Forest Planting on Illinois Farms

Circular 567

UNIVERSITY OF ILLINOIS - COLLEGE OF AGRICULTURE
Extension Service in Agriculture and Home Economics

In cooperation with

ILLINOIS STATE NATURAL HISTORY SURVEY
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This circular is a revision of Circular 477 by the same title
FOR BETTER LAND USE and for erosion control, trees are needed on more than three million acres of Illinois farms which cannot, at the present time, be profitably used to produce annual farm crops.

Much of this acreage was once good farm land but has been ruined by erosion. Good topsoil has been washed away, especially on the steep slopes, and gullies have formed that are still eating into good crop-land and dumping poor subsoil on the fields below. Trees should be planted on this land to protect it from further destruction. They should also be planted on areas where the original forest growth was cleared from soil too poor ever to produce good crops. Trees will thrive on these poorer soils because they have less exacting demands for food and moisture than have the annual farm crops.

That planted forests can be made to produce profitable crops of timber in Illinois has been proved. Fence posts have been grown in six years, Christmas trees in ten years, and timber trees cutting three 16-foot logs in fifty-five years. Ten to fifteen million dollars’ worth of forest products are used on Illinois farms in an average year. Production of even a part of these products on poor cropland or on badly eroded land would have been a long stride toward better land use.

Fig. 1.—A fine stand of timber once covered this rolling land. Illinois has many areas like this, which will some day be as unproductive as the pasture shown on page 5 if measures are not taken to prevent such tragedy.
Starting a forest plantation is neither a difficult nor a costly undertaking. Once the trees are growing, the plantation requires very little care. Of course trees grow comparatively slowly, so it is well for a landowner to plant them early, for the sooner they are planted, the sooner will a wood crop be ready for harvest.

**PLANNING A PLANTATION**

**Areas That Can Be Profitably Utilized**

Idle land, land subject to destructive erosion, and heavily grazed woodlands are three common kinds of areas on which forest trees should be planted in Illinois.

**Idle land.** Land that has become idle or which cannot be profitably used for crops or pasture because of poor soil or soil erosion can be made to produce crops of wood and furnish a haven for wildlife. It is only in this way that such land can ever be made to pay profits again.

**Eroded land.** Where gullies have developed, trees can be used to check further cutting of the banks and prevent further erosion from menacing valuable cropland. In areas of lighter soils, trees can be used to stabilize blowing sand or to develop shelterbelts to protect fields from wind erosion.

**Grazed woodlands.** Woodlands that have been grazed so heavily that grass and weeds have developed generally over the area should be interplanted to insure the renewal of a stand of timber trees. Often the undergrowth of a grazed woodland will be made up entirely of hickory and elm, two low-value timber trees that survive in pastures because their leaves are less attractive to livestock than those of the more valuable kinds. This undergrowth should be severely thinned and the area interplanted with seedlings of the more valuable hardwoods. Evergreen trees, however, should never be used for this purpose, as they will not survive in the shade of the larger trees.

**Native Hardwoods and Conifers Preferred**

Any of the native hardwoods and conifers (commonly known as evergreens) and a few introduced conifers are satisfactory for Illinois plantations. To realize the best financial returns, it is necessary to choose the most valuable kinds that will grow satisfactorily in the particular area selected.

