodate the soil ball is recommended for windbreaks with more than ten plants. Drill the holes just prior to planting at a depth sufficient to bury the roots to the root collar. In heavy clay soils, the auger may "slick" the sides of the hole. Rough them up slightly with a shovel and remove the loose dirt. This will aid in root penetration.

Prior to placing the tree in the hole, push an inch or two of crumbled soil back into the hole and tamp slightly to minimize settling. Loose soil in the bottom of the hole also aids in good root development. Place the balled plant in the hole taking special care to keep it straight. Remove the twine holding the burlap to the trunk and fold the burlap back into the hole. If you leave it sticking out of the ground after the soil is back-filled, it will act like a wick, sucking valuable moisture away from the roots. A few cuts along the ball with a knife will enhance root penetration through the burlap, which will rot away entirely in a few years.

Transplant Stock

This option is less expensive than the previous one, but you should expect a slower growth response to reach effective height. In most cases, however, transplant stock will reach effective height faster than seedling stock.

The roots of transplant stock must remain moist during planting, so soak them in a bucket of water. Transplants usually have a much larger root system than seedlings and therefore require a larger hole at planting time. A small auger or posthole digger usually is preferred for large plantings.
of twenty or more. Drill the hole deep enough to accommodate the root system. Avoid crowding or bending roots into a "J." This will cause abnormal growth and may result in the eventual death of the plant.

Seedling Stock

Bare-rooted seedlings are the least expensive windbreak option. However, in exchange for the reduced cost, you must be willing to accept higher mortality rates, slower growth rates, and increased maintenance obligations. Seedlings experience planting shock and require two to three years before they achieve acceptable growth rates. Using seedlings thus adds to the length of time it takes the windbreak to reach its effective height. They will also require increased maintenance. Their small size puts them at a disadvantage with grass and weed competition because their limited root systems often cannot compete for moisture. For the seedlings to survive and thrive, the competition must be eliminated or suppressed. This can be done by hand cultivation or through the use of herbicides, as discussed in Chapter 4.

Seedlings can usually be planted with a planting bar or a shovel. Plants with excessive root systems may require root pruning. The goal is to achieve an equal balance between the top (foliage) and the root system. Root pruning also helps control "J" roots. Seedlings should be planted at the same depth that they grew in the nursery, and this depth should be evident on the root collar.

Cultural Practices
Following Planting

It is common practice to make a small doughnut-like depression in the soil around the plant as shown in Figure 16. This helps retain moisture following rain or watering. A mulch also is recommended to protect the roots from excessive drying and to discourage weed and grass competition. Ground corn cobs, wood chips, or shredded hard-wood bark make excellent mulch. The mulch should cover an area approximately 4 feet in diameter and should be 3 to 4 inches thick.

![Figure 16. A doughnut-like mound of soil and mulch around a tree to aid in water retention and to suppress weed competition.](image)

Each plant should receive at least 5 gallons of water immediately following planting. Fertilizer is not necessary unless the soil is particularly poor in nutrients. Remember that fertilization may cause excessive leader development and encourages weed and grass competition.
Chapter 7. Windbreak Design Options

The ultimate design of a windbreak will reflect the homeowner's reasons or purpose for establishing it. If energy conservation is the only consideration, three rows of evergreens or two rows of evergreens and one row of dense shrubs will suffice. If, on the other hand, the homeowner wants to encourage wildlife and enhance the beauty of the home's landscaping, additional rows of shrubs might be considered. The finished design is a compromise between the homeowner's desires and the physical layout of the property on which it is planted, including the structures.

Shape

The shape of the windbreak reflects its purpose and its site. If space is limited, a straight or angular windbreak will most likely be chosen. However, if creating wildlife habitat and enhancing the landscape are important, then variations of the three-row, angular windbreak should be considered. Curved edges and variations in color and texture tend to break up the harshness of a single-species windbreak. A curved row will produce more edge effect, which is important to wildlife.

Similarly, the use of more than one tree species creates diversity that will attract wildlife and add color and texture as well. No iron-clad rule says that the windbreak must be a straight line. The design is totally dependent on the farmstead or homesite and the willingness of the landowner to take ground out of other uses. For most farmers, establishing a windbreak will mean giving up some agricultural land. The amount depends on the layout of the farmstead buildings and on the need to keep the field as rectangular as possible to minimize equipment maneuvering problems.

Number of Rows

For maximum energy conservation, three rows of conifers are recommended. Studies have shown that a conifer or evergreen windbreak of two rows is nearly optimum for efficiency. However, if individual trees in either row die, leaving only a single row to break the wind, the effectiveness drops dramatically. One row of trees is better than nothing if space is limited, but for maximum protection, three rows are recommended.

Additional rows may be added if the landowner wishes to improve habitat for wildlife or beautify the farmstead or homesite. For beautification, consider using flowering fruit trees and shrub species on the leeward side of the windbreak. For a complete list of suitable species, refer to Chapter 10. The homeowner should realize, however, that adding additional rows above the two or three rows of conifers will require additional space. This will move the windbreak further into the field or take up more lawn area. In certain situations, the additional rows may shift the primary windbreak past the optimum distance for building protection. Again, a compromise must be achieved.

An extra row of multi-stemmed shrubs planted approximately 100 feet on the windward side of the windbreak will significantly reduce the amount of snow that accumulates on the leeward side. This “snow tripper” row will allow you to move the primary windbreak as close as 50 feet to buildings requiring protection because of reduced snow accumulation on the leeward side.

Spacing

Conifer or evergreen windbreaks require at least 16 feet between rows and between trees within a row. If eastern redcedar or arborvitae is used, the spacing may be reduced to 4 to 8 feet. A noticeable effect will be realized by the time the trees are 8 to 10 feet tall. The windbreak may close in faster if they are spaced at 8 x 8 feet but this will encourage increased shading and earlier death of the lower branches. The windbreak will then open up near the ground and a wind tunnel effect will result. Windbreaks whose trees are spaced closer than 16 feet should be thinned to allow the remaining trees more room to expand and develop fully (Figure 17). If shrub rows are used, they should be spaced 4 to 6 feet apart within the row, and spacing between the rows should remain at 16 feet.

In a three-row windbreak, the spacing of the inside and outside rows of trees should be identical. The middle row of trees should be staggered or offset by 8 feet as shown in Figure 18. This equilateral spacing allows maximum growth space for each tree and helps to “tighten up” the windbreak more quickly.
Spacing and Layout

In designing the windbreak, each leg should be considered as a separate unit. The spacing within each unit should remain the same. When an angle or corner is encountered, special spacing will be required to seal it effectively from wind penetration. Follow the corner spacing guides shown in Figure 20. If angles other than 90 degrees are encountered, adjust the tree spacing slightly. Curved rows will also require special spacing, but keep it as close to 16 feet as possible. The scale drawing of the farmstead or homesite made during the initial planning stage should show the location of each tree. This simplifies the layout and planting in the spring.

Species

Species selection will also reflect the landowner's purpose for establishing the windbreak. Energy conservation requires the use of dense vegetation, most likely coniferous species. Windbreaks should be 75 to 80 percent dense for best protection. The minimum density for an effective farmstead windbreak is 65 percent. Species with a high density rating, such as spruce, fir, and arborvitae, have densities of 90 percent. Two rows should provide sufficient density, but an additional row is recommended to help fill any gaps that might occur between trees.

Pines have a different branching pattern than the spruces or firs. During their early development, pines tend to be compact and provide a density of approximately 85 percent. However, as they increase in age, the branches begin to thin out and density drops to 40 to 65 percent.

It is not a good idea to plant the entire windbreak to one species. Monocultures can encounter serious problems with disease and insect pests, and they lack variety in texture and color. On the other hand, trees of the same species and growth habits should be planted within the same row. This will minimize shading problems for trees that do not grow as quickly as their neighbors in adjoining rows.
Figure 19. Rapid closure variation with tighter spacing in the windward row.

Figure 20. Corner spacing requirements between legs A and B for 16-foot spacing in a two-legged windbreak.
Chapter 8. Windbreak Designs to Benefit Wildlife

You can attract songbirds and other wildlife to your windbreak and even discourage pest species by taking a few special considerations in the design stage. Windbreaks are valuable additions to wildlife habitat in regions of intensive agriculture. Although many species of wildlife will benefit from windbreaks, not all of them will be conspicuous. Some species are nocturnal and some are secretive. A good design and a well-placed bird feeder will bring many species into view.

The single most important variable influencing the use of a windbreak by wildlife is its size. The windbreak will be used by more wildlife in direct proportion to its length and width, that is, the number of rows and their length.

Multiple rows of evergreen trees bordered by rows of shorter trees and shrubs will attract more species of wildlife than evergreen trees alone without a shrub border.

Wildlife numbers will also increase if cover is provided. The combination of conifers and deciduous shrubs will provide adequate cover and food at different seasons. For maximum wildlife benefits, a combination of two or three rows of conifers plus inside and outside rows of deciduous shrubs are recommended. The shrub rows should be separated from the conifer rows by at least 16 feet to minimize crowding and to allow adequate space for mowing and maintenance. At least four different species of shrubs that are attractive to wildlife are recommended for the two outer rows.

A diversity of shrub and evergreen species will attract more wildlife than will monotypic rows of single species. Species diversity also provides structural diversity, which is a desirable feature for attracting different kinds of birds (Figure 21). Additionally, various species produce fruit at different times of the year, providing modest amounts of food over an extended period of time. Where windbreaks are composed of just one or two species, the fruit comes on at one time and cannot be fully utilized by resident wildlife, or it may attract undesirable concentrations of migrating birds for brief periods in the fall. A diversity of tree and shrub species will also reduce the impact of insect or disease problems in the windbreak.

For maximum wildlife benefits, at least four different species of conifers should be used with particular attention to their growth rates. Species with similar growth rates should be planted together to avoid excessive competition from a fast-growing species. Avoid those conifers that are alternate hosts for disease and insect problems. Figure 22 shows a windbreak designed for maximum wildlife benefits.

Species known to be good for attracting nesting birds include spruce, pine, arrowwood, and hawthorn. Some studies have shown that many song-

Figure 21. Cross sections of two three-row windbreaks. The windbreak at left shows little diversity in structure or species and will be utilized by only a few types of wildlife. The windbreak at right has greater diversity and will attract a greater variety of wildlife. It will also be more resistant to severe insect and disease problems.
birds avoid Douglas fir for nesting sites. Species with favored fruits are listed in Table 2. More detailed descriptions of all these plants can be found in Chapter 10.

