3-1953

Shelterbelts for South Dakota

E.K. Ferrell

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SHELTERBELTS
FOR SOUTH DAKOTA
By E. K. Ferrell, Extension Forester

Tree Planting Benefits

Tree plantings will make your farm home and its surroundings a more pleasant and comfortable place to live.

Tests have shown that a good shelterbelt can cut your fuel bill 32%. Snowdrifts can be kept out of your farm yard and driveways by planting trees in the right places. Livestock make better gains on less feed when protected from cold winter winds. Your garden and orchard will be much more successful protected from wind.

Shelterbelts slow down the speed of the wind for a distance of about 20 times the height of the shelterbelt. In other words, a shelterbelt 30 feet high, will cut down wind speed for a distance of 600 feet from the shelterbelt.

By reducing wind speed, you can prevent or reduce soil blowing. Damage to crops—such as blowing of seeds or seedlings out of the ground, cutting off seedlings, or blowing down mature crops—often can be prevented by shelterbelts. Slowing down wind speed modifies temperatures and reduces evaporation. This provides more favorable conditions for plant growth. Snow piles up to greater depths on fields protected by shelterbelts. This added moisture is one of the reasons why crop yields are usually higher in fields protected by shelterbelts.

Wood products such as posts, poles, and fuelwood can be made out of trees thinned from your shelterbelt a few years after planting. Fruit-bearing shrubs such as wild plumb, chokecherry, and Nanking cherry planted in the shelterbelt will provide a good supply of fruit for home use. Shelterbelts containing fruit bearing trees and shrubs furnish food and cover for wildlife.

Recommended Trees and Shrubs

Soil, moisture, and climatic conditions vary widely in South Dakota. Some trees and shrubs do well in low, wet places. Others may die if planted under such conditions. There is quite a difference in the amount of alkali that the various trees and shrubs will stand. When you select trees and shrubs for your shelterbelt try to “fit” them to the conditions they must meet on your farm.

Table I lists the trees and shrubs which have been found most suitable for planting in this state. Information that will help you to select the best ones for your location is also included. Additional help is available from your County Extension Agent, Soil Conversationist, District Forester, local nurseryman, or Extension Forester at South Dakota State University.

In addition to the trees and shrubs
<table>
<thead>
<tr>
<th><strong>SHRUBS</strong></th>
<th><strong>Average Height</strong></th>
<th><strong>Cold</strong></th>
<th><strong>Alkali</strong></th>
<th><strong>Sand Action</strong></th>
<th><strong>Rodents</strong></th>
<th><strong>Borers</strong></th>
<th><strong>Leaf Eaters</strong></th>
<th><strong>Disease</strong></th>
<th><strong>Drought</strong></th>
<th><strong>Remarks</strong></th>
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<td>American Plum</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Suckers; thorny; produces fruit</td>
</tr>
<tr>
<td>Caragana</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>Not suited to low wet spots</td>
</tr>
<tr>
<td>Chokecherry</td>
<td>12</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>Suckers; produces fruit</td>
</tr>
<tr>
<td>Common Lilac</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>Excellent shrub; ornamental</td>
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<tr>
<td>Honeysuckle</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Bird food; ornamental</td>
</tr>
<tr>
<td>Nanking Cherry</td>
<td>12</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Produces fruit; ornamental</td>
</tr>
<tr>
<td>Golden Currant</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>2</td>
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<td>Aromatic Sumac</td>
<td>7</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Bird food</td>
</tr>
<tr>
<td>Cotoneaster</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Bird food</td>
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</table>