Plantations already established have proved that good financial
returns can be obtained from the conifers. Pines, in particular, make rapid growth and yield high-quality timber. In southern Illinois cypress has possibilities, and in the northern third of the state European larch has outstripped all other trees in rapidity of growth. Altho the wood of conifers is not so valuable, unit for unit, as the wood of some of the better hardwoods, the conifers produce a crop in a shorter time and
<table>
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<th>AREA IN ILLINOIS</th>
<th>CONIFERS</th>
<th>HARDWOODS</th>
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| **General**     | Virginia pine | (Western yellow pine)³⁴
|                 | Pitch pine  | (Japanese red pine)³⁴
|                 | Jack pine  | (Japanese black pine)³⁴
|                 | Red cedar  | Osage orange
|                 |            | Cottonwood |
| **Better sand** (Sumner, Sylvan, Biggs) | Red pine | (Douglas fir)³⁴
|                 | White pine³ | Cypress³
|                 | Pitch pine  | Red cedar |
|                 | Red cedar  | Osage orange
|                 |            | Soft maple
|                 |            | Sycamore |
| **Tight clay** (Cisne, Wynoose) | Virginia pine | (Cypress)³⁴
|                 | Pitch pine  | (Japanese black pine)³⁴
|                 | Red cedar  | Osage orange
|                 |            | (Red gum)³⁴ |
| **Ozark region** | Cypress³ | Soft maple
|                 | Red cedar  | Cottonwood
|                 |            | Sycamore
| **South-central** | Cypress³ | Soft maple
|                 | Red cedar  | Cottonwood
| **Eroded gravelly slopes** (Hickory, Hennepin) | Virginia pine | Shortleaf pine³
|                 | Pitch pine  | Lobolly pine³
|                 | Jack pine  | Red cedar |
| **Rough and stony** | Virginia pine | Shortleaf pine³
|                 | Pitch pine  | Red cedar |
| **Eroded deep loess** (Clinton, Sylvan, Ava) | Shortleaf pine³
|                 | Lobolly pine³ | White pine³
|                 | Virginia pine | Red cedar
|                 | Pitch pine  | Locust (for cover)
|                 | Jack pine  | Osage orange
|                 | Red pine  | Locust
| **Rolling loess soils of the Ozarks** | Loblolly pine³ | Norway spruce³
| **Gravelly ridges** (calc) (Rodman) | Virginia pine | Red cedar
| **Prairie, with permeable subsoil** (Tama) | Virginia pine | Jack pine³
| **Prairie, with impervious subsoil** (Clarence, Elliott) | Virginia pine | Jack pine³
| **Northeast** | Red cedar  | Walnut
|                 | (Virginia pine)³ | White oak
|                 | (Pitch pine)³ | Ash
|                 | (Jack pine)³⁴ | Locust
|                 |            | Catalpa
|                 |            | Osage orange
|                 |            | Tulip³
|                 |            | Sycamore
| **Strip mines** | All species | (Footnotes are on next page.)
they produce more timber per acre at all ages. They are therefore useful where early returns are desired.

Trees recommended for farm forest planting in Illinois under various planting conditions and for the production of various wood crops are listed here and on page 6.

**TREES FOR VARIOUS PURPOSES**

**Lumber**
- White pine (N)
- Red pine
- Shortleaf pine (S)
- Loblolly pine (S)
- Jack pine (N)
- Virginia pine
- Pitch pine
- Norway spruce (N)

**European larch (N)**
- Cypress (S)
- White oak
- Red oak
- Bur oak
- Black walnut
- White ash
- Green ash
- Tulip poplar (S)
- Soft maple
- Basswood
- Cottonwood
- Red Gum (S)
- Sycamore

**Ties and props**
- Red pine
- Shortleaf pine (S)
- Loblolly pine (S)

**Red cedar (•)**
- Pitch pine
- Jack pine (N)
- Virginia pine

**Poles and posts**
- European larch (N)
- Cypress (S)

**Osage orange**
- Black locust
- Hardy catalpa

**Christmas trees**
- Norway spruce (N)
- Douglas fir (N)

**Red cedar (•)**
- White spruce (N)

**Gully control**
- Black locust (plant other trees between gullies according to soil and use desired)

**Field windbreaks**
- Osage orange or any of the evergreens adapted to the planting site

**Note.—** (N) Plant only in northern half of state. (S) Plant only in southern half of state. (•) Do not use red cedar where there is danger of transmitting cedar-apple rust to apple orchards.

**(Footnotes for table on page 6)**

1 These are the joint recommendations of the Agricultural Experiment Station, Agricultural Extension Service, State Division of Forestry, State Natural History Survey, U. S. Soil Conservation Service, and U. S. Forest Service.

2 The soil series mentioned are merely representative examples.

3 White pine, jack pine, Norway spruce, Douglas fir, and larch are recommended for the northern half of the state. Shortleaf pine, loblolly pine, cypress, tulip tree (yellow poplar) and red gum are recommended for the southern half.