![Figure 22. Windbreak designed to improve wildlife habitat. The inside rows are conifers, and the outside rows are shrub species.](image)

### Table 2. Windbreak Plants that Provide Desirable Wildlife Foods

<table>
<thead>
<tr>
<th>Species number</th>
<th>Common name/scientific name</th>
<th>Month of fruit</th>
<th>Drainage tolerance</th>
<th>Shade tolerance</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Alternate leaf dogwood <em>Cornus alternifolia</em></td>
<td>8 to 9</td>
<td>M-S</td>
<td>FS-PS</td>
</tr>
<tr>
<td>2</td>
<td>American plum <em>Pruas americana</em></td>
<td>8 to 10</td>
<td>D-M</td>
<td>FS</td>
</tr>
<tr>
<td>4</td>
<td>Black chokeberry <em>Aronia melanocarpa</em></td>
<td>8 to 11</td>
<td>D-M</td>
<td>FS</td>
</tr>
<tr>
<td>5</td>
<td>Black haw <em>Viburnum prunifolium</em></td>
<td>8 to 11</td>
<td>W-S</td>
<td>FS-PS</td>
</tr>
<tr>
<td>7</td>
<td>Chokecherry <em>Pruas virginiana</em></td>
<td>7 to 10</td>
<td>D-M</td>
<td>FS</td>
</tr>
<tr>
<td>8</td>
<td>Cock's-spur hawthorn <em>Crataeogus crus-galli</em></td>
<td>8 to 2</td>
<td>M-P</td>
<td>FS</td>
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<td>12</td>
<td>Downy arrowwood <em>Viburnum refinesquianum</em></td>
<td>8 to 11</td>
<td>M-P</td>
<td>FS-PS</td>
</tr>
<tr>
<td>Species number</td>
<td>Common name/scientific name</td>
<td>Month of fruit</td>
<td>Drainage tolerance</td>
<td>Shade tolerance</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------</td>
<td>----------------</td>
<td>--------------------</td>
<td>-----------------</td>
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<td>13</td>
<td>Gray dogwood&lt;br&gt;&lt;em&gt;Cornus racemosa&lt;/em&gt;</td>
<td>7 to 10</td>
<td>D-S</td>
<td>FS</td>
</tr>
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<td>14</td>
<td>Hazelnut&lt;br&gt;&lt;em&gt;Corylus americana&lt;/em&gt;</td>
<td>7 to 10</td>
<td>D-M</td>
<td>FS-PS</td>
</tr>
<tr>
<td>15</td>
<td>Highbush cranberry&lt;br&gt;&lt;em&gt;Viburnum trilobum&lt;/em&gt;</td>
<td>8 to 3</td>
<td>W-S</td>
<td>FS-PS</td>
</tr>
<tr>
<td>16</td>
<td>Iowa crab&lt;br&gt;&lt;em&gt;Malus ioensis&lt;/em&gt;</td>
<td>9 to 10</td>
<td>W-S</td>
<td>FS</td>
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<td>17</td>
<td>Maple-leaved arrowwood&lt;br&gt;&lt;em&gt;Viburnum acerifolium&lt;/em&gt;</td>
<td>8 to 12</td>
<td>D-M</td>
<td>FS-PS</td>
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<td>18</td>
<td>Snowberry&lt;br&gt;&lt;em&gt;Viburnum lentago&lt;/em&gt;</td>
<td>8 to 10</td>
<td>W-S</td>
<td>FS-PS</td>
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<td>20</td>
<td>Redcedar, Eastern&lt;br&gt;&lt;em&gt;Juniperus virginiana&lt;/em&gt;</td>
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<td>D-S</td>
<td>FS</td>
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<td>21</td>
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<td>FS</td>
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<td>22</td>
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<td>M-P</td>
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<td>23</td>
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<td>24</td>
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<td>6 to 8</td>
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<td>FS</td>
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<td>25</td>
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<td>26</td>
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<td>M-S</td>
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<tr>
<td>27</td>
<td>Southern arrowwood&lt;br&gt;&lt;em&gt;Viburnum dentatum&lt;/em&gt;</td>
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<td>S-P</td>
<td>FS-PS</td>
</tr>
<tr>
<td>28</td>
<td>Southern blackhaw&lt;br&gt;&lt;em&gt;Viburnum rufidulum&lt;/em&gt;</td>
<td>8 to 11</td>
<td>M-S</td>
<td>FS-PS</td>
</tr>
<tr>
<td>30</td>
<td>Washington hawthorn&lt;br&gt;&lt;em&gt;Crataegus phaenopyrum&lt;/em&gt;</td>
<td>9 to 12</td>
<td>M-P</td>
<td>FS</td>
</tr>
</tbody>
</table>

1Species code numbers correspond to those used in Chapter 10.
2Drainage tolerance refers to internal soil drainage class: D = droughty; W = well drained; M = moderately well drained; S = somewhat poorly drained; and P = poorly drained.
3Shade tolerance refers to sunlight. Plants requiring full sun will do best in the south and west rows, and those requiring partial shade will do best in rows on the north side of the windbreak. FS = full sun, and PS = partial shade.
Curvilinear rows will provide more edge habitat than will straight rows, as well as improved visual quality. Clump plantings of flowering shrubs can be made at strategic points along the edges, adding visual appeal and increasing plant species diversity for wildlife.

Row configuration also influences wildlife use of the windbreak. As the row complexity increases with snow trappers, variable spacing, and curvilinear design, the habitat quality also improves (Figure 23). Nest boxes, den boxes, bird feeders, and food plots will quickly encourage wildlife to use the windbreak.

The Illinois landowner with a very keen interest in attracting wildlife and who has space available for additional rows beyond a three-row windbreak, that is, one row of shrubs and two rows of evergreens, may wish to consider the following. If you have room for a fourth row, assuming 16 feet per additional row, your best bet will be another row of shrubs on either the windward or the leeward side of the evergreens. If you have room for additional rows, you may wish to consider adding pin oak, green ash, or hackberry. These alternatives are suggested in addition to the minimum three-row windbreak and are not intended to replace it. Figure 24 shows a simple farmstead windbreak designed for multiple purposes that incorporates a number of these options.

Figure 23. Windbreak with curvilinear rows, clump plantings, complex row configurations, and species diversity to enhance wildlife habitat.

Figure 24. Multipurpose farmstead windbreak, attractively landscaped and designed to attract wildlife.

Mowing and cultivation within the windbreak should be discontinued after the windbreak has become established. The natural succession of understory plants, such as gooseberry, raspberry, coralberry, black haw, and other shrubs, as well as grasses and forbs, increases the richness of wildlife habitat without harming the windbreak and without being conspicuously visible from the outside.
Chapter 9. Protection, Care, and Maintenance

A farmstead windbreak is a sizable investment in labor, time, and capital. Obligations do not cease after the windbreak has been planted: a neglected windbreak will suffer and may eventually die. A number of cultural practices will keep a windbreak healthy and growing vigorously. They include controlling competing vegetation and insect and disease outbreaks, protecting the trees and shrubs from livestock grazing, corrective pruning, fertilizing, and replanting or renovating the windbreak as necessary.

Controlling Competing Vegetation

Weed and grass competition must be controlled in a newly planted windbreak. As discussed earlier, weed and grass control can be accomplished through the use of herbicides, manual cultivation, or a combination of both. Place a good mulch around trees and shrubs immediately after planting and maintain it until the lower branches of the plants cover and shade the mulched area. Mulch reduces weed competition around the tree and helps to retain soil moisture during periods of dry weather. The mulch should cover an area approximately 4 feet in diameter and should be at least 3 to 4 inches thick. As the mulch begins to break down, weed seed may begin to sprout in it. Add more mulch to each tree or shrub annually until the windbreak has reached five years of age.

Keep the mulch and the grass 3 to 4 inches away from the stem of the tree or shrub to control mouse damage. If the mulch is tight against the trunk or if grass is allowed to build up, a protected habitat has been created for mice, and they are more apt to chew on the bark of the trees.

Protection Against Livestock Damage

Farm animals that are allowed to graze in the windbreak can severely damage or kill the trees and shrubs. A suitable fence should be constructed to keep livestock away. At least 7 feet should separate the windbreak from the grazing area. This will keep livestock from leaning over the fence and grazing on the trees and shrubs. A fence also will help control compaction of the ground within the windbreak.

Wild animals, particularly rabbits and mice, are more difficult to control because fences do not deter them. Rabbit damage can be reduced by using chemical repellents or by providing the rabbits with another food source away from the trees and shrubs during periods of heavy snowfall. Deer may also be discouraged with repellents.

Insect and Disease Control

Insects and disease are the major enemies of a windbreak. A watchful eye is always necessary. Insects or diseases do not usually attack a healthy, vigorously growing windbreak, but trees under stress are very vulnerable. The species factsheets in Chapter 10 indicate some of the major insects and diseases that attack individual windbreak species.

Corrective Pruning

Branches may be damaged occasionally by ice, wind, animal grazing, or birds. When the central leader of a conifer is damaged, the lateral branches assume the role of the central leader and begin to grow upward. If left to grow, a double leader will develop. This creates a weak spot in the trunk as the tree matures. One of the double leaders should be removed with a pair of hand clippers or a pruning saw so that the straightest and fastest growing one can assume the role of the central stem. Broken branches or branches with large wounds should be removed.
Fertilizing

Fertilizing is not generally recommended unless the growth of individual plants falls behind the rest of the windbreak. Fertilization encourages rapid growth height, which leads to large, weak leaders and reduced density. If fertilization is necessary, it is usually due to lack of nitrogen. For specific information, refer to Illinois Natural History Survey Circular 52, *Fertilizing and Watering Trees*.

Replanting and Renovation

A windbreak will not last forever. The effective life for most Illinois windbreaks will be 40 to 50 years. Once the trees mature, their health will slowly decline and the lower branches will die. A good renovation plan should be developed prior to the decline of the existing windbreak.

Chapter 10. Windbreak Species for Specific Soils

This section is intended to be used to match a suitable species to site conditions. Several factors are considered in Table 3, "Quick Reference Factsheet." The first two are most important: the species' hardiness and their suitability for different kinds of soils. If a given species is not rated for use in a particular hardiness zone or windbreak planting group, then a different, more suitable species should be selected. The 20-year height for suitable planting groups indicates growth rate, which can be important in choosing species.

Other values rated in Table 3 are the species' usefulness for wildlife, both for nesting and food, and their potential landscape value. Densities from ground level to a height of 6 feet are also noted. Density is important for determining a species' capability to serve as a snow tripper.
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<table>
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<tr>
<th>Number</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Food nesting</th>
<th>Landscape value</th>
<th>Density (0-6' above ground level)</th>
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<td>15</td>
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Table 3, Footnotes

1 Refer to Figure 25, "Illinois Plant Hardiness Zones." N = north, C = central, and S = south.
2 See "Windbreak Planting Groups" below. A blank spot in a column indicates that a species is not recommended for that windbreak planting group. L = high lime content with pH > 7.4 within 20 inches of surface; O = high organic material; C = clayey throughout; F = fragipans with slow permeability; G = sandy or gravelly within 40 inches of surface; and R = bedrock within 20 to 40 inches of surface.
3 G = good, F = fair, and P = poor.
4 D = dense, M = medium, O = open. This density rating refers to the lowest 6 feet of plant growth. This area is important for determining the plant's effectiveness as a snow tripper. Those plants with a medium rating will provide adequate density if planted closer together or in two rows.
5 Tends to open up with age.
6 Their 2-inch thorns can seriously injure small children.

Windbreak Planting Groups for Correlated Soil Series in Illinois
(From Soil Conservation Service Technical Guide)

This planting grouping system is a guide for selecting tree and shrub species best suited for different kinds of soils for field and farmstead windbreaks.

All soils mapped in Illinois have been placed in one of ten groups. The groups are discussed according to plant hardiness zones. Groups 1, 2, 3, 4, and 6 are further divided into subgroups according to the following characteristics:

- L = High lime content; pH > 7.4 within 20 inches of surface
- O = High organic material
- C = Clayey throughout
- F = Fragipans with slow permeability
- G = Sandy or gravelly within 40 inches of surface
- R = Bedrock within 20 to 40 inches of surface

Be sure that the soil subgroups and the proper plant hardiness zones are considered when evaluating the suitability and performance of various species. To determine the proper plant hardiness zone, refer to Figure 25, "Illinois Plant Hardiness Zones."

Windbreak Group 1

WG-1. Soils in this group are well suited to all climatically adapted species except those that may be affected by excess moisture. These soils may be somewhat poorly drained with a water table at 1 to 3 feet in the spring, or they may be subject to flooding. Permeability is moderately slow to rapid. They lack free carbonates at or near the surface. Windbreak sites are adequately drained for corn and soybean production.

Subgroup WG-1(L). Soils in this group are well suited to all climatically adapted species except those that may be affected by excess moisture and high lime content. These soils may be somewhat poorly drained with a water table at 1 to 3 feet in the spring, or they may be subject to flooding. Permeability is moderately slow to rapid. They have a pH greater than 7.4 within 20 inches of the surface or free carbonates at or near the surface. Windbreak sites are adequately drained for corn and soybean production.
Windbreak Group 2

WG-2. If artificially drained, soils in this group are well suited to all climatically adapted species. These soils may be poorly drained with slow to rapid permeability or somewhat poorly drained with slow permeability. Runoff is slow to ponded. Some of these soils may be subject to frequent flooding. They lack free carbonates at or near the surface. Windbreak sites are adequately drained for corn and soybean production.