<table>
<thead>
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<th><strong>TREES</strong></th>
<th><strong>Degree of Resistance: 1—Resistant; 2—Susceptible; 3—Highly susceptible.</strong></th>
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<tr>
<td>American Elm</td>
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<td>Box elder</td>
<td>30</td>
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<td>Bur Oak</td>
<td>30</td>
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<tr>
<td>Chinkota Elm</td>
<td>35</td>
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<tr>
<td>Siberian Elm</td>
<td>40</td>
</tr>
<tr>
<td>Siouxland Cottonwood</td>
<td>60</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>60</td>
</tr>
<tr>
<td>Golden Willow</td>
<td>30</td>
</tr>
<tr>
<td>White Willow</td>
<td>45</td>
</tr>
<tr>
<td>Green Ash</td>
<td>40</td>
</tr>
<tr>
<td>Hackberry</td>
<td>35</td>
</tr>
<tr>
<td>Russian Olive</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CONIFERS (Evergreens)</strong></th>
<th><strong>Degree of Resistance: 1—Resistant; 2—Susceptible; 3—Highly susceptible.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Redcedar</td>
<td>30</td>
</tr>
<tr>
<td>Rocky Mt. Juniper</td>
<td>25</td>
</tr>
<tr>
<td>Black Hills Spruce</td>
<td>35</td>
</tr>
<tr>
<td>Colorado Blue Spruce</td>
<td>30</td>
</tr>
<tr>
<td>Ponderosa Pine</td>
<td>40</td>
</tr>
<tr>
<td>Austrian Pine</td>
<td>40</td>
</tr>
</tbody>
</table>
listed in Table 1, a few others may be used. These are listed below:

**SHRUBS**


**Snowberry** — Average height 3 feet. Hardy. Not suited to alkali.

**Buffaloberry** — Average height 10 feet. Stands drought, cold and alkali well. Produces fruit. Subject to disease.

**False indigo** — Tall shrub. Ornamental. Good bird food. Resistant to drought, cold, and alkali.

**Sandcherry** — Low shrub. Hardy. Produces abundant supply of edible fruit. Should not be depended upon for windward side of shelterbelts.

**Mongolian cherry** — Low shrub. Produces abundant supply of edible fruit. Hardy. Confine to leeside of shelterbelt.

**Korean cherry** — Low shrub. Produces abundant supply of edible fruit. Dieback is quite common. Confine to lee side of shelterbelt.

**TREES**

**Black Cherry** — Average height 20 feet. Sometimes freezes back. Not suited to dry soil or alkali. Good bird food. Plant in Southeastern South Dakota only.

**Siberian Apricot** — Average height 20 feet. Stands cold well but fruit buds often freeze. Edible fruit. Not suited to alkali. Subject to severe rabbit damage. Brittle.

Manchurian Apricot — Smaller tree than Siberian apricot. Bitter fruit. Plant only in east half of state. Subject to severe rabbit damage.


**Siberian Crabapple** — Average height 20 feet. Sometimes freezes back. Not suited to alkali but stands drought well. Keep away from cedar trees because of cedar-apple rust.

**Harbin Pear** — Average height 20 feet. Hardy. Not suited to alkali. Stands shade well. Disease and insect free. Fruit not edible.

**Ginnala Maple** — Average height 15 feet. Sometimes freezes back. Not suited to alkali or dry soil. Ornamental.

**Black Walnut** — Average height 40 feet. Prefers rich bottomland. Not suited to alkali or dry soil. Plant only in Southeastern and South Central South Dakota.

**Soft Maple** — Average height 60 feet. Not suited to alkali or dry soil. Brittle.

**Honey Locust** — Average height 35 feet. Sometimes freezes back. Plant only in Southeastern and South Central South Dakota.

**Jack Pine** — Average height 25 feet. Plant only on sandy soils in the eastern half of South Dakota.

**Planting Plans**

"Plan before you plant" is good advice. Your shelterbelt planting plan may consist of a sketch. Your sketch should include the following points:

1. Location of the planting with reference to the buildings.
2. Number of rows to be planted.
3. Distance between rows.
4. Kind of tree, or shrub to be planted in each row. Be sure to include at least three rows of evergreens in your plan to get long life and good winter protection from your planting.
5. Distance between shrubs in the row.
6. Distance between trees in the row.

Figure 1—Plan of a farmstead shelterbelt. Important features: (1) Width, at least 10 rows. (2) Distance from buildings, 100 feet. (3) Tight shrub row on both sides. (4) A fence to exclude livestock. (5) Plenty of evergreens to insure long life and maximum winter protection.
7. Total length of the planting.
8. Number of each kind of tree and shrub needed. (Obtained by dividing the length of the planting by the distance the trees are to be placed apart in the row.)
9. Location and width of lanes through the planting.
10. Location of the fence that will enclose the planting. (Allow at least a rod between the fence and outside rows of trees.)