4 Species in parentheses are suggested for experimental or trial use. They are not recommended generally.

5 Strip-mine spoil banks cannot be included in a soil classification. The material is highly variable in many respects. The selection of species must be based on local conditions. Each of the species recommended for the state may be adapted to some strip-mine condition.
Mixed Plantations Are Usually Best

A mixed plantation is a plantation made up of two or more kinds of trees; a pure plantation is made up of only one kind. Mixed plantations are preferred because they tend to establish more natural forest conditions, to insure against serious losses from insects and diseases, and to provide a wider variety of wood crops. Conifers and hardwoods, however, should not be used in the same plantation, for there is no evidence that such a mixture will prove satisfactory in this state. A mixture of two or three conifers or three or four hardwoods should be sufficient and will not seriously complicate the job of planting.

Black locust should be planted pure. Cypress, because of its adaptation to bottomland soils, will probably be used best in pure plantations.

When to Use Seedlings and Transplants

Small trees are usually offered by nurseries for sale in sizes best suited for forest planting, but among the conifers there is sometimes a choice between seedling stock and transplant stock. Seedlings have been grown one, two, or three years in seedbeds and have never been moved. Transplants have been transplanted into rows after one or two years in the seedbeds, and because of the transplanting have developed stronger, more compact root systems.

For white pine, red pine, Norway spruce, Douglas fir, and red cedar, transplants are preferred to seedlings. They will better withstand the competition of weeds and grasses and will become more quickly established in the field, thereby giving greater assurance of success. Shortleaf pine, loblolly pine, jack pine, Virginia pine, pitch pine, cypress, and European larch grow so rapidly in the nursery that they are seldom transplanted, and they may be used satisfactorily as seedlings. Transplants cost more to produce than seedlings, and in some instances the matter of cost may be the deciding factor in a choice between the two kinds of planting stock. Hardwood trees develop such large roots in the nursery that they are usually sold only as one-year-old seedlings.

The largest coniferous transplants will probably not be more than 18 inches high, and seedlings may vary from 4 to 12 inches. Hardwood seedlings usually are 8 to 24 inches high, excepting black locust, which may vary from 6 to 36 inches in one-year-old seedlings.

Planting stock of the most valuable trees for Illinois is grown in nurseries operated by the Division of Forestry of the State Department of Conservation. Several private nurseries also specialize in growing trees for
forest planting. Availability and costs of various kinds of planting stock change from year to year, and specific information may be had at any time by writing to the Extension Forester, University of Illinois, Urbana, Illinois.

Spring Is Best Time to Plant

Spring is the most favorable time for planting forest trees. The planting should be done as soon as the frost is out of the ground and the soil can be worked easily, so the trees may have the advantage of early spring rains and may attain good growth before late spring droughts occur. In the southern part of the state the planting season may start in early March, while in the extreme northern counties trees often cannot be planted until the middle of April.

Planting in the fall may be done on light porous soils but is not generally recommended. Fall-planted trees have no opportunity to take hold in the soil with new roots and are often seriously damaged by frost heaving during their first winter. The only point in favor of fall planting is the economy of getting the planting work done without interfering with routine spring work, but usually trees can be planted before fields can be plowed or oats seeded.

Include Food and Cover for Wildlife

The demand for recreation areas is constantly increasing, and it is evident that wildlife management is necessary if the needs of the people are to be met. A demand for good-quality paid shooting has already been voiced by numbers of Illinois sportsmen; and farmers could dispose regularly of a game crop at a profit if a good stand of quail and other small game were available on their lands.

The landowner who is carrying out a tree-planting program is in a position to add his bit to wildlife conservation as well as to his income. While a solid coniferous plantation is not favorable to wildlife because, compared with open, weedy or brushy patches, it is practically barren of food plants and favorable ground cover for game, conifers do provide excellent winter cover, especially along the borders of a plantation. A coniferous plantation broken by open patches in which woody food and cover plants have been planted along with patches of grain makes an ideal game area.