Subgroup WG-2(L). If artificially drained, soils in this group are well suited to all climatically adapted species, except those affected by excess lime. These soils are poorly drained with slow to rapid permeability or somewhat poorly drained with slow permeability. Runoff is slow to ponded. Some of these soils may be subject to frequent flooding. They have a pH of 7.4 within 20 inches of the surface or free carbonates at or near the surface. Windbreak sites are adequately drained for corn and soybean production.

Subgroup WG-2(O). If artificially drained, soils in this group are well suited to all climatically adapted species, except those affected by very high organic matter. These organic soils are poorly drained, and runoff is slow to ponded. Some of them may be subject to frequent flooding, and they lack free carbonates at or near the surface. Windbreak sites are adequately drained for corn and soybean production.

Windbreak Group 3

WG-3. Soils in this group are well suited to all climatically adapted species. The soils are moderately well drained or well drained. They are loamy or silty and have a high available water-holding capacity.

Subgroup WG-3(L). Soils in this group are well suited to all climatically adapted species. They are moderately well drained or well drained. They are loamy or silty and have a high available water-holding capacity. They have a pH of 7.4 within 20 inches of the surface.

Windbreak Group 4

WG-4(L)(F). Soils in this group are suited to most climatically adapted species, except those that have a high moisture requirement. They have clay subsoils or fragipans with slow or very slow permeability. The available water-holding capacity is moderate to low.

Subgroup WG-4(C). Soils in this group are poorly suited to most climatically adapted species. A few species are adapted but their growth rate is slow. These soils are clayey throughout and have free carbonates at or near the surface. The available water-holding capacity is low.

Windbreak Group 5

WG-5. Soils in this group are well suited to all climatically adapted species, except those that have a high moisture requirement. They are loam and sandy loam soils that have a moderate available water-holding capacity.

Windbreak Group 6

WG-6(G)(B). Soils in this group are suited to most climatically adapted species, except those that have a high moisture requirement. These soils have sand, gravel, or both, or bedrock within 20 to 40 inches of the surface. They have low to moderate available water-holding capacity.

Windbreak Group 7

WG-7. Soils in this group are suited to most of the climatically adapted species, except those that have a high moisture requirement. They are sandy loam or sands and have a low to moderate available water-holding capacity.
Windbreak Group 8

WG-8. Soils in this group are poorly suited to most climatically adapted species, except those that have high moisture requirements. They are sandy loam or sands and have a low to moderate available water-holding capacity.

Windbreak Group 9

WG-9. Soils in this group are poorly suited to most climatically adapted species. They are high in sodium and moderately well to poorly drained. Windbreaks are adequately drained for corn and soybean production.

Windbreak Group 10

WG-10. Soils in this group are generally unsuited to most climatically adapted species. They are shallow to bedrock, which is usually less than 20 inches from the surface, or they have a high percentage of coarse fragments.

Figure 25. Plant hardiness zones in Illinois. South, central, and northern zones are based on plant growth factors such as temperatures from January to July, the number of frost-free days, and annual rainfall.
<table>
<thead>
<tr>
<th>Soil series</th>
<th>Soil series number</th>
<th>Soil series number</th>
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<th>Windbreak planting group</th>
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Species Factsheets

The following factsheets contain specific information on those species being recommended for use in windbreak plantings in Illinois. Each of the species is listed in Table 5 and in the factsheets in alphabetical order by common name and according to its species code number. The table serves as an index to the recommended species.

Table 5. Species Codes

<table>
<thead>
<tr>
<th>Species code number</th>
<th>Common name</th>
<th>Latin name</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Alternate leaf dogwood</td>
<td>Cornus alternifolia</td>
</tr>
<tr>
<td>2</td>
<td>American plum</td>
<td>Prunus americana</td>
</tr>
<tr>
<td>3</td>
<td>American yew</td>
<td>Taxus canadensis</td>
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<tr>
<td>4</td>
<td>Black chokeberry</td>
<td>Aronia melanocarpa</td>
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<td>5</td>
<td>Black haw</td>
<td>Viburnum prunifolium</td>
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<td>Blue spruce</td>
<td>Picea pungens</td>
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<td>7</td>
<td>Chokecherry</td>
<td>Prunus virginiana</td>
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<td>8</td>
<td>Cock’s-spur hawthorn</td>
<td>Crataegus crus-galli</td>
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<td>Common juniper</td>
<td>Juniperus communis</td>
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<td>Coralberry</td>
<td>Symphoricarpos orbiculatus</td>
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<td>11</td>
<td>Douglas-fir</td>
<td>Pseudotsuga menziesii</td>
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<tr>
<td>12</td>
<td>Downy arrowwood</td>
<td>Viburnum rafinesquianum</td>
</tr>
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<td>13</td>
<td>Gray dogwood</td>
<td>Cornus racemosa</td>
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<td>Hazelnut</td>
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<td>Highbush cranberry</td>
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<td>Iowa crab</td>
<td>Malus ioensis</td>
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<td>Maple-leaved arrowwood</td>
<td>Viburnum acerifolium</td>
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<td>Nannyberry</td>
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<td>19</td>
<td>Norway spruce</td>
<td>Picea abies</td>
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<td>Redcedar, Eastern</td>
<td>Juniperus virginiana</td>
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<td>Red haw</td>
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<td>Red-osier dogwood</td>
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<td>Rough-leaf dogwood</td>
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<td>Shadbush</td>
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<td>Silky dogwood</td>
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<td>Smooth arrowwood</td>
<td>Viburnum recognitum</td>
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<td>Southern arrowwood</td>
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<td>White-cedar, Northern</td>
<td>Thuja occidentalis</td>
</tr>
<tr>
<td>32</td>
<td>White pine</td>
<td>Pinus strobus</td>
</tr>
<tr>
<td>33</td>
<td>Witch hazel</td>
<td>Hamamelis virginiana</td>
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</table>
Alternate Leaf Dogwood (Cornus alternifolia)
Species code number 1

General description: A handsome, large shrub or shrubby tree with broad, graceful branches; moderate growth rate after initial establishment.

Mature height: 15 to 25 feet; spread 15 to 30 feet.

Flowers: Creamy white on loose half-circle clusters, 1 1/2 to 2 1/2 inches in diameter; May and June.

Fruit: Blue-black, fleshy, single-seeded, 1/4 to 1/3 inch in diameter; abundant July to September.

Natural habitat: Rich, steep, wooded slopes and bluffs and wooded banks of streams.

Soil suitability: Performs best on well drained or moderately well drained soils.

Shade tolerance: Intermediate to tolerant.

Range in Illinois: Statewide.

Planting range: Throughout Illinois, but may require some shading in southern portions of state.

Insect and disease problems: Twig blight disease may be a problem in some localities, particularly out of its natural range. Plants are susceptible to scale insects, borers, and leaf miners.

Use by wildlife: Fruits eaten by songbirds, including bluebirds, cardinals, and warbling vireos. Twigs browsed by deer and rabbits.

Spacing: 10 feet within row; 16 feet between rows.
American Plum (*Prunus americana*)
Species code number 2

**General description:** A shrub or small tree with a spreading crown, often forming thickets. Moderately slow growing.

**Mature height:** Usually 8 to 15 feet, but may reach as much as 20 to 30 feet; spread 10 to 15 feet.

**Flowers:** White in small showy clusters of 2 to 4 flowers, each 1 inch in diameter; appear before the leaves; April to May.

**Fruit:** Round or nearly so, up to 1 inch in diameter, red with a whitish waxy covering; August and September.

**Natural habitat:** Roadsides, thickets, and open woods.

**Soil suitability:** Performs well on a wide variety of soil conditions from excessively well drained to somewhat poorly drained.

**Shade tolerance:** Intolerant to intermediate.

**Range in Illinois:** Statewide.

**Planting range:** Statewide.

**Insect and disease problems:** The Eastern tent caterpillar may use the American plum, defoliating portions of the tree; damage can be reduced by clipping and destroying the tents at night when the caterpillars are in them. Some wood-boring insects may also cause slight problems with the American plum.

**Use by wildlife:** Fruits are eaten by mammals such as raccoons, woodchucks, and squirrels.

**Spacing:** 15 feet within row; 16 feet between rows.
American Yew (*Taxus canadensis*)
Species code number 3

**General description:** Shrub with spreading horizontal branches, evergreen dark green foliage, slow to moderate growth, very hardy.

**Mature height:** 3 to 6 feet; spread 6 to 8 feet.

**Flowers:** Both male and female cones on the same shrub; small cones form in the axils of the branches; April and May.

**Fruit:** A red cup-like sac with a whitish, waxy covering, 1/3 inch in diameter. Brown nutlet exposed at the lower end; July and August.

**Natural habitat:** Wooded northfacing hillsides, usually associated with limestone cliffs.

**Soil suitability:** Performs well on somewhat well drained soils to somewhat poorly drained soils.

**Shade tolerance:** Intermediate to tolerant.

**Range in Illinois:** Northern third of the State.

**Planting range:** Planted statewide.

**Insect and disease problems:** Needle blight, twig blight, Armillaria root rot, Phytophthora and Pythium root (causing die-back), black vine weevil, mealy bugs, scale, and Taxus bud mite.

**Use by wildlife:** Fruits eaten by pheasants, cedar waxwings, robins, blue jays, and squirrels.

**Spacing:** 5 to 6 feet within row; 16 feet between rows.

**Special landscaping note:** Twig browning often caused by snow and low temperatures.
Black Chokeberry (Aronia melanocarpa)
Species code number 4

General description: A loose, erect, open shrub with slender stems; a moderate grower noted for its handsomely colored fall foliage.

Mature height: 3 to 6 feet, rarely to 10 feet; spread 3 to 4 feet; sometimes suckers spread profusely, forming large colonies.

Flowers: Small, white, showy on terminal clusters; clusters 1 to 2 inches in diameter; May and June.

Fruit: Black, lustrous berries; late August and September.

Natural habitat: Low, moist locations in swamps and wet woods; also locally in sandy, wet prairies and on sandstone ledges.

Soil suitability: Performs best on somewhat poorly drained or wet soils; will grow well on any good and moist soil; will tolerate drier or rocky soils if adequate moisture is supplied during the establishment period.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Occasionally in the northeast quarter of the state, also in Johnson, St. Clair, and Saline counties.

Planting range: Statewide.

Insect and disease problems: None known.

Use by wildlife: Fruit used by cedar waxwings, black-capped chickadee, bobwhite, gray catbird, brown thrasher, and eastern meadowlark.

Spacing: 4 feet within row; 16 feet between rows.
Black Haw (*Viburnum prunifolium*)
Species code number 5

General description: A small, hardy tree with rather stout branches; moderate to slow growth rate on moist soils.

Mature height: 10 to 15 feet; spread 8 to 12 feet.

Flowers: Small, white in round-topped clusters, 2 to 4 inches in diameter; April and May.

Fruit: Blue-black, fleshy, single-seeded, 1/2 to 2/3 inch in diameter; August to October.

Natural habitat: Rocky woods, thickets, and roadsides.

Soil suitability: Somewhat well drained to somewhat poorly drained soils. However, it is more drought-tolerant than many viburnums.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Statewide.

Planting range: Statewide.

Insect and disease problems: Four-lined plant bug, dogwood borers, Asiatic weevil, obscure weevil, Japanese beetle, and cottony maple leaf scale.

Use by wildlife: Many species of birds and mammals utilize the fruits. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

Spacing: 6 feet within row; 16 feet between rows.
Blue Spruce (*Picea pungens*)
Species code number 6

General description: A very hardy, broad, dense tree with horizontal, stiff branches; moderate to slow growth rate.

Mature height: 80 to 150 feet; spread 20 to 30 feet. In Illinois, height is only 30 to 60 feet and spread is 10 to 20 feet.

Flowers: Male and female on different branches on the same tree; male are orange pendant spikes; female are greenish or purplish, oblong-round, erect spikes; abundant April to June.