LOCATION

Winds in South Dakota are usually from the northwest during the winter months. In summer they come from the south and southwest. You will get the most winter protection from your shelterbelt if you locate your planting on the north and west sides of your farmstead. In some localities a tight, narrow planting on the east and south is desirable for snow trap purposes. A planting on the south will also give protection against hot summer winds.

Gardens need protection from hot summer winds and orchards need protection in both summer and winter. Trees should be planted on the north, west and south to give orchards and gardens complete protection. Leave a space of at least 50 feet between the shelterbelt and the orchard and garden to prevent moisture sapping by the trees.

Figure 1 shows a recommended plan for a farmstead shelterbelt. You will get the best protection by planting the inside row of trees not less than 100 feet nor more than 150 feet from your farm buildings. By extending the ends of your shelterbelt at least 100 feet beyond the buildings you will avoid the strong winds that whip around the ends of any shelterbelt.

When it is necessary to have a lane through your shelterbelt, try to locate it at right angles to the prevailing winds. This will help to stop wind and snow from blowing into your yard. Gaps through a shelterbelt greatly reduce its value and every effort should be made to close them.

Figure 2 shows the effect of a small gap and suggests ways of stopping such openings.

CONTOUR PLANTING

On sloping land shelterbelts should be planted on the contour whenever possible. This is especially important in the drier parts of the state. It is often impossible to locate a planting on the contour and still get it in the right place to give protection from wind and snow.

Figure 3 shows a shelterbelt planted on terraces. The trees should be planted on the ridge of the terrace. Cultivation of trees on full-sized terraces is difficult so it is best to build up the terraces gradually as the trees are cultivated.

When less than 10 rows are planted, a snow trap may be needed to keep snow out of the yard. A snow trap can be made by planting a closely-spaced row of shrubs 2 or 3 rods north of the main shelterbelt. Snow traps should not be used if enough space is available to plant a good shelterbelt. They leave a strip of ground that grows up to weeds unless it is cultivated often or planted to a crop such as alfalfa. Snow is kept out of the shelterbelt by a snow trap and the trees do not get the moisture when the snow melts. In dry years, snow is an important source of moisture for the trees.
SMALL GAP IN A SHELTERBELT GREATLY DECREASES ITS USEFULNESS

A - Shelterbelt
B - Opening

DRIVEWAYS AND ROADS THROUGH SHELTERBELTS SHOULD BE AT AN ANGLE OR CURVED

ROADWAYS | SHELTERBELT

GAPS CAUSED BY UNPLANTABLE AREAS SHOULD BE CLOSED IF POSSIBLE

UNPLANTABLE AREA | SHELTERBELT

Figure 2
SPACING

In areas of favorable soil and rainfall, close spacing—10 to 14 feet between rows and 6 feet apart in the row—has in most cases produced better shelterbelts than wide spacing. Branches of closely-spaced trees grow together much faster and weeds and grass are shaded out. A leaf mulch is formed beneath the trees which absorbs and holds moisture. Both soil and trees dry out less. You can "lay by" your shelterbelt much sooner if the rows are kept fairly close together.

A spacing distance of 10 to 14 feet between rows is recommended for the state, in general, with the wider distance being used on the heavy soils and lower rainfall areas. Some of these areas may require a row spacing wider than 14 feet.

Shrubs should be planted 3 to 4 feet apart in the rows, medium tall trees 6 to 8 feet apart and tall trees 8 to 10 feet apart. Cedar and pine should be set 6 to 8 feet apart and spruce 8 to 10 feet apart. When cedar is used in the windward row, they should be set 4 to 5 feet apart.

ARRANGEMENT OF TREES AND SHRUBS

A closely-spaced shrub or cedar row on the windward side of the shelterbelt is one of the most important rows in the planting. Low, bushy shrubs or cedars act like a snow fence and keep the snow from blowing through the trees and into your yard. Tests have shown that a row of shrubs stops more snow than 20 rows of single stemmed trees. Shrubs also stop the wind from sweeping under the trees. This results in more wind protection for your farmstead and also helps to keep fallen leaves from blowing out of the planting. Leaves build up a moisture-holding mulch and return humus to the soil.