An excellent example of what can be done in combining reforestation and wildlife conservation exists in western Illinois. Here a 10-acre

\footnote{Prepared with the assistance of R. E. Yeatter, Game Specialist, Illinois State Natural History Survey, Urbana, Illinois.}
field was so badly eroded that it could no longer be farmed, even for pasture, and several gullies too deep to be crossed had formed. To check erosion and to put the land to profitable use, conifers, principally pines, were planted between and around the gullies but not on the gully margins or in the gullies. Some willows were planted in the bottoms of

the gullies, and a few Russian mulberries were planted around the edges. The open spaces between the blocks of conifers were from 50 to 150 feet wide. The trees stopped the rapid run of water from the field, and the gullies soon grew in with briars, weeds, and grasses. This 10-acre area, which was once bare, open land now harbors quail, woodcock, rabbits, and several species of song birds.

Planting for wildlife conservation can be made a part of any tree-planting program, and the food and cover plants set out at the same time. It is not necessary to set out a large number of plants; a few well-selected ones set in favorable places will do a lot of good. A large selection of game food and cover plants is usually available from commercial growers of ornamental shrubs. Many of the most useful food and cover plants are native and can be found locally, the only cost in putting them in a plantation being the time and labor of transplanting.
For game food, cover, and erosion control

Barberry, Japanese, *Berberis thunbergii*

Bittersweet, *Celastrus scandens*

Blackberry, *Rubus allegheniensis*

Buckthorn, *Rhamnus spp.*

Cherry, wild, *Prunus spp.*

Coralberry, *Symphoricarpos orbiculatus*

Cranberry, highbush, *Viburnum opulus*

Dogwood, panicled, *Cornus racemosa*

Elderberry, *Sambucus canadensis* and *S. racemosa*

Grape, wild, *Vitis aestivalis* and *Vitis cinerea*

Hazel, *Corylus americana*

Honeysuckle, *Lonicera tartarica*

Juneberry, *Amelanchier canadensis*

Mulberry, red, *Morus rubra*

Plum, wild, *Prunus americana*

Raspberries, *Rubus spp.*

Roses, *Rosa spp.*

Sheepberry, *Viburnum lentago*

Snowberry, *Symphoricarpos albus*

**CONIFERS FOR ILLINOIS**

Further information about the conifers listed on pages 6 and 7, their adaptability to certain soils and sites, and their uses are given in the following paragraphs.

**White pine** (*Pinus strobus*). White pine is native to northern Illinois, but all evidence indicates that it will grow well on timber soils throughout the entire state. It is adapted to a wide variety of soils but should not be planted on land subject to overflow nor on very poor, dry land. The growth of white pine in suitable locations is exceptionally good in Illinois, some trees making saw logs in 40 to 50 years. The wood is light, soft, straight grained, and easily worked. It has a wide variety of uses and is always in demand on the market.

In practically all its native habitats, white pine has been attacked by the white pine blister rust, a fungous disease which spends part of its life cycle on currant or gooseberry leaves. The blister rust has not been found on white pine in Illinois, but as a precautionary measure all currant and gooseberry plants should be removed from the white-pine plantation and from an area not less than 1,000 feet wide surrounding the plantation.

**Red (Norway) pine** (*Pinus resinosa*). Red pine is a native of the lake states and the northeastern United States but it is probably the best all-around coniferous tree for reforestation in Illinois because of its adaptability to difficult planting sites and its relative freedom from insects and disease. Its requirements are like those of white pine except that it will grow on poorer soils and is more drouth resistant. Its growth also compares well with white pine, and the wood, although heavier and more resinous, is used for much the same purposes.

**Shortleaf pine** (*Pinus echinata*). Shortleaf pine is a southern yellow pine which is found native in southern Illinois on poor, dry ridges of the Ozarks. It is adapted to practically all except wet soils and will grow on the poorest, driest soils. Its growth is very rapid, but the wood is heavy and hard, not so valuable as white pine, but widely used for construction and
Fig. 6.—Red pine is probably the best all-round coniferous tree for reforestation in Illinois. It will grow on poorer soils and is more drought-resistant than white pine. The stake in this eight-year old plantation on sand land is 3 feet high.

Fig. 5.—A red and white pine mixed planting on sand land in Henderson county. Photograph was taken eight years after the trees were set out. The stake is 3 feet high.
general lumber. This tree is useful in the southern third of Illinois, where poor planting sites and dry conditions are often encountered.