Fruit: Shiny yellow-brown, oblong cones, 2 to 4 inches; abundant September and October.

Natural habitat: Rocky Mountains from Wyoming to New Mexico.

Soil suitability: Performs best on rich, moist soils. However, it will grow well in dry situations if adequate moisture is available during establishment period.

Shade tolerance: Intolerant.

Range in Illinois: Does not occur in Illinois naturally.

Planting range: Planted statewide.

Insect and disease problems: Spruce gall aphids, weevils, *Cytospora* canker, aphids, spruce needle miners, spruce budworm, bagworm.

Use by wildlife: Browsed by deer and rabbits in winter. Provides excellent nesting, roosting, and winter cover for birds.

Spacing: 16 feet within row; 16 feet between rows.
Chokecherry (Prunus virginiana)
Species code number 7

General description: A shrub or small tree up to 30 feet tall with an irregular, rounded top; rapid to moderate growth on moist soils.

Mature height: 20 to 30 feet; spread 10 to 15 feet.

Flowers: White, 1/3 to 1/2 inch in diameter, in long slender clusters 4 to 6 inches long; April to June.

Fruit: Red becoming black, 1/4 to 1/3 inch in diameter; July to September.

Natural habitat: Woods, thickets, along streams and roadsides.

Soil suitability: Performs best on well drained to somewhat well drained soils, but will tolerate most soils, even sand.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Occasional in the north half of the state, rare in the southern half.

Planting range: Statewide.

Insect and disease problems: Fall webworms frequently use this species, making it unsightly; it is mainly detrimental to the beauty of the tree; the nests of the fall webworm can be cut out. The eastern tent caterpillar may also use chokecherry, defoliating portions of the tree; damage can be reduced by clipping and destroying the tents at night when the caterpillars are in them.

Use by wildlife: Fruits eaten by turkey, bobwhite, ring-necked pheasant, common flicker, pileated woodpecker, red-bellied woodpecker, red-headed woodpecker, yellow-bellied sap sucker, hairy woodpecker, downy woodpecker, eastern kingbird, great crested flycatcher, blue jay, common crow, mockingbird, gray catbird, brown thrasher, American robin, wood thrush, hermit thrush, Swainson's thrush, gray-cheeked thrush, veery, eastern bluebird, cedar waxwing, red-eyed vireo, warbling vireo, common grackle, northern oriole, scarlet tanager, summer tanager, northern cardinal, rose-breasted grosbeak, evening grosbeak, pine grosbeak, American goldfinch, rufous-sided towhee, white-crowned sparrow, white-throated sparrow, and song sparrow.

Spacing: 15 feet within row; 16 feet between rows.
Cock's-spur Hawthorn (Crataegus crus-galli)
Species code number 8

General description: A small, broadly rounded tree with stiff, broad, spreading, thorny branches; moderately slow growth rate.

Mature height: 20 to 30 feet.

Flowers: White, showy clusters, 1/2 to 3/4 inch in diameter; May and June.

Fruit: Red, fleshy, 1/4 to 1/2 inch in diameter; occur late summer, persisting most of the winter.

Natural habitat: Wooded slopes, thickets, and open field borders.

Soil suitability: Performs best on well drained soils, very tolerant to dry situations if adequate moisture is available during establishment period.

Shade tolerance: Intolerant.

Range in Illinois: Statewide.

Planting range: Statewide.

Insect and disease problems: Hawthorns can be very susceptible to blights and rusts if planted near junipers.

Use by wildlife: The flowers, leaves, and fruits provide for the needs of many species of wildlife.

Spacing: 16 feet within row; 16 feet between rows.
Common Juniper (Juniperus communis)
Species code number 9

General description: A medium height evergreen tree, usually with ascending or spreading branches. Sometimes found as a sprawling shrub. Plants are gray-green in color.

Mature height: 5 to 10 feet, occasionally reaching 15 feet; spread 6 to 12 feet.

Flowers: Male and female trees; male flowers small, oval, bright yellow; female flowers small, oval, pale yellow; April and May.

Fruit: Bluish to black, 1/4 to 1/2 inch in diameter, 3-seeded; August and September.

Natural habitat: Sandy soils in open habitats.

Soil suitability: Performs in well drained and somewhat well drained soils.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Restricted to the northeastern corner of Illinois.

Planting range: Throughout Illinois.

Insect and disease problems: Susceptible to rust fungi, bagworms, and spruce spider mite. To avoid rust problems, do not plant with shadbush, apple, hawthorn, or chokeberry.

Spacing: 6 feet within row; 16 feet between rows.
Coralberry (Symphoricarpos orbiculatus)
Species code number 10

General description: A low shrub, often suckering with slender, upright, spreading branches. Rapid to moderate growth on moist soils.

Mature height: 1 to 5 feet; spread 2 to 3 feet.

Flowers: Small, yellow-white, in dense clusters not easily seen; July.

Fruit: About 3/8 inch in diameter, in clusters, purplish-red; September and October.

Natural habitat: Roadsides, open woods, pastured fields.

Soil suitability: Performs best on well drained to somewhat poorly drained soils. Will also grow in dry and rocky soils.

Shade tolerance: Tolerant.

Range in Illinois: Found throughout the state.

Planting range: Statewide.

Insect and disease problems: None known.

Use by wildlife: Fruit used by bobwhite, turkey, ring-necked pheasant, brown thrasher, American robin, wood thrush, hermit thrush, cedar waxwing, warbling vireo, northern cardinal, evening grosbeak, purple finch, and pine grosbeak. The floral nectar is used by ruby-throated hummingbirds.

Spacing: 4 feet within row; 16 feet between rows.
Douglas-fir (Pseudotsuga menziesii)
Species code number 11

**General description:** An open, pyramidal evergreen with straight branches, the lower ones usually dropping, the upper ascending. This tree grows moderately and is hardy.

**Mature height:** 150 to 300 feet; spread 12 to 18 feet. In Illinois 40 to 60 feet; spread 12 to 18 feet.

**Flowers:** Both male and female flowers on the same tree; male flowers are about 3/4 inch long near the crown of the tree; female flowers form at the end of the tips of the crown branches, about 1 1/4 inches long; March and April.

**Fruit:** Seeds released from cones September and October.

**Natural habitat:** Not native to Illinois, often planted for windbreaks, ornamentals, or Christmas trees.

**Soil suitability:** Performs in a variety of soil conditions from well drained to somewhat poorly drained soils.

**Shade tolerance:** Intolerant.

**Range in Illinois:** Does not occur naturally in Illinois.

**Planting range:** Planted statewide.

**Insect and disease problems:** Pine needle scale, Rhabdocline needlecast, Swiss needlecast, bagworms, spruce budworm, Eastern pine shoot borer, Pales weevil, pine spittlebug, Sclerotoditis canker, spruce gallaphid.

**Use by wildlife:** The winged seeds are used by small mammals, and many other species use fir for cover.

**Spacing:** 16 feet within row; 16 feet between rows.
Downy Arrowwood (Viburnum rafinesquianum)
Species code number 12

General description: An attractive shrub with erect branches; moderate growth rate on moist soils.

Mature height: 3 to 6 feet; spread 1 to 3 feet.

Flowers: Small, creamy, in clusters 2 to 4 inches across, May and June.

Fruit: Blue-black, fleshy, single-seeded, 1/5 to 1/4 inch in diameter; August and September.

Natural habitat: Wooded slopes, rocky open woods, bluffs, and thickets along stream margins.

Soil suitability: Performs best on well drained or moderately well drained soils. However, it will grow on wetter or somewhat poorly drained clay soils.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Restricted to the northern half of the state.

Planting range: Throughout Illinois.

Insect and disease problems: Four-lined plant bug, dogwood borers, Asiatic weevils, obscure weevil, Japanese weevil and cottony maple leaf scale.

Use by wildlife: Many species of birds and mammals utilize the fruits, which may persist into the cold season. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

Spacing: 6 feet within row; 16 feet between rows.
Gray Dogwood (*Cornus racemosa*)
Species code number 13

General description: An erect shrub, twigs reddish, soon becoming gray; moderately to fast growing on soils with adequate moisture. Usually forming thickets.

Mature height: 3 to 15 feet; spread 4 to 6 feet.

Flowers: Small, white, on elongated clusters 1 1/2 to 2 inches in diameter; May and June.

Fruit: White, fleshy, single-seeded, 1/6 to 1/5 inch in diameter on reddish stalks; August to October.

Natural habitat: Moist woods, thickets, roadsides, and stream banks.

Soil suitability: Performs best on moderately well drained to somewhat poorly drained soil. However, it will grow well on well drained soils if adequate moisture is available during the establishment period.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Statewide.

Planting range: Statewide.

Insect and disease problems: Susceptible to scale insects, borers, and leaf miners. Plants damaged during transplant may be susceptible to fungal diseases including crown canker and blights.

Use by wildlife: Fruit is eaten by birds including bluebirds, cardinals, and pheasants.

Spacing: 6 feet within row; 16 feet between rows.
Hazelnut (Corylus americana)
Species code number 14

General description: Round-topped, broad-spreading shrub with pendulous branches; moderately fast growing on moist soils.

Mature height: Usually 3 to 8 feet, but may reach 15 feet and spread 5 to 10 feet.

Flowers: Male flowers in catkins 1 1/2 to 3 inches in length; female flowers small starlike tufts; April.

Fruit: Hard-shelled nut 1/2 inch in diameter tightly encased in an involucre; abundance varies yearly; September and October.

Natural habitat: Dry or moist woods and thickets, roadsides.

Soil suitability: Performs best on well drained soils but displays a wide tolerance to soil types if provided with adequate moisture during initial establishment period.

Shade tolerance: Intolerant.

Range in Illinois: Statewide.

Planting range: Statewide.

Insect and disease problems: Blight, crown gall, black knot, caterpillars, and scalea. These pests are not serious threats to the hazelnut but may use the tree as a host.

Use by wildlife: Provides good cover for wildlife. Nuts eaten by turkey, bobwhite, ring-necked pheasant, red-bellied woodpecker, hairy woodpecker, blue jay, fox squirrel, gray squirrel, and chipmunks.

Spacing: 6 feet within row; 16 feet between rows.
Highbush Cranberry (Viburnum trilobum)
Species code number 15

General description: A large, very hardy, broad-spreading shrub that has a moderately rapid growth rate on moist soils.

Mature height: 6 to 12 feet; spread 8 to 12 feet.

Flowers: Small, white, in loose clusters 2 to 4 inches in diameter; May and June.

Fruit: Bright red, fleshy, single-seeded 2/5 to 3/5 inch in diameter; August and September

Natural habitat: Rocky, talus slopes and moist, cool woods.

Soil suitability: Performs best on moderately well drained or well drained soils. However, it will grow well on fragipan soils with slow permeability.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Restricted to northern half of state.

Planting range: Throughout Illinois.

Insect and disease problems: Relatively few: borers, weevils, and scales.

Use by wildlife: Many species of birds and mammals utilize the fruits, which may persist into the cool season. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

Spacing: 6 feet within row; 16 feet between rows.
Iowa Crab (*Malus ioensis*)
Species code number 16

**General description:** A small, hardy tree with spreading crown and ground-sweeping branches.

**Mature height:** 15 to 25 feet; trunk diameter up to 1 foot.

**Flowers:** Showy, white or rose petals, fragrant, 1 1/2 to 2 inches in diameter, occur in clusters; May and June.

**Fruit:** Yellow-green, edible apples, 1 1/2 to 1 3/4 inches in diameter; September and October.

**Natural habitat:** Open woods, thickets, and prairie borders.

**Soil suitability:** Performs best on well drained and moderately well drained porous soils.

**Shade tolerance:** Intolerant to intermediate.

**Range in Illinois:** Statewide.

**Planting range:** Statewide.

**Insect and disease problems:** Susceptible to cedar apple rust. To avoid cedar rust infections, do not plant next to cedar trees.