A closely-spaced shrub row on the leeward side of the planting is also
very important. This will help keep fallen leaves in the planting and will stop drying winds from blowing through the shelterbelt. Shrubs in the outside rows help keep grass from creeping into the planting.

Evergreens are very important because they are longer lived and give much more winter protection than trees that shed their leaves. Evergreens are harder to get started than broad-leaved trees, but they are worth the extra care needed to get them off to a good start. Once started, evergreens (such as Ponderosa pine, Eastern Redcedar and Rocky Mountain Juniper) will stand more drouth and cold than many of the broad-leaved trees.

Figure 4 shows the best location for the evergreens. Redcedar or Rocky Mountain Juniper may be used in place of broad-leaved shrubs in the first row on the windward side of the planting. If spaced 4 or 5 feet apart they do a good job in this location. Snow breakage has been a problem with evergreens. This is not likely to be serious if the evergreens are placed near the windward side of the planting.

Some people like to have a row of evergreens on the side nearest the buildings. When planted in this location, they help to beautify the farmstead. If you plant evergreens in this location, be sure to put a closely-spaced shrub row and the main planting of evergreens on the windward side of your shelterbelt. This will lessen the danger of snow breakage.

some broad-leaved trees so it is best not to plant fast growing trees too close to them. Fast-growing trees like Siberian (Chinese) Elm, Cottonwood, Willow, Boxelder and Russian Olive are apt to overtop the evergreens and shade them. Ponderosa pine is especially apt to be hurt by shading and whipping. Slow-growing trees like Green Ash and Bur Oak are good choices to plant next to the evergreen row.

Height is important in a shelterbelt so it pays to plant some tall-growing trees near the center of your planting. Tall trees like Cottonwood or White Willow may be used if plenty of soil moisture is available. Siberian Elm or American Elm are much better choices where the supply of soil moisture is limited. Avoid using Cottonwood and Siberian Elm in the same planting. Siberian Elm robs cottonwood of moisture and is likely to weaken or kill it.

Mixing different kinds of trees or shrubs in the same row is sometimes done to lessen the danger of loss from insects and disease. There is no proof that mixing trees in this way helps to prevent such losses. On the other hand, there is danger in mixing trees with different growth rates. Faster growing trees or shrubs are almost sure to crowd out the slower ones. Slowly-growing trees and shrubs that need plenty of light are almost sure to be hurt if mixed with fast growers. Every farmstead shelterbelt should contain several different kinds of trees and shrubs but each kind should be kept in its own row.
Cross Section of a 10-Row Farmstead Shelterbelt

PREVAILING WIND

SHRUB
1
Redcedar
Rocky Mtn.-Juniper
Caragana
American Plum
Chokecherry
Honeysuckle
Lilac
Cotoneaster
Golden Currant
Aromatic Sumac

EVERGREENS
2 3 4
Redcedar
Rocky Mtn.-Juniper
Ponderosa Pine
Austrian Pine
Scotch Pine
Jack Pine

MEDIUM GROWTH
5
Green Ash
Bur Oak
Hackberry

TALL TREES
6 7 8
American Elm
Cottonwood
Siberian Elm
White Willow
Honeylocust
Soft Maple
Boxelder
Russian Olive
Apricot
Harbin Pear

MED. GROWTH
9
Lilac
Caragana
American Plum
Chokecherry
Honeysuckle
Cotoneaster
Golden Currant
Aromatic Sumac
Nanking Cherry

Figure 4
Shelterbelts for South Dakota

Planting Stock

Young nursery-grown trees usually do better than wild seedlings. They have more compact roots than wild seedlings and stand transplanting better. They are also more uniform in size and age. Size of the seedlings is very important, and diameter is more important than height. Seedlings with a diameter of not less than 7/32 inch or more than ½ inch at the ground line have been the most successful. Seedlings less than 7/32 inch in diameter may live if growing conditions are favorable but they are a poor risk in dry years. Pine, Cedar and Spruce seedlings do not make good shelterbelt planting stock. They must be grown and transplanted in the nursery to develop a bushy root system.