**Loblolly pine** (*Pinus taeda*). Loblolly pine is another yellow pine, native of the South, which makes a good showing in southern Illinois. It demands more soil moisture than shortleaf pine and is not adapted to very poor, dry sites. The loblolly pine is one of the fastest growers of the yellow-pine group. The wood is hard, resinous, and coarse-grained, with marked contrast between the spring and the summer wood. Planting of this pine should be restricted to the southern end of the state.

**Pitch pine** (*Pinus rigida*), **Jack pine** (*Pinus banksiana*), **Virginia pine** (*Pinus virginiana*). Pitch, jack, and Virginia pine are yellow pines which have been introduced into Illinois and will grow on the poorest, driest soils. Their growth is rapid, but the wood is hard, coarse, and brash, and their uses are more limited than are those of the other pines. They have possibilities for use as ties and mine props and may prove valuable for growing such crops on extremely poor sites. Jack pine should be used in the northern half of the state and Virginia in the southern half.

**Norway spruce** (*Picea abies*). Norway spruce can grow throughout Illinois but reaches a greater height in the northern part of the state. In growth it compares well with white pine. Like pine, it is short-lived on the prairie. The wood is light, soft, and strong, and makes good light lumber. Probably the best use for Norway spruce in this state will be for windbreaks and for Christmas trees, with the possibility of leaving thinned Christmas tree plantations to grow up to produce timber. This conifer makes an excellent Christmas tree, having a rich green foliage and an even pyramidal form.

**Douglas fir** (*Pseudotsuga taxifolia*). The Douglas fir is a native of the western part of the United States. The Rocky Mountain form is well adapted to the northern two-thirds of Illinois. As a Christmas tree it is even more satisfactory than Norway spruce since it will hold its needles for a longer time when kept indoors. It forms a dense pyramidal tree. The needles have a bluish cast, sometimes nearly equal to that of blue spruce.

**European larch** (*Larix europaea*). The European larch is a close relative to the tamarack found in northern Illinois, but unlike the tamarack it cannot stand excessive moisture. It prefers a deep, fresh, but well-drained soil, and is adapted only to the northern half of the state. Larch grows rapidly, making better height growth than any other conifer adapted to northern Illinois. The wood is heavy, hard, and durable in contact with the soil. It is excellent for posts or poles and makes good rough lumber for general farm building and repair work. Several plantations of European larch set out 50 to 60 years ago have proved its value for farm plantings where rapid production of timber is desired for home use (Fig. 7).

**Red cedar** (*Juniperus virginiana*). Red cedar is a native thruout most of Illinois and is adapted to planting on extremely poor, dry soils, especially where a calcareous condition exists. The greatest use of red cedar is for fence posts, altho it is used also for the lining of closets and chests because the spicy odor of the wood repels clothes moths. Red cedar is an alternate host for cedar-apple rust and should not be planted where there is danger of transmitting this disease to apple orchards.
European larch, with its rapid growth and heavy durable wood, has proved its value for farm plantings where timber for home use is desired. This 55-year-old plantation contains 30,600 board feet of timber to the acre.

Cypress (Taxodium distichum). The cypress is native to southern Illinois, being found in deep swamps and wet bottomlands. It needs an abundance of moisture and should therefore be planted only on soils where the water table is usually high. Plantings should be confined to the southern part of the state. The growth of cypress is usually slow, but in a plantation on bottomland in Union county young cypress trees are making growth equivalent to pine. The wood is light, soft, easily worked, and is very durable in contact with the soil. In reforestation work the cypress is useful on wet bottomlands where other conifers could not survive.
HARDWOODS FOR ILLINOIS

White oak (Quercus alba). White oak is the commonest hardwood tree of Illinois and the most important commercially. It grows abundantly throughout the entire state but is not adapted to wet bottomland nor poor, dry soils. It makes its best development on deep, fresh loams. The growth of white oak is slow compared with the conifers, taking from 55 to 65 years to produce a 10-inch tree. The wood is heavy, strong, hard, tough, close-grained, and durable. It is used for construction, furniture, flooring, interior trim, cooperage, wagons, and implements, and makes an excellent fuel wood.

Red oak (Quercus borealis). The red oak is not so abundant as the white oak in Illinois, but it is nearly as well distributed throughout the state. It grows best in well-drained loam, or clay loam, and in forest growth makes a tall, straight tree with a clear trunk. The growth is a little more rapid than white oak. The wood is hard, strong, and straight-grained but not very durable. It is used for construction, furniture, flooring, interior trim, and ties, and is good fuel wood.