**Use by wildlife:** The flowers, leaves, and fruits provide for needs of many species of wildlife.

**Spacing:** 16 feet within row; 16 feet between rows.
Maple-leaved Arrowwood (*Viburnum acerifolium*)
Species code number 17

General description: A hardy, small shrub that is moderate to slow growing on soils with adequate moisture.

Mature height: 4 to 6 feet; spread 3 to 4 feet.

Flowers: Small, white, in clusters 1 to 2 inches in diameter; May and June.

Fruit: Purple-black, oval, fleshy, single-seeded, 1/4 to 1/3 inch in diameter; August and September.

Natural habitat: Moist to dry woods.

Soil suitability: Performs best on moist well drained soils. However, it will tolerate some dryness.

Shade tolerance: Tolerant to intermediate.

Range in Illinois: Generally restricted to the northern half of the state.

Planting range: Throughout Illinois.

Insect and disease problems: Susceptible to four-lined plant bug, dogwood borers, Asiatic weevil, Japanese beetle, obscure weevil, and cottony maple leaf scale.

Use by wildlife: Many species of birds and mammals utilize the fruits, which may persist into the cold season. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

Spacing: 6 feet within row, 16 feet between rows.
Nannyberry (Viburnum lentago)
Species code number 18

General description: A small, attractive, hardy tree with arching branches that is moderately to fast growing on soils with adequate moisture.

Mature height: 6 to 15 feet; spread 6 to 10 feet.

Flowers: Small, white, in round-topped clusters, 2 to 4 inches in diameter; May and June.

Fruit: Blue-black, fleshy, single-seeded 1/3 to 1/2 inch in diameter; August to October.

Natural habitat: Moist woods and roadsides.

Soil suitability: Somewhat poorly drained to somewhat moderately well drained soils. However, it is widely adapted to different soils, including dry situations.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Generally restricted to the northern quarter of the state.

Planting range: Throughout Illinois.

Insect and disease problems: Susceptible to woolly aphids, scales, tree hoppers, and sucking plant bugs.

Use by wildlife: Many species of birds and mammals utilize the fruits. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

Spacing: 6 feet within row; 16 feet between rows.
Norway Spruce (*Picea abies*)
Species code number 19

General description: A hardy, lofty tree with a straight trunk and ascending branches, moderately to fast growing on moist soils.

Mature height: 80 to 100 feet to perhaps 150 feet; spread 25 to 35 feet.

Flowers: Male and female on different branches of the same tree; male crimson-purple, round, pendant spikes; female yellowish-green or purple-colored, round erect spikes; abundant April to June.

Fruit: Crimson-colored, slender cones, 5 to 7 inches long; abundant September to November.

Natural habitat: Mountains of northern and central Europe.

Soil suitability: Tolerant for a wide range of soil types on moist sites. However, it should not be planted on hot, dry lands.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Does not occur naturally in Illinois.

Planting range: Planted throughout the state.

Insect and disease problems: Cytospora canker, needle casts, rusts, spruce gall aphid, cooley gall aphid, spruce budworms, pine budworm, scales, spruce needle miner, sawflies, weevils, mites, and bagworms.

Use by wildlife: Nuthatches, pine siskin, cedar waxwing, gray squirrel, red squirrel, chipmunk, and white-tailed deer.

Spacing: 16 feet within row; 16 feet between rows.
Redcedar, Eastern (*Juniperus virginiana*)
Species code number 20

**General description:** A durable, upright tree with a medium-short trunk and slightly spreading branches forming a conical crown; moderate growth rate.

**Mature height:** 40 to 50 feet, rarely 90 feet; spread 8 to 12 feet.

**Flowers:** Male and female on different trees, male in small, narrow yellowish spikes; female in small, ovoid, purplish clusters, occur March to May.

**Fruit:** Dark blue, berry-like, 1/4 inch in diameter, occur September to November.

**Natural habitat:** Open fields, dry woods, cliffs, and roadsides.

**Soil suitability:** Performs best on dry well drained or moderately well drained loamy soils. However, it displays a wide tolerance to soil preference, especially on poor, dry soils.

**Shade tolerance:** Intolerant.

**Range in Illinois:** Statewide.

**Planting range:** Throughout Illinois.

**Insect and disease problems:** Twig blight, needle cast, cedar apple rust, bagworms, mealy bugs, scale, webworms, red cedar bark beetle, mites, aphids, and juniper midge. To avoid rust problems, do not plant with or near apple, hawthorn, shadbush, or chokeberry.

**Use by wildlife:** Fruit used by cedar waxwing, purple finch, bluebird, tree swallow, robin, flicker, catbird, yellow-bellied sapsucker, brown thrasher, and starling.

**Spacing:** 12 feet within row; 16 feet between rows.
Red Haw (Crataegus mollis)
Species code number 21

General description: Medium-sized tree with dense, wide, spreading branches. Sparingly thorny or thornless.

Mature height: Approximately 35 feet.

Flowers: White, 3/4 to 7/8 inch across, many flowered woolly clusters; April.

Fruit: Small, bright red, fleshy, about 1/2 inch in diameter, usually ripening in September.

Natural habitat: Wooded slopes, thickets, and open fields.

Soil suitability: Generally prefers moist or well drained sites, however it displays a wide tolerance for soil preference.

Shade tolerance: Intolerant.

Range in Illinois: Occurs throughout Illinois.

Planting range: Statewide.

Insect and disease problems: Susceptible to tent caterpillar, lace-bugs, and woolly aphid, also subject to leaf blight and eastern red cedar and hawthorn rusts.

Use by wildlife: Special habitat for upland wildlife including woodcocks. Nesting sites for brown thrasher, catbird, robins, bluejay, and mourning dove. Fruit consumed by a number of birds and mammals.

Spacing: 16 feet within row; 16 feet between rows.
Red-osier Dogwood (*Cornus stolonifera*)
Species code number 22

General description: Hardy, upright, round-topped shrub. Twigs are bright red during the winter and early spring months, then fading to bronze-brown once leaf development occurs. Twig pith white. Rather slow growing, forming dense thickets.

Mature height: 8 to 10 feet; spread 6 to 10 feet.

Flowers: White, flat-topped clusters; May and June.

Fruit: White clusters, fruits 1/4 to 3/8 inch in diameter, falling in late summer or early fall.

Natural habitat: Open marshes, pond edges, and wet areas; forms thickets.

Soil suitability: Performs best on somewhat poorly drained or wetter soils. However, it will thrive on well drained soils if adequate water is available during the establishment period.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Scattered throughout the state.

Planting range: Statewide.

Insect and disease problems: Susceptible to scale insects, bag worms, borers, and leaf miners. Plants damaged due to transplant may be infected by fungal diseases including crown canker and blights.

Use by wildlife: Fruit used by songbirds, bobwhite, quail, and pheasant. Twigs eaten by deer, cottontail, and other small mammals.

Spacing: 6 feet within row; 16 feet between rows.
Rough-leaved Dogwood (Cornus drummondii)
Species code number 23

General description: An erect, multi-stemmed shrub, twigs gray or brown, with brown pith in branches older than 1 year. Leaves rough above, whitish below.

Mature height: 3 to 15 feet; spread 5 to 10 feet.

Flowers: Numerous, rough-topped clusters, white; May and June.

Fruit: Round, white berries, 1/6 to 1/4 inch in diameter on bright red stalks; August to October.

Natural habitat: Roadsides, thickets, dry forest edges, prairie borders, and bluffs.

Soil suitability: Performs best on well drained soils or somewhat well drained soils, able to survive droughty conditions.

Shade tolerance: Intolerant.

Range in Illinois: Statewide, somewhat uncommon in the northeastern counties.

Planting range: Statewide.

Insect and disease problems: Susceptible to scale insects, borers, and leaf miners. Damaged planting stock may be infected by fungal diseases including crown canker and blights.

Use by wildlife: Fruits eaten by many songbirds, bobwhite quail, pheasant, and wild turkey.

Spacing: 6 feet within row; 16 feet between rows.
Shadbush (Amelanchier arborea)
Species code number 24

General description: A small to medium, graceful tree with a narrow, rounded crown of many limbs.

Mature height: 20 to 40 feet; spread 10 to 20 feet.

Flowers: Delicate, white, showy blossoms, 3/4 to 1 inch in diameter, in loose clusters; March to May.

Fruit: Rosy, reddish, turning wine-purplish, 1/4 to 1/3 inches in diameter; June and July.

Natural habitat: Steep or rocky open wooded slopes, bluffs and locally on sand dunes.

Soil suitability: Performs best on well drained or moderately well drained soils.

Shade tolerance: Intermediate.

Range in Illinois: Throughout Illinois.

Planting range: Throughout Illinois.

Insect and disease problems: Susceptible to fire-blight, mites, lacewing fly, and scale.

Use by wildlife: Fruits are a prime source of food for many songbirds including the gray catbird, American robin, eastern bluebird, northern oriole, veery, evening grosbeak, cedar waxwing, brown thrasher, American redstart, and common flicker.

Spacing: 16 feet within row; 16 feet between rows.
Silky Dogwood (*Cornus obliqua*)
Species code number 25

General description: A multi-stemmed shrub that is moderate to fast growing on soils with adequate moisture.

Mature height: 6 to 10 feet; spread 6 to 10 feet.

Flowers: Creamy white in flat clusters, 1 1/2 to 2 1/2 inches in diameter; May and June.

Fruit: Blue, fleshy, single-seeded, 1/4 to 3/8 inch in diameter; abundant August to October.

Natural habitat: Low, moist locations, along stream banks, pond edges and swamps. Usually grows in thickets.

Soil suitability: Performs best on somewhat poorly drained or wetter soils. However, it will grow well on well drained soils if adequate water is provided during the establishment period.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Statewide.

Planting range: Statewide.

Insect and disease problems: Susceptible to scale insects, borers, and leaf miners. Damaged planting stock may be susceptible to fungal diseases including crown canker and blight.

Use by wildlife: Used by songbirds, small mammals, and deer.
Smooth Arrowwood (*Viburnum recognitum*)
Species code number 26

General description: A medium, multi-stemmed shrub with erect branches; moderate to rapid growth rate on soils with adequate moisture.

Mature height: 5 to 15 feet; spread 6 to 15 feet.

Flowers: Small, creamy, in clusters 2 to 4 inches across; May and June.

Fruit: Blue-black, fleshy, single-seeded, 1/5 to 1/4 inch diameter; July to September.

Natural habitat: Moist woodlands and along streams.

Soil suitability: Performs best on somewhat poorly drained soils. However, it will grow well on moderately well drained soils if adequate moisture is available during the establishment period.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Scattered throughout the state.

Planting range: Throughout Illinois.

Insect and disease problems: Four-lined plant bug, dogwood borer, Asiatic weevil, obscure weevil, Japanese beetle, and cottony maple leaf scale.

Use by wildlife: Many species of birds and mammals utilize the fruits, which may persist into the cold season. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and mammals.

Spacing: 6 feet within row; 16 feet between rows.
**Southern Arrowwood** (*Viburnum dentatum*)

Species code number 27

**General description:** A large, erect, handsome shrub with broad, spreading and arching branches; moderate to rapid growth rate on soil with adequate moisture.

**Mature height:** 4 to 6 feet, occasionally to 15 feet; spread 6 to 15 feet.

**Flowers:** Small, white, in dense clusters, 2 to 4 inches in diameter; May to June.

**Fruit:** Blue-black, fleshy, single-seeded, oval, 1/5 to 2/5 inch in diameter; July and August.

**Natural habitat:** Low alluvial woods.

**Soil suitability:** A widely adapted shrub to moist and dry soils. However, adequate moisture should be available during establishment period.

**Shade tolerance:** Intolerant to intermediate.

**Range in Illinois:** Restricted to the extreme southern counties of the state.

**Planting range:** Throughout Illinois.

**Insect and disease problems:** Four-lined plant bug, dogwood borers, Asiatic weevil, obscure weevil, Japanese beetle, and cottony maple leaf scale.