Trees from states having a milder climate than South Dakota are likely to be killed by our winters. Every effort should be made to get trees that have been grown from South Dakota seed.

Several commercial nurseries in South Dakota produce suitable trees and shrubs for shelterbelts. Trees and shrubs also may be obtained at low cost through the office of the State Forester at Pierre.

When you order your trees, plan on ordering about 10 per cent more of each kind than your planting plan calls for. This will make it possible for you to cull out trees that are too small and those that were damaged when they were dug. Trees left over after culling out the poor ones can be lined out in a row in the garden and used the following spring to replace the trees that failed to grow in your shelterbelt.

Seedling trees and shrubs often need both top and root pruning to insure good survival. If the tops are not already cut back when the trees are received it will pay to remove about one-half of the tops. An easy way to do this is to cut off the tops with a sharp hatchet or pruning shears before cutting the string on the bundle.

Tips of roots should be pruned if they are so long that they cannot be planted in the hole or furrow without cramping.

Care of Planting Stock

Trees should be planted as soon as possible after they arrive from the nursery. If weather or soil conditions prevent immediate planting, they can be kept a few days if given proper care. They should be unwrapped and the roots and packing material should be wetted down. Then repack and store in a cool, protected place such as a barn or cellar and protect them from freezing.

If planting must be delayed for longer than a week the trees should be heeled-in. This is done by digging a trench with the back wall sloping at from 30 to 45 degrees. See Figure 5. The trench should be deep enough to allow the roots to be completely covered with moist soil. The bundles of trees are then laid against the sloping back wall and soil from the front wall is shoveled against the trees to a depth of about 6 inches. This soil should be firmly tamped in place over and around the roots. The heel-in bed should then be crowned over with 2 or 3 inches of loose soil. Trees should be removed from the heel-in bed before the buds burst and leafing starts. The sooner they are planted the better.

A young tree is a living thing, easily
Figure 5—Steps in heeling in nursery stock: (A) A trench 3 feet wide with a 30° to 45° slope from the vertical on the back wall; (B) Bundle of seedlings placed with root collars 1 to 2 inches below ground line (indicated by twine binding); (C) First row packed in and new back wall ready for second row; (D) Position of alinement pole; (E) Trench filled with four seedling rows.
Shelterbelts for South Dakota

damaged by having its roots exposed to drying out or to freezing temperatures. While planting the trees, be sure to always keep the roots moist. Carrying the trees in a bucket with water or thin mud covering the roots is a good method. Drying quickly kills evergreen trees. Tests show that exposing the roots to wind for as little as 30 seconds can cause killing. Extreme care should be taken to always keep the roots of evergreens moist.

Starting the Shelterbelt

Ground Preparation

One year of clean summer fallow before the trees are planted is the best way to get the planting off to a good start. Summer fallow for tree planting has these advantages:

(1) Year-in and year-out fallow provides better moisture conditions. This is very important in dry years.

(2) It reduces weed growth in the years following planting. This makes the cultivation job easier.

(3) Better survival and better growth are obtained. A planting made on fallowed land usually grows enough faster to make up for the one year delay in planting.

Fallowing should be started not later than June 1. Plow the land to a depth of 6 to 8 inches and drag it once or twice. During the summer, cultivate the land as often as necessary to keep it free from weeds and grass. A duck-foot type cultivator is the best for leaving the ground in a rough and ridged condition. The land should not be plowed in the spring of planting, since a firm, well settled soil is best for tree planting. However, a thorough dragging just before planting will destroy early weeds.

Land in sod, sweet clover or alfalfa should be fallowed at last one year. Quack grass, brome grass and noxious weeds should be killed out completely before planting a shelterbelt.

Very sandy soils—subject to severe wind erosion—should not be clean fallowed. Trashy fallow or stubble mulch tillage may instead be used on soils which are subject to blowing.

Fencing

Livestock of all types must be kept out of the trees if the shelterbelt is to be successful. Severe damage always results to both young and old plantings if livestock is allowed in them. Damage is caused by packing the soil, browsing and breaking of branches, and rubbing against the trees.

“A good shelterbelt makes a poor pasture—if pastured it soon becomes a poor shelterbelt.”