White ash (Fraxinus americana). The white ash is found throughout Illinois, making its best development on deep, fresh soils in bottoms or on lower slopes. It grows fairly fast, developing a 10-inch tree in 50 to 60 years. The wood is hard, strong, tough, and elastic, and these properties combined with its light weight make it very valuable. It is used for handles, agricultural implements, bats and athletic equipment, bending stock, and general manufacture. This tree is useful either for open field planting or for interplanting in woodlands.

Green ash (Fraxinus pennsylvanica lanceolata). Green ash is not so widely distributed in Illinois as white ash. It is well adapted for reforestation and may be used for much the same purposes as white ash.

Black walnut (Juglans nigra). Black walnut is the most valuable tree species found in Illinois. It is common throughout the state, but, contrary to general belief that black walnut will grow well anywhere, its satisfactory development as a commercial tree is limited to moist, fertile soils. About 35 to 40 years are required to grow a 10-inch tree. The wood is hard, strong, durable, and moderately heavy. The rich chocolate-brown color of the heartwood, its ability to take a high polish, and its freedom from warping and checking make walnut highly valuable for furniture, cabinet work, and interior trim. The nuts are also highly prized and make a good commercial crop. This tree may be used for open field planting or for interplanting woodlands, but should always be mixed with other trees. Favorable associates are ash and tulip poplar.

Tulip poplar (Liriodendron tulipifera). The tulip poplar, also known as tulip tree and yellow poplar, is native to southern Illinois, making its best growth in deep, moist soil along streams and in cool, moist ravines. It is a rapid grower, making a 10-inch tree in 30 to 40 years and developing a tall, straight, clear trunk. The wood is light, soft, and easily worked, and has a high commercial value. It is used for lumber, interior trim, veneer, vehicle bodies, and general manufacture. The planting of tulip poplar should be restricted to fresh loams and clay loams.
Fig. 9.—Cottonwood makes its best growth where there is plenty of water in the soil. This plantation on blow sand in Whiteside county was produced in twelve years. The front tree is 47 feet high and 12.5 inches in diameter.

Fig. 8.—Basswood is particularly suited to well-drained loams or clay loams. These 49-year-old trees are part of the University of Illinois forest plantation at Urbana in Champaign county.
Basswood, or Linn (*Tilia americana*). Basswood is fairly well distributed throughout the state, occurring on rich wooded slopes, moist stream banks, and cool ravines. It makes rapid growth, developing a 10-inch tree in 30 to 40 years. The wood is light, soft, and tough but not durable. It is widely used for woodenware, boxes, novelties, turning, and for lumber where light weight is essential. Basswood may be planted on moist to well-drained loams or clay loams, and should be used in the northern half of the state for such situations as tulip would be used in the southern half.

Silver maple, or soft maple (*Acer saccharinum*). Silver maple is common throughout Illinois, occurring naturally on bottomlands and other moist soils. It is well adapted to bottomland planting and its rapid growth gives it an important place among Illinois timber trees. The wood is light, even-grained, and moderately weak. Commercially it is used principally for furniture and pulpwood, but as farm lumber it can be put to a wide variety of uses in general construction.

Cottonwood (*Populus deltoides*). Cottonwood is common throughout Illinois but is most successful on sites where plenty of moisture is available. It will grow on sandy soil where water is usually not far below the surface, as well as on moist bottomlands. The cottonwood grows very fast and to large size. It will produce a 10-inch tree in 15 to 25 years. The wood is light, soft, and fine-grained but fairly tough. It is used for boxes, crates, excelsior, pulp, and light lumber. For reforestation the cottonwood is useful on bottomlands subject to overflow where other trees cannot survive and on sandy soils. It may be planted as seedlings or cuttings. For the best results seedlings should be cut back halfway to the ground as soon as planted.

Red gum, or sweet gum (*Liquidambar styraciflua*). The red gum is a common lowland tree in southern Illinois. It is adapted to planting in the southern third of the state on bottomland or other moist soils. The wood is heavy, moderately hard, and close-grained. It has a wide variety of uses for lumber, furniture, pulp, and veneers.