**Use by wildlife:** Various species of birds and mammals utilize the fruits, which may persist into the cold season. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

**Spacing:** 6 feet within row; 18 feet between rows.
Southern Black Haw (*Viburnum rufidulum*)
Species code number 28

General description: An attractive small tree with slender branches and a moderate growth rate on moist soils.

Mature height: 15 to 30 feet; spread 20 to 30 feet.

Flowers: Small, creamy-white in round-topped clusters 2 to 4 inches in diameter; July to September.

Fruit: Black-blue, fleshy, single-seeded, 1/2 to 2/3 inch in diameter; July to September.

Natural habitat: Rocky or dry woods, bluffs, ravines, stream banks, and thickets.

Soil suitability: Performs best on well drained or somewhat moderately drained soils. However, it will grow in wetter conditions.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Restricted to southern half of the state, not hardy in northern Illinois.

Planting range: Southern half of Illinois.

Insect and disease problems: Four-lined plant bug, dogwood borers, Asiatic weevils, obscure weevil, Japanese weevil, and cottony maple leaf scale.

Use by wildlife: Many species of birds and mammals utilize the fruits, which may persist into the cold season. Leaves, twigs, and bark used by several mammals. Provides cover and nest sites for birds and small mammals.

Spacing: 6 feet within row; 16 feet between rows.
Swamp Holly (*Ilex verticillata*)
Species code number 29

General description: A hardy, oval, erect shrub that is moderate to slow growing on soils with adequate moisture.

Mature height: 6 to 8 feet; spread 3 to 5 feet.

Flowers: Small, inconspicuous, greenish-white, in clusters, male and female borne separately; September and October.

Fruit: Bright red-scarlet, fleshy, seeded, 1/6 to 1/5 inch in diameter; abundant September and October.

Natural habitat: Swamps and wet woods.

Soil suitability: Performs best on somewhat poorly drained soils or wetter soils. However, it will grow well on rich, well drained, moist soils.

Shade tolerance: Intermediate.

Range in Illinois: Occasional in northeastern counties, rare in southern counties.

Planting range: Throughout Illinois.

Insect and disease problems: None noted.

Use by wildlife: Fruits are prime source of food for birds, including the common flicker, mockingbird, gray catbird, brown thrasher, American robin, bobwhite, veery, and cedar waxwing.

Spacing: 6 feet within row, 16 feet between rows.
Washington Hawthorn (Crataegus phaenopyrum)
Species code number 30

General description: A handsome, small tree with densely compact ovate head of slender, thorny branches; moderate growth rate.

Mature height: 20 to 30 feet.

Flowers: Small, white, 1/2 inch in diameter in larger clusters; May and June.

Fruit: Small, bright-red, fleshy, about 1/4 inch in diameter; occur in the fall and persist all winter.

Natural habitat: Wooded slopes, thickets, and open field borders.

Soil suitability: Performs best on well drained or somewhat well drained soils; however, it displays a wide tolerance for soil preference.

Shade tolerance: Intolerant.

Range in Illinois: Occasional in southern third of the state.

Planting range: Statewide.

Insect and disease problems: Can be very susceptible to blights and rusts and host to a series of pest problems.

Use by wildlife: The flowers, leaves, and fruits provide for needs of many species of wildlife.

Spacing: 16 feet within row; 16 feet between rows.
White-cedar, Northern (*Thuja occidentalis*)
Species code number 31

General description: Moderate height, evergreen, usually conical shape with flat, spread branches. Very hardy.

Mature height: 40 to 60 feet; spread 4 to 10 feet.

Flowers: Both male and female liver-colored flowers on the same tree. Cones usually solitary at the ends of different branches; April and May.

Fruit: Seeds 1/3 to 1/2 inch long, brown, with thin wings, ripening and discharging from the cones in September and October.

Natural habitat: Open woods on cliffs and bluffs, occasionally in bogs.

Soil suitability: Performs on a wide variety of soil conditions from well drained to poorly drained.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Restricted to northeastern Illinois.

Planting range: Throughout Illinois.

Insect and disease problems: Blights, aphids, cedar tree borer, arbor vitae leaf miner, weevil, mealy bugs, scales.

Use by wildlife: Pine siskin, white-tailed deer.

Spacing: 16 feet within row; 16 feet between rows.
White Pine (*Pinus strobus*)
Species code number 32

**General description:** A large, picturesque, flat-topped tree with somewhat pendulous branches; moderate growth on soils with adequate moisture.

**Mature height:** 100 to 150 feet, known to 200 feet; spread 50 to 60 feet.

**Flowers:** Male and female on different branches of the same tree; male, yellow spikes, 1/4 to 1/2 inch, clustered; female pink-purple spikes; May and June.

**Fruit:** Oblong cone, 4 to 8 inches long, tapering, often curved; August and September.

**Natural habitat:** Rich, wooded slopes, ravines, bluffs, sand dunes, and blow-outs.

**Soil suitability:** Performs best on well drained or moderately well drained soils. However, it will grow well on practically all soils in its range if adequate moisture is available during establishment period and there is no hardwood competition.

**Shade tolerance:** Tolerant to intermediate.

**Range in Illinois:** Restricted to northern third of the state.

**Planting range:** Throughout Illinois.

**Insect and disease problems:** Sclerotinia canker, armillaria root rot, pine sawfly, bagworms, scale, aphids, wood borers and bark beetles, pine tussock moth, weevils, or spittlebugs.

**Use by wildlife:** Mourning dove, bobwhite quail, black-capped chickadee, Carolina chickadee, nut hatches, pine siskin, brown thrasher, white-footed mouse, beaver, and white-tailed deer.

**Spacing:** 16 feet within row; 16 feet between rows.
Witch Hazel (*Hamamelis virginiana*)
Species code number 33

General description: A small, hardy tree that is moderately slow growing on soils with adequate moisture.

Mature height: 15 to 20 feet; spread 20 to 25 feet.

Flowers: Small, yellow, in clusters 1/2 to 1/3 inch in diameter; October and November.

Fruit: Brown, hairy, black-seeded capsule 1/4 to 1/2 inch long, occur the following autumn after flowering.

Natural habitat: Rich, wooded ravines and slopes. Frequently found along rocky stream banks with north exposures.

Soil suitability: Performs best on better drained, moist soils. However, it will grow well on dry, stony soils if adequate moisture is provided during the establishment period.

Shade tolerance: Intolerant to intermediate.

Range in Illinois: Occasional in the northern half of the state, occurring less frequently in the southern region.

Planting range: Throughout Illinois.

Insect and disease problems: None noted.

Use by wildlife: The seeds of witch hazel are preferred by bobwhite, cardinals, ring-necked pheasant, and turkey.

Spacing: 6 feet within row; 16 feet between rows.
Appendix A. Directory of Commercial Nurseries and Illinois Department of Conservation State Tree Nurseries

This section provides a reference to some of the commercial nurseries in Illinois that have available one or more of the species recommended for windbreak plantings. The nurseries listed are only those who responded to an Illinois State Nurseriesmen's Association questionnaire sent to their membership. It does not imply that the nurseries in this listing are the only ones in Illinois that have these species available; nor does it imply endorsement by the authors of this manual. The stock carried by each nursery is numbered according to the species codes noted in Table 5, page 35 and they are available in the forms noted in the following stock codes:

- **BB** = Ball and burlap  
- **BR** = Bare root  
- **C** = Containerized  
- **S** = Seedling

### • Anna Nursery
Box 150  
Anna, IL 62906  
618/895-2124

24BB, 32BB

### • Berthold Nursery
434 East Devon Avenue  
Elk Grove Village, IL 60007  
312/439-2600

1BB, 4BB, 5BB, 6BB/C, 7BB, 8BB, 10BB, 11BB, 13BB, 18BB, 19BB, 20BB, 24BB, 27BB/C, 29BB, 30BB, 31BB, 32BB, 33BB

### • Boehm's Lawn & Garden Center
RR 3, Box 251  
Macomb Road  
Rushville, IL 62671  
217/322-5644


### • Bond Nursery
1020 Peterson Road  
Libertyville, IL 60048  
312/680-3960


### • Bork Nurseries, Inc.
P.O. Drawer 147  
Onarga, IL 60955  
815/268-7265

6BB/C/BR, 13BB/BR, 15BB/BR, 18BB/BR, 19BB/C/BR, 30BB, 32BB, 33BB/BR
• J. F. Chaney Company
  P. O. Box 1462
  Champaign, IL 61820
  217/356-7147

  11BB, 19BB, 20BB, 24BB,
  30BB, 31BB, 32BB, 33BB

• Crippen Landscaping
  RR 1, Box 195A
  Maple Park, IL 60151
  815/895-5448

  1BB, 2BB/C/S, 3BB,
  5BB/BR, 6BB, 8BB, 9BB,
  11BB/S, 12BB/BR, 13BB/BR,
  14BB/BR, 15BB/BR, 17BB/BR,
  18BB/BR, 19BB, 23BB,
  24BB/BR, 25BB, 26BB,
  27BB/BR, 30BB, 33BB/BR

• Custer Brothers Nursery
  505 East Vernon Avenue
  Normal, IL 61761
  309/452-4115

  3BB/C, 6BB/C/BR, 8BB,
  11BB, 15BB/C, 19BB/C,
  30BB, 32BB/C/BR, 33BB

• Dean's Sullivan Greenhouses
  & Nursery
  408 East Water Street
  Sullivan, IL 61951
  217/726-4321

  1C, 6C, 8C, 9C, 11S, 15C,
  24C, 27C, 30C, 32S

• Diehl's Nursery, Inc.
  Route 1, Box 150
  Columbia, IL 62236
  618/281-4911

  5BB, 6BB, 9BB/C, 11BB,
  19BB, 22C, 27BB, 30BB, 32BB

• Dundee Landscape Nursery, Inc.
  154 Hilltop Lane
  Dundee, IL 60118
  312/428-2305

  1BB/S/BR, 2C/S/BR, 4S/BR,
  5DD/C/S/BR, 6DD/C/S/BR,
  7BB/S/BR, 8BB/S/BR, 10BB/S/BR,
  11BB/C/S/BR, 12S/BR, 13S/BR,
  14BB/S/BR, 15BB/C/S/BR,
  16S/BR, 17BB/C/S/BR, 18BB/C/S/BR,
  19BB/C/S/BR, 20S/BR, 21S/BR,
  22BB/S/BR, 23S/BR, 24S/BR, 25S/BR,
  26S/BR, 27BB/C/S/BR, 28S/BR,
  29BB/C/BR, 30S/BR, 31BB/C/S/BR,
  32BB/C/S/BR, 33BB/C/S/BR

• Egyptian Nursery and Landscape Co.
  P.O. Box 247
  Farina, IL 62838
  618/245-3551

  6BB, 15BB, 22BB, 27BB, 29BB, 30BB, 32BB

• Eleventh Street Nursery
  208 11th Street
  Mendota, IL 61342
  815/538-7331

  2BB/C, 6BB/C, 8C, 9BB/C, 10C,
  11BB/C, 15BB/C, 18C, 19BB/C,
  22BB/C, 24BB/C, 27C, 29C,
  30BB/C, 31BB/C, 32BB/C

• E. L. Fasci & Sons, Inc.
  7 South 882 Camp Dean Road
  Big Rock, IL 60511
  312/556-3811

  6BB/C, 9BB/C, 15BB/C, 18BB/C,
  19BB/C, 22BB/C, 27BB/C,
  30BB/C, 31BB/C, 32BB/C

• Charles Fiore Nurseries, Inc.
  P.O. Box 67
  Prairie View, IL 60069
  312/634-9400

  6BB, 4BB, 7BB, 8BB, 10BB,
  13BB, 14BB, 15BB, 18BB,
  19BB, 22BB, 24BB, 27BB,
  29BB, 30BB, 31BB, 32BB, 33BB
• Flowerwood, Inc.
P.O. Box 217
Crystal Lake, IL 60014
815/459-6200