A good stock-tight fence should be built around the planting either before or right after the trees are planted. Be sure to leave enough room—not less than a rod—between the outside rows and the fence to allow for cultivation around the outside of the planting. Enough space also should be left between the ends of the shelterbelt and the fence for a turn-row.

Time of Planting

Early spring is the best time to plant trees in South Dakota. Best results are obtained when trees are planted within four weeks after the frost is out of
the ground. Fall planting is not recommended. Fall planted trees do not start before winter sets in and by spring they have been weakened through loss of moisture. Cold winter winds and rodents are also hard on them.

Trees received in the fall are better off heeled-in until spring. Store them in a place where they are protected from the sun and wind and covered by whatever snow falls.

**PLANTING THE TREES**

Your trees should be planted as soon as possible after you get them from the nursery. Planting should be completed before the buds open. A calm, cloudy day is ideal for tree planting. Most of the tree planting in South Dakota is now done with tree planting machines. Care must be taken by the men riding the machine to see that the trees are set at the proper depth. When the planting is finished, it pays to walk the rows and reset any trees that are planted too deep or too shallow.

If you find it necessary to plant your trees by hand, the diagrams in Figure 6 show a good method to follow.

Subsoiling the tree rows before hand planting makes the job much easier and also gets the trees off to a better start. This is done by attaching a deep tillage shank to the toolbar of a tractor and running it down each tree row at a depth of 14 to 16 inches. The first row is staked and the other rows are marked with a row marker.

Trees should be set in straight rows

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**Figure 6**—A good method for planting trees by hand.
to make the cultivation job easier. If the rows are not marked by subsoiling they can either be staked or marked with binder twine. A simple row marker can be built. This will make it necessary to stake only the first row.

If your shelterbelt is to be planted in an “L” or “U” shape around the buildings, a round corner is desirable. A round corner requires only one-half as many turns as a square corner when you are cultivating the trees. Snow and wind are also more likely to get through a square corner. A round corner can be marked by tying a long piece of twine to the inside corner

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**Figure 7**—Correct and incorrect planting methods, adapted from Fig. 5 of USDA Farmer’s Bulletin No. 1603, “Planting and Care of Shelterbelts on the Northern Great Plains.” Evergreen trees should be set at the same depth they stood in the nursery to avoid covering lower leaves of the plant. Other trees may be set slightly deeper.
fencepost. Extend the twine to the outside shrub row which has been marked on the ground by a stake. Swing the twine in a quarter-circle and at the same time draw a line on the ground with a stake to mark the row. Mark the remaining rows in the same way.

**Field Shelterbelts**

Field shelterbelts are plantings made for the protection of crops and cropland. Studies made by the Lake States Forest Equipment Station during the 1930's on over 300 fields in the Central and Northern Plains leave no doubt that shelterbelts increase crop yields. Figure 8 shows this increase in terms of land “added” to the field by shelterbelts. It also shows that the most benefit is received on the south side of an east-west shelterbelt.

A survey made in 1954 in Eastern South Dakota by the Soil Conservation Service and Agricultural Experiment Station gave more proof that

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**Figure 8**—Crop yield increase in terms of land “added” to fields. Cropland protected by an east-west shelterbelt produced enough additional gain to equal a strip of land 5.96 rods wide added to the field. Part of this gain (1.68 rods) was north of the shelterbelt and the remainder (4.28 rods), was south. North-south shelterbelts added 1.98 rods to fields east of them.
Shelterbelts for South Dakota

PREVAILING WIND

FENCE

SHRUB

Redcedar
Caragana
American Plum
Chokecherry
Honeysuckle
Lilac
Cotoneaster
Golden Currant
Aromatic Sumac

EVER-GREEN

Redcedar
Rocky Mtn. Juniper
Colorado Spruce
Black Hills Spruce
Ponderosa Pine
Austrian Pine
Scotch Pine
Jack Pine

INTERMEDIATE

Green Ash
Bur Oak
Hackberry

MEDIUM TO TALL

American Elm
Cottonwood
Siberian Elm
White Willow
Honey Locust
Soft Maple

SHRUB OR LOW TREE

Boxelder
Russian Olive
Lilac
Caragana
American Plum
Chokecherry
Honeysuckle

Figure 9—Cross section of a 5-row field shelterbelt.