Sycamore (*Platanus occidentalis*). Sycamore occurs throughout the state, most commonly along streams and on bottomlands. It is considered the largest hardwood tree in North America and is one of the more rapid-growing trees. The wood is hard and moderately strong. It is used mostly for furniture and interior trim but also makes good farm lumber.

Black locust (*Robinia pseudoacacia*). Black locust, altho native to southern Illinois, is now found throughout the state on practically all except wet soils. It is a very rapid-growing legume and develops a spreading, fibrous root system which has made it useful for erosion control. Planted on gully banks, this tree has checked soil erosion and at the same time produced trees in six years large enough to cut 7-foot posts with 4-inch tops. The wood is heavy, hard, strong, and very durable in contact with the soil, and is widely used for fence posts.

The black locust is generally attacked by the locust borer, and plantations may be destroyed by this insect unless the trees are making rapid growth. Black locust should not, therefore, be planted on extremely dry, poor sites, except where erosion control is imperative and where the wood crop is not an important consideration.
Osage orange, or hedge (*Maclura pomifera*). The Osage orange is well known throughout Illinois, where it has been extensively planted to form hedge fences. The wood is heavy, exceedingly hard, strong, and very durable in contact with the soil. It is the most durable wood for fence posts that can be grown in Illinois. When set out in a solid plantation and trained by pruning, it makes a straighter tree than when grown in fence rows. Osage orange is not so fast-growing as black locust; trees large enough for fence posts are produced in 15 to 20 years.

Hardy catalpa (*Catalpa speciosa*). Catalpa is native to the Wabash valley in Illinois but is adapted to the better soils throughout the state. It grows rapidly and its soft, light, durable wood is useful for posts and poles. The catalpa is only a medium-sized tree but will produce saw logs which make excellent lumber for farm construction.
PLANTING SEEDLINGS AND TRANSPLANTS

Preparing the Site

General plowing rarely desirable. Areas that are to be reforested are usually not suited for farming and cannot be easily plowed or fitted. Usually Illinois land to be reforested is land that has been abandoned for farming because of soil erosion, and general plowing would only increase this trouble.

An exception to the rule against general plowing is in the fitting of level land for a specialized crop, as when black locust is planted for a post crop or evergreens are planted for Christmas trees. The land is plowed and fitted before planting and cultivated after planting. Gully sides also may be plowed down to prepare a site for black locust, but this is expensive and is recommended only where the gullies are so steep that the soil has to be sloped to make tree planting possible.

When trees are to be planted on grassland, the sod is removed from an area about 18 inches square and the tree is placed in the center of this open space, or the area is furrowed, as described below.

Shallow furrows may be used on level areas. Shallow furrowing is advantageous on sandy soils and may be used on other soils provided the area is fairly level. Furrowing should not be done on slopes unless a person experienced in laying out level contours is available for the job, for a furrow dipping downhill will cause water to collect at the low point and may start a serious gully. Where furrows are used, the trees should be planted in the furrow and not on the turned-over sod.

Weed trees can be poisoned. If weed trees, such as thorn apple, black jack oak, and hickory, are so numerous as to interfere with the plantation, they may be killed with sodium arsenite. The poison is used in a solution — 1 pound to 2 pints of water — and poured into ax cuts made thru the bark near the base of the tree. Edges of the cuts should be not more than one inch apart, and only enough solution used to fill each cut. To be most effective, this work should be done in November or early December.

Small brush may be left. Small brush need not be removed from the planting site. Where it can be left in strips or patches, it will provide open areas for wildlife. Scattered thorn apple, wild crab, plum, and cherry should also be left near such open patches and along the borders of the plantation.

1More detailed instructions are available in a mimeographed leaflet, “Killing Undesirable Trees With Poison.” Address EXTENSION FORESTER, UNIVERSITY OF ILLINOIS, Urbana.
Fig. 11.—Trees can be planted in shallow furrows where the soil is level or can be plowed on the contour. These men can set about 500 hardwoods in a day.

Fig. 12.—A Two-man crew can plant 600 to 1,000 coniferous seedlings or transplants in a day. Hardwood trees (Fig. 11) are slower to plant because of the large roots.
Plant Nursery Stock Promptly

Nurseries usually ship trees by express in burlap bundles with roots packed in moist moss. The purchaser is notified when his trees are shipped, and he should keep in close contact with the express office so he can take the trees to the planting site immediately after they arrive. Delay may cause heating and killing of roots. At the planting site the trees should be promptly unpacked, heeled-in, and planted.

By heeling-in is meant the placing of the trees upright in a trench and the packing of soil firmly around the roots to keep them moist. To do this make a trench deep enough to accommodate the roots without bending them, and make one side of the trench even and slightly sloping. Cut the strings around the bundles of trees and spread the trees along the side of the trench. Replace the soil and be sure that it is worked in around the roots and packed tightly. Do not leave any roots exposed. After the trees are heeled-in, water the trench thoroughly and put up a burlap or board shade if the trench was not made in a shady place.

Keep Tree Roots Moist

Trees should be carried in the field in a galvanized bucket about one-fourth filled with water in order to keep the roots moist during planting. The bucket can be loosely filled with trees from the heeling-in trench, and the roots kept moist while being carried in the field.

Before taking hardwood seedlings into the field, prune off any broken roots above the break with a smooth slanting cut to lessen possibilities of root decay. If coniferous seedlings or transplants have exceptionally long roots, prune off those that are longest and most straggling but be careful not to remove more than one-fifth of the root system. At the planting site take the trees from the bucket one at a time as each hole is prepared.

At all times be careful to keep the roots of the trees moist. Drying of the roots will kill the trees.

Vary Spacing With Kind of Tree

A spacing 6 by 6 feet is recommended for most planting. This spacing will require 1,200 trees to the acre. Christmas trees may be planted 4 by 4 feet, or 2,700 to the acre, since the crop will be harvested before serious crowding develops. Black walnut, tulip poplar, and European larch should be given more room than other trees, or 8 by 8 feet; and other species, when mixed with walnut, will require an 8-by-8-foot spacing, which means 680 trees to the acre.
When interplanting woodlands, regular spacing is seldom possible; the trees are placed irregularly in the open areas. The more open the woodland, the denser the planting required. Where there is no undergrowth in the woodland, the spacing should be as nearly equivalent to 8 by 8 feet as possible.

### Organized Crew Speeds Work

Tree planters can work best in pairs, one man digging holes and the other planting the trees. If four men are available, they can best work as two pairs.

Two men can usually plant an average of 500 hardwood trees in a day. Under favorable conditions or as experience is gained, this rate may be considerably increased. Coniferous seedlings and transplants usually do not need as deep holes as hardwoods and can be planted much faster, two men often putting in a thousand trees a day.

*When planting is done by two, three, or four workers*, straight rows can best be kept by means of flags set up in accordance with the spacing and direction of the rows to be made (Fig. 13).

*When a large planting is to be done*, a party consisting of several
pairs of men and a foreman is most effective. The simplest way to keep such a party organized in the field is to use a guideline marked with the spacing to be used in the plantation (Fig. 14).

When the field that is to be planted has been plowed, the spacing of the trees can be easily laid out by marking the field two ways with a corn planter.

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**Fig. 14.**—When large areas are to be planted, lining and spacing the rows with a guideline is recommended. For the above guideline 6 pairs of men are needed: 1 pair at each mark on the line and two more men to run the line. The men on the line stand behind it, two at each mark. As soon as they are in their places, the two linemen move the guideline forward by ending-over the poles, which are equal in length to the spacing to be used. As soon as the first set of trees is planted the whole party moves up to the line, and the line is again moved forward.

By this system, the party is kept compact and under easy supervision, and no time is wasted in figuring out spacing. The linemen may have to set up flags across the field to keep the first strip straight, but thereafter the line across the field is kept straight by simply following the last row of trees planted.

**Planting Tools Are Simple**

For practically all types of planting the grub hoe (Fig. 15) is the most satisfactory tool. Where hardwoods with long taproots are to be planted and the soil is not stony, a tiling spade is effective. In planting
cuttings or seeds of the oaks or nut trees, a planting bar is most satisfactory. The only equipment needed other than digging tools is a 12- or 14-quart bucket for each crew.

Fig. 15.—Four tools most commonly used for tree planting are the grub hoe