1BB, 5BB, 6BB, 8BB, 10BB,
11BB, 15BB, 18BB, 19BB,
20BB, 22BB, 27BB, 30BB,
31BB, 32BB, 33BB

• Fritz Nursery
926 Douglas Street
Morris, IL 60450
815/942-1784

2BB, 6BB/C, 7S,
11BB/C, 19BB/C,
27C/S, 31BB/C, 32BB

• Adam Fritz Nursery
P.O. Box 578
Lake Zurich, IL 60047
312/438-5101

2BB, 8BB, 18BB, 19BB,
22BB, 29BB, 30BB, 31BB, 33BB

• Godfrey Greenery
4004 Stanka Lane
Godfrey, IL 62035
618/466-8475

4C, 6BB/C, 10C, 13BB,
15BB/C, 18BB/C, 19BB/C,
25BB, 27BB/C, 29BB, 30BB,
31C, 32BB

• Golden Gate Nursery
7848 West 95th Street
Hickory Hills, IL 60437
312/598-3355-8

2BB, 3BB/BR, 6BB, 8BB/BR,
9BB/BR, 17BB/BR, 18BB/BR,
19BB, 30BB, 32BB, 33BB

• Green Glen Nursery, Inc.
Route 4, Laraway & Cherry Hill Roads
Joliet, IL 60433
815/722-3133

1BB, 4BB/C, 5BB, 6BB, 7BB, 8BB, 11BB,
13BB, 15BB, 18BB, 19BB, 20BB, 22BB,
24BB, 27BB, 30BB, 32BB, 33BB

• Green View Nursery, Inc.
2700 West Cedar Hills Drive
Dunlap, IL 61525
309/243-7761

1BB, 4C, 5BB, 6BB/C, 11BB,
15BB/C, 18BB/C, 19BB, 22C,
24BB/C, 27C, 29C, 30BB/C,
31BB, 32BB, 33BB

• The Growing Place
25 West 471 Plank Road
Naperville, IL 60540
312/355-4000

1BB, 5BB, 6BB, 11BB,
13BB, 15BB, 19BB, 22BB,
27BB, 30BB, 31BB, 32BB, 33BB

• H. E. Nursery
RR 3, Box 4
Litchfield, IL 62056
217/324-6191

4C, 5C, 6BB, 11BB, 13BR,
14S/BR, 15C, 18BB, 19BB,
22C, 24BB/C, 25BR, 26BB,
28BB, 29BB/C, 30BB, 31BB/C,
32BB/CS, 33BB/C

• Harnotiaux Evergreen Nursery
RR 2
Greenville, IL 62246
618/326-8383

6BB/C, 9C, 11BB/C, 14C,
19BB/C, 22C, 27C, 30C,
32BB/C

• D. Hill Nursery Co.
Route 176
Union, IL 60180
815/923-2141

4BB, 6BB, 11BB, 13BB,
15BB, 18BB, 19BB, 22BB,
27BB, 31BB, 32BB, 33BB

• The Dean Hills Tree Farm
RR 2, Box 140
Ramsay, IL 62080
618/423-2357

6BB, 11BB, 19BB/C, 32BB/CS/BR

71
• Hinsdale Nurseries
8111 Route 34
Yorkville, IL 60560
312/553-8411

1BB, 5BB, 6BB, 8BB, 9BB,
11BB, 15BB, 18BB, 20BB,
22BB, 24BB, 30BB, 31BB,
32BB, 33BB

• D. A. Hoerr & Sons
8020 N. Shadetree Drive
Peoria, IL 61615
309/691-4561

1BB/C, 3BB/C, 4C, 5C,
6BB/C, 8BB/C, 11BB/C,
14C, 15C, 18C, 19BB/C,
20BB/C, 24C, 27BB/C,
29BB/C, 30BB/C, 31BB/C,
32BB/C, 33BB/C

• Illinois Department of Conservation
Division of Forest Resources
600 North Grand Avenue West
Springfield, Illinois 62706
217/782-2361

2S, 4S, 13S, 14S, 15S, 16S,
20S, 25S, 30S, 32S

• Jacksonville Landscape Nursery
RR #5
Jacksonville, IL 62650
217/245-2813

6BB/C, 11BB, 15C, 19BB, 29BB,
31BB/C, 32BB

• Juneberry Farms of Dennis Anderson
& Wife, Inc.
P.O. Box 702
Barrington, IL 60010-0702
312/438-4770

2BB, 4BB, 5BB, 8BB, 10BB, 14BB,
15BB, 16BB, 19BB, 24BB, 27BB,
30BB, 33BB

• King Nursery
1400 South Fourth Street
Montgomery, IL 60538
312/851-4548

1BB/C/S/BR, 2BB/C/S/BR,
4BB/C/S/BR, 5BB/C/S/BR,
6BB, 7BB/C/S/BR, 8BB/C/S/BR,
10BB/S/BR, 11BB/C, 13BB/C/S/BR,
14BB/C/S/BR, 15BB/C/S/BR, 18BB/C/S/BR,
19BB, 20BB/C/S/BR, 21BB/C/S/BR,
22BB/C/S/BR, 23BB/C/S/BR,
24BB/C/S/BR, 25BB/C/S/BR, 27BB/C/S/BR,
29BB/C/S/BR, 30BB/C/S/BR, 31BB/C/S/BR,
32BB/C, 33BB/C/S/BR

• Kleiss Farms — Tree Transplanting
RR #1, Box 43
Tolono, IL 61880
217/867-2364

6BB/C/S/BR, 11BB/C/S/BR,
19BB/C/S/BR, 32BB/C/S/BR

• Knupper Nursery & Florist
1801 North Rand Road
Palatine, IL 60074
312/359-1080

4BB, 6BB, 8BB, 14BB, 15BB,
19BB, 22BB, 24BB, 27BB/BR,
30BB, 31BB, 32BB, 33BB

• Kotnour Nursery
7118 West 40th Street
Berwyn, IL 60402
312/788-3183

6BB, 8BB, 14BB, 15BB,
22BB, 27BB, 30BB, 32BB

• Krajee Landscape Nursery
RR 1, Box 111
West Salem, IL 62476
618/456-8445

6BB/C, 8BB, 11BB/C,
15BB/C/BR, 19BB/C, 30BB/C/S,
31BB/C, 32BB/C/S/BR,
33BB/C
• Lee's Trees
Box 1666, RR #2
Mt. Vernon, IL 62864
618/244-4260
1BB, 6BB, 8BB, 11BB,
13BB, 18BB, 19BB,
27BB, 30BB, 32BB

• Jeffers Landscape & Nursery
RR #3
Quincy, IL 62301
217/434-8328
2C/BR, 6C, 8C, 9C, 11C,
13C/BR, 15C/BR, 17C/BR,
19C, 22C, 25C/BR, 27C/BR,
30C, 32C, 33C

• Henry Lohse Nursery
594 Palmyra Road
Dixon, IL 61021
815/288-1637
6BB, 11BB, 15BR, 19BB, 22BR, 32C

• M & L Landscaping Service
RR #1, Box 185
Sheldon, IL 60966
815/429-3138
1BB, 5BB, 6BB, 8BB, 9BB,
11BB, 13BB, 14BB, 15BB,
18BB, 19BB, 20BB, 22BB,
27BB, 30BB, 32BB

• McDevitt Nursery, Inc.
910 West Evergreen
Effingham, IL 62401
217/342-2579
6BB, 8BB, 13BR, 19BB,
22BR, 29BB, 31BB, 32BB

• Mettawa Tree Farm
RR 1, Box 24A
Libertyville, IL 60048
312/367-7314
6BB, 11BB, 19BB, 32BB

• Midwest Groundcovers
P.O. Box 384
St. Charles, IL 60174
312/742-1790
6C, 19C, 20C, 22C, 31C

• Monee Nursery Co.
Junction I-57 & Manhattan Monee Road
Monee, IL 60449
312/534-8382
1BB, 4BB, 5BB, 6BB, 8BB, 9BB,
11BB, 13BB, 15BB, 18BB, 19BB,
20BB, 22BB, 27BB, 30BB, 31BB,
33BB

• Mosquito Creek Nursery
RR 2, Box 142
Blue Mound, IL 62513
217/692-2366
6BB, 8BB/BR, 30BB/BR

• Nickrenz Nursery
RR 3, Box 91
Mt. Vernon, IL 62864
618/242-1603
2BB/C/BR, 6BB/C/BR, 9BB/C/BR,
11BB/C/BR, 15BB/C/BR, 19BB/C/BR,
20BB/C/BR, 31BB/C/BR, 32BB/C/BR

• Onarga Nursery Co.
606-18 North Oak
Onarga, IL 60965
815/268-7244
1BB/S/BR, 2BB, 5BB/S/BR, 6BB/S,
7BB, 8BB/S/BR, 11BB/S, 13BB/S/BR,
15BB/S/BR, 18BB/S/BR, 19BB/S,
21BB/S/BR, 22BB/S/BR, 27BB/S/BR,
29BB, 30BB/S/BR, 31BB/S/BR,
32BB/S, 33BB/S

• Pine Acres
6666 Old River Road
Rockford, IL 61103
815/633-8193
6C, 11BB, 19BB, 30BB, 32BB
• Pleasant Nursery, Inc.
1424 North MacArthur
Springfield, IL 62702
217/522-2222
6BB, 8BB, 11BB/C, 12BB,
15BB, 18BB, 19BB, 27BB,
30BB, 32BB

• Possibility Place Nursery
RR 1, Box 235B
Monee, IL 60449
312/534-3988
1BB, 2BB, 4BB/BR, 5BB, 8BB,
11BB, 12BB, 13BB, 14BB, 15BB,
18BB, 22BB, 24BB, 26BB, 27BB,
29BB, 30BB, 32BB, 33BB

• RKR & Associates Ltd.
9585 Henry Road
Morrison, IL 61270
615/778-3664
2C, 3C, 5BB/C, 8C, 9C,
10C, 11C, 15BB/C, 16C,
18BB/C, 19C, 20C, 22C,
24BB/C, 27BB/C, 30BB/C,
31C, 33BB/C

• Saunoris Brothers, Inc.
19600 South Harlem
Monkana, IL 60448
312/479-9000
3BB/C/BR, 4C/BR, 6BB/C/S,
6BB, 9BB/C, 11BB, 16BB/C/BR,
17BB/C, 18C/BR, 27BB/C/BR,
30BB/C, 31BB/C, 32BB, 33C,

• Schroeder's Nursery, Inc.
23379 West Route 60
Grayslake, IL 60030
312/546-9444
1BB, 4BB, 5BB/S, 6BB,
8BB, 13BB/BR, 14BB,
15BB/S/BR, 18BB, 19BB,
22BB/S/BR, 27BB/BR/BR,
30BB/S/BR, 33BB

• Schwarz Nursery, Inc.
21W020 Army Trail
Addison, IL 60101
312/627-6261
1BB, 4BB/C, 5BB/C, 6BB/C,
8BB, 13BB, 14BB, 15BB/C,
18BB/C, 19BB, 20BB/C,
22BB/C, 24BB/C, 27BB/C,
29BB/C, 30BB/C, 31BB,
32BB/C, 33BB/C

• Seidl Nursery
Route 83, Box 89B
Prairieview, IL 60069
312/537-1234
4BB, 5BB, 6BB, 11BB,
13BB, 15BB, 19BB

• Siemer Farm & Home
Route 40, Box 607
Teutopolis, IL 62467
217/857-3613
3BB, 6BB, 9BB, 11BB,
15BB, 19BB, 32BB

• Siems Nursery, Inc.
Box 65
Plato Center, IL 60170
312/464-5740
5BB, 6BB, 8BB, 13BB,
19BB, 22BB/BR, 27BB,
30BB, 31BB, 32BB

• Steve's Garden Center
320 Ottawa
Morris, IL 60450
815/942-6805
2BB/C, 3BB/C, 6BB/C,
8BB, 9BB/C, 10C,
11BB/C, 15BB/C, 17C,
18BB/C, 19BB/C, 22C,
27BB/C, 30BB, 33BB/C
• Synnestvedt Nursery Co.
24550 West Route 120
Round Lake, IL 60073
312/546-4700
1BB, 4BB/BR, 5BB, 6BB,
7BB, 8RR, 11BB, 14BB,
15BB, 16BB, 19BB, 22BB,
27BB/BR, 30BB, 31BB, 32BB, 33BB

• T & Z Nursery, Inc.
28 West 521 Roosevelt Road
Winfield, IL 60190
312/293-1040
4C, 24C, 27C

• Tecza & Sons Nurseries, Inc.
Route 2, Box 67
Elgin, IL 60120
312/742-3321
1BB, 4BB, 5BB, 6BB, 8BB,
11BB, 13BB, 15BB, 18BB,
19BB, 22BB, 27BB, 29BB,
30BB, 31RR, 32RR, 33BB

• Tholen's Landscape & Garden Center, Inc.
RR 7, Box 369
Kankakee, IL 60901
815/939-9670
2BB/C/BR, 6BB/C/S/BR, 8BB,
9BB/C, 11BB/C/S/BR, 14BB/C,
15BB/C, 18C, 19BB/C/S/BR,
20BB, 22BB/C/BR, 24BB,
27BB/C/BR, 30BB/C, 31BB/C,
32BB/C/S/BR

• Tonica Nurseries, Inc.
P.O. Box 157
Tonica, IL 61370
815/442-3176
1BB, 4BB, 5BB/BR, 6BB,
8BB, 11BB, 12BB/BR,
15BB/BR, 18BB/BR, 19BB,
22BR, 27BB/BR, 30BB,
31BB, 32BB, 33BB

• Vienna Nursery
Box 306
Vienna, IL 62995
618/658-3621
6BB, 15BB, 18BB, 19BB,
20BB, 22BB, 29BB, 30BB,
31BB, 32BB

• A. Waldhart & Sons Nursery
RR 1, Box 140
Dorsey, IL 62021
618/585-3414
6BB, 11BB, 15BB, 18BB, 19BB
20BB, 22BB, 27BB, 30BB, 32BB

• Arthur Weiler, Inc.
1280 Wincanton
Deerfield, IL 60015
312/945-1602
1BB, 4BB, 5BB, 6BB,
8BB, 9BB, 11BB, 13BB,
15BB, 18BB, 19BB, 22BB,
27BB, 30BB, 32BB, 33BB

• Mel M. Wirkus Nurseries, Inc.
2760 Willow Road
Northbrook, IL 60062
312/272-2244
4BB/S, 6BB, 7BB, 8BB, 10BB,
11BB, 13BB, 16BB/S, 19BB,
22BB, 27BB/S, 30BB, 32BB
## Appendix B. General Characteristics of Some Windbreak Herbicides

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Common name</th>
<th>Product name</th>
<th>Application</th>
<th>Control</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siazine</td>
<td>Princep</td>
<td></td>
<td>Pre-emergence; fall or early spring</td>
<td>Variety of annual grasses and broad-leaves</td>
<td>Safe on established conifers. Deciduous plants may not be tolerant. Transplants should be more than 3 years old.</td>
</tr>
<tr>
<td>Dichlofenil</td>
<td>Casoron</td>
<td></td>
<td>Pre-emergence; late fall or early spring application to established plants</td>
<td>Annual grasses and broad-leaves and some perennials</td>
<td>Shallow incorporation may improve activity. Allow 4 weeks establishment time before application.</td>
</tr>
<tr>
<td>Parathion</td>
<td>Parathion</td>
<td></td>
<td>Post-emergence; for site preparation or established plants</td>
<td>Nonselective contact herbicide</td>
<td>Do not spray foliage or green stems of desirable plants.</td>
</tr>
<tr>
<td>Divrinol</td>
<td>Karmex</td>
<td></td>
<td>Pre-emergence; apply early spring</td>
<td>Annual grasses and broad-leaves</td>
<td>Use on trees at least 2 years old.</td>
</tr>
<tr>
<td>2, 4-D</td>
<td>2, 4-D</td>
<td></td>
<td>Post-emergence</td>
<td>Broadleaf weeds</td>
<td>Do not spray new growth of spruce or pine.</td>
</tr>
<tr>
<td>Oxyflurfen</td>
<td>Goal</td>
<td></td>
<td>Pre- or post-emergence; before conifer buds break or after new growth hardens</td>
<td>Variety of annual grasses and weeds</td>
<td>Grasses should be treated before they are beyond 2-leaf stage. Do not disturb surface.</td>
</tr>
<tr>
<td>Oryzalin</td>
<td>Surflan</td>
<td></td>
<td>Pre-emergence</td>
<td>Variety of annual grasses and broad-leaves</td>
<td>Shallow cultivation needed.</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Roundup</td>
<td></td>
<td>Post-emergence; before planting or after 4</td>
<td>Annual and perennial grasses and broad-leaves</td>
<td>Apply to foliage to be controlled. Direct spray at base of planted tree or protect with a cover.</td>
</tr>
<tr>
<td>Trifluralin</td>
<td>Traflan</td>
<td></td>
<td>Pre-emergence; apply 1 to 2 weeks before planting</td>
<td>Most effective on grasses</td>
<td>Incorporate immediately to 2 to 3 inches.</td>
</tr>
<tr>
<td>Nacoprolol</td>
<td>Devrinol</td>
<td></td>
<td>Pre-emergence; early spring application</td>
<td>Annual grasses</td>
<td>Safe on new plantings and on deciduous plants. Allow 4 weeks establishment time before application.</td>
</tr>
<tr>
<td>Difeniamide</td>
<td>Enide</td>
<td></td>
<td>Pre-emergence; repeat application for season-long control.</td>
<td>Annual grasses and broad-leaves</td>
<td>Safe on new plantings. Allow 4 weeks establishment time before application.</td>
</tr>
<tr>
<td>Oxaflute</td>
<td>Ronstar</td>
<td></td>
<td>Pre-emergence; apply to clean cultivated soil.</td>
<td>Annual grasses and broad-leaves</td>
<td>Safe on new plantings. Cultivate 4 weeks after planting.</td>
</tr>
<tr>
<td>Alachlor</td>
<td>Lasso</td>
<td></td>
<td>Pre-emergence</td>
<td>Annual grasses</td>
<td>Safe on new plantings. Apply to clean, cultivated soil 4 weeks after planting.</td>
</tr>
<tr>
<td>Chemical 1</td>
<td>Common name</td>
<td>Product name</td>
<td>Application</td>
<td>Control 3</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>Pronamide</td>
<td>Herb</td>
<td>Pre- or postemergence</td>
<td>Annual and perennial grasses</td>
<td>Shallow cultivation or rainfall needed. Transplants should be more than 3 years old.</td>
<td></td>
</tr>
<tr>
<td>Fluridone butyl</td>
<td>Fusilade</td>
<td>Postemergence</td>
<td>Annual and perennial grasses</td>
<td>Apply to foliage to be controlled.</td>
<td></td>
</tr>
<tr>
<td>Sotoksizim</td>
<td>Roast</td>
<td>Postemergence</td>
<td>Annual and perennial grasses</td>
<td>Apply to foliage to be controlled.</td>
<td></td>
</tr>
<tr>
<td>Amino-trazole Amizine and simazine</td>
<td>Pre- and postemergence; apply on small weeds.</td>
<td>Both grasses and broadleaves</td>
<td>Keep spray off of tree foliage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfometuron Dust methyl</td>
<td>Preemergence</td>
<td>Annual grasses and broadleaves</td>
<td>Apply in early spring.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 This is a partial listing of herbicides most commonly used in windbreaks; others may be applicable as well. Herbicide users should follow all directions and precautions shown on the container label and use only on the species noted.
2 Brand names are used only to provide product information. This list is not an endorsement.
3 Use only for plants identified on herbicide label.
4 May be applied over small deciduous or coniferous woody plants at specific times of year. Consult herbicide label.
Appendix C. Calibration of Hand-held Sprayers

The following discussion presents step-by-step procedures for accurate calibration of hand-held sprayers.

Step 1

Decide on the size of the area to be treated around each seedling. It may be easier to apply herbicides uniformly with a side-to-side wand movement if the treated area is a square rather than a circle.

Step 2

Determine the time required to treat the selected area. Lay out the selected treatment spot on the ground or driveway and measure the time required to adequately cover the area at a pre-selected operational pressure. If this is done on a driveway, take the opportunity to check the consistency of the coverage. Watch the treated spot to see that it dries uniformly. Wet and dry areas in the treated spot indicate uneven application.

Step 3

Determine the number of treated spots, that is, the number of seedlings to be treated with each gallon of solution, by measuring the volume of spray solution applied to each treated spot. At the same pressure used in Step 2, collect the spray water in a container for the same length of time used in Step 2 and measure the volume in some convenient unit such as ounces or cups.

Step 4

Determine the number of treated spots or seedlings you can treat with each tankful.

\[
gallons \times \frac{treated\ spots}{tank} = \frac{treated\ spots}{gallon\ tank}
\]

Step 5

Determine the acreage of each treated spot.

\[
square\ feet \times \frac{1\ acre}{treated\ spot} = \frac{acre}{43,560\ sq.\ ft.\ treated\ spot}
\]

Step 6

Determine the number of acres that can be treated with each tank.

\[
treated\ spots \times \frac{acre}{tank\ treated\ spot} = \frac{acres}{tank}
\]

Step 7

Determine the amount of product to use per tank.

\[
product\ desired \times \frac{acres}{acre\ tank} = \frac{product\ desired}{tank\ tank}
\]
Sample Step 1

Decide to treat a square spot, 4 feet on each side.

Sample Step 2

After pressurizing the sprayer, you find that it takes 10 seconds to treat the 4-foot square.

Sample Step 3

In 10 seconds, the sprayer applies 4 ounces of water when caught in a measuring cup. Determine the number of spots that can be treated per gallon.

\[
\begin{align*}
1 \text{ treated spot} & \times 128 \text{ ounces} = 32 \text{ treated spots or} \\
4 \text{ ounces} & \times 1 \text{ gallon} = 8 \text{ gallons} \\
1 \text{ treated spot} & \times 16 \text{ cups} = 32 \text{ treated spots} \\
0.5 \text{ cup} & \times 1 \text{ gallon} = 2 \text{ gallons}
\end{align*}
\]

Sample Step 4

The sprayer has a 3-gallon tank. Use the number of treated spots per gallon from Step 3 to find the number of spots that can be treated per tank.

\[
3 \text{ gallons} \times 32 \text{ treated spots} = 96 \text{ treated spots per tank}
\]

Sample Step 5

A square 4 feet on each side contains 16 square feet (from Step 1), which is what portion of an acre?

\[
\begin{align*}
16 \text{ square feet} & \times \frac{1 \text{ acre}}{43,560 \text{ sq. ft.}} = \frac{0.0037 \text{ acre}}{\text{treated spot}} \\
\end{align*}
\]

Sample Step 6

Take the number of treated spots per tank from Step 4 and the portion of an acre per treated spot from Step 5 to determine what portion of an acre your tank will cover.

\[
\frac{96 \text{ treated spots}}{\text{tank}} \times \frac{0.0037 \text{ acre}}{\text{treated spot}} = \frac{0.36 \text{ acre}}{\text{tank}}
\]

Sample Step 7

Take the portion of an acre per tank from Sample Step 6. Take the amount of product recommended per acre from the herbicide label to find the amount of product to use per tank.

\[
\begin{align*}
5 \text{ lb product} & \times \frac{0.036 \text{ acre}}{\text{tank}} = \frac{0.18 \text{ lb}}{\text{tank}} \text{ or} \frac{2.9 \text{ oz}}{\text{tank}} \\
2 \text{ qt product} & \times \frac{0.036 \text{ acre}}{\text{tank}} = \frac{0.07 \text{ qt product}}{\text{tank}} \text{ or} \frac{2.3 \text{ oz}}{\text{tank}} \text{ or} \frac{4.5 \text{ tablespoons}}{\text{tank}}
\end{align*}
\]
Bibliography