Field shelterbelts increase crop yields. Of the 331 farmers interviewed, more than 88 per cent stated that their shelterbelts increased their crop yields.

Field shelterbelts do not need to be as wide as plantings made for farmstead protection. They can be made up of 1 to 5 rows of trees and shrubs. This will let most of the snow blow through the planting and hold it on the field where the moisture will benefit crops. Spacing field shelterbelts not more than 20 rods apart will give the most protection to crops and soils.

Replanting

Some trees fail to grow in almost all plantings. Poor stock, poor planting, weeds, insects, disease, livestock,
Holds Sandy Soil

Figure 11—A sandy farm completely protected from wind erosion by field shelterbelts.

Fenced and Clean

Figure 12—Clean cultivation and protection from livestock has made this an excellent shelterbelt.
weather conditions and rodents are the chief causes of losses.

Dead trees should be replanted the first spring after the planting is made. Each year that passes after the original planting lessens the chances for the replanted trees to get started. They have an uphill battle because they must compete with the established trees for moisture, plant food and light.

If you space your trees as recommended in this bulletin, there is no need to replant single missing trees. Where two adjacent trees fail, replant one tree half way between the living trees. If three trees fail, divide the distance between the living trees and put two back in. Where more than three failed, space the replanted trees the same distance apart as the original trees were planted.

A tight shrub row is so important that every missing shrub should be replaced the spring following the original planting.

Care must be taken to choose the right kinds of trees for replanting old shelterbelts. Those that will stand shade should be used. Eastern Redcedar and Rocky Mountain Juniper are the best evergreens for this purpose.
Among the broad leaved trees American Elm, Boxelder, Hackberry and Siberian Elm are best. Chokecherry, Golden Currant and Tatarian Honeysuckle are the best shrubs for replanting old shelterbelts.

Care and Protection of Shelterbelts

Figure 12 shows a shelterbelt that has had good care. Fencing has kept out all livestock. Branches have grown together and shaded out grass and weeds and a layer of leaf mold covers the ground. This leaf mold will hold moisture and return plant food to the soil. Large numbers of volunteer tree and shrub seedlings are coming up. They would have been browsed and trampled out if livestock had been allowed in the planting.

This planting gives complete protection to the sheltered buildings and also makes conditions favorable for its own protection against drouth and weeds. Little care will be needed to keep the trees in healthy growing condition.

Figure 13 shows a contrast. No grazing has been allowed in the planting on the left. On the right livestock have completely killed out the shrub row. Because of grazing there are no young trees and shrubs coming in. Wind and snow can sweep under the trees and lack of shade results in a heavy growth of grass. The grass sod catches and holds most of the rainfall and keeps it from reaching the tree roots. Open plantings such as this one allow drying of the soil by the sun and wind.

Cultivation

Weeds and grass have exactly the same effect on trees that they have upon a crop—the weak trees die and
the rest are stunted. Much of the moisture that should go to the trees is lost unless clean cultivation is practiced as long as it is possible to cultivate between the tree rows. Never seed grass in shelterbelts. Seeding grass to stop weed growth has been tried and is ineffective since grass is harder on the trees than weeds.

Shovel-type cultivators are better for tree cultivation than machinery that leaves the ground smooth. Duckfoot cultivator, the one- or two-row cultivator, and the spring-tooth harrow are good implements for cultivating shelterbelts. One-row cultivators are especially good for the first one or two years since the rows can be straddled as is done in cultivating corn. The spring-tooth harrow does a fine job if it is used while the weeds are small. It also is useful when the trees branch out and narrowed machinery becomes necessary.

Single disks should not be used for cultivating trees. These form a ridge in the tree rows and a low center between the rows. The ridge causes water run-off and moisture loss. A tandem disc leaves the surface level but continued use of this implement pulverizes the soil into a condition that favors run-off and wind erosion.

Take care to prevent smothering small evergreens during cultivation. Pines, especially, may be killed if soil is heaped up to cover the lower stem and branches.

Weeds in the tree rows are often more of a problem than those between the rows. Hand hoeing is one method of getting rid of weeds in the row but this is a difficult job if the planting is large. The grape and shelterbelt hoe, shown in Figure 14, is a good implement for removing weeds and grass in the row. A tree row cleaner, invented by a South Dakota farmer, is available and does an excellent job of weed removal from tree rows.

Ask your County Agent for a copy of Fact Sheet 126, entitled “Over-the-Tree-Row Cultivators.” This publication describes several implements that can be used to eliminate weeds in young shelterbelts.

Check-rowing is sometimes done to permit cross cultivation. This is hard to do when the trees are planted with a machine. Check-rowing also makes it impossible to space the shrubs and trees at different distances apart in the rows. Check-rowed plantings are not as efficient in stopping wind and snow as are plantings with the trees staggered in the rows.

Leave a strip of ground at least as wide as the distance between the rows on both sides of the shelterbelt. Keep this ground clean-cultivated throughout the life of the planting to keep weeds and grass from growing into the shelterbelt from the sides. The clean area around the planting also makes a good fire-break.

Discontinue cultivating and watering trees by the middle of August. Stop fertilizing by July 1. These practices tend to keep trees growing late into the fall. A sudden freeze is then likely to damage the unripened wood. On the other hand, watering trees, especially evergreens after a killing frost but before the ground freezes, helps to bring them through the winter in good shape.
Figure 16 shows a shelterbelt that has been neglected. Weeds are taking moisture from the trees and will also make a good nest for rodents. Heavy weed growth is a dangerous fire hazard. Figures 16 and 17 show plantings that have been given good care.

Some chemicals now on the market offer much promise for weed control in shelterbelts. Others, such as 2,4-D, are harmful to trees and should not be used in your planting. When it is necessary to spray cropland near your shelterbelt, be careful to avoid drifting spray into the trees. Use of the amine or low volatile ester form of 2,4-D is less likely to cause tree injury.

Mulching trees with straw or other materials as a substitute for cultivation cannot be recommended. Mulching tends to hold the moisture...
near the surface and makes the trees shallow-rooted. Light rains cannot penetrate the mulch and the trees lose the benefit of the moisture. Mice are attracted to plantings that have been mulched with straw and are apt to girdle the trees. Straw also makes a fire hazard in the planting.

Shelterbelts planted on soils subject to severe wind erosion need special attention until the trees are big enough to hold the soil. It may be necessary to leave a band of weeds between the tree rows, but a seeded cover crop is much better. Extension Circular 523 entitled "Shelterbelt Care" contains information about cover crops for tree plantings.

PRUNING

Pruning the lower branches on shelterbelt trees makes the planting less effective in stopping wind and snow. Trimming the trees to a height of 5 or 6 feet also has a bad effect on growth and survival. Trees in the inside rows may be pruned to one stem, but no side branches should be removed from the stem that is left. Remove broken branches close to the trunk so that no stubs are left.

Pruning wounds heal best if pruning is done in the spring just before growth starts. Paint large wounds with a dressing to protect against rot and insects. Asphalt paint makes a good wound dressing. Tree paints made especially for dressing wounds are also available from paint dealers.

RODENT CONTROL

Jackrabbits, cotton-tail rabbits, and mice often cause severe damage to tree plantings. Damage sometimes starts early in the fall. Take steps early to control rodents before damage begins since there is no quick way of getting rid of these pests. A rodent control program carried on throughout the year is the best way to protect the trees.

Poisoning, shooting, trapping, repellents all help to reduce rabbit damage. Mice are easily controlled by scattering poisoned oats in the planting. Clean cultivation is a great help in avoiding mouse and pocket gopher damage. Weedy plantings attract mice and pocket gophers and may encourage the pests to burrow under the weeds and snow during the winter to girdle a great many trees.

No repellent yet developed will protect the trees under all conditions. When rodents get hungry enough they will eat the trees, repellent included. When hunger conditions are not too severe, repellents help to restrict mice and rabbit damage.

Poison and repellents, including directions for their use, can be obtained from the U. S. Fish and Wildlife Service, Mitchell, South Dakota.

Recommendations contained in this circular have the approval of the South Dakota Farm Forestry Council.
TREES MAKE A GOOD FARM BETTER!

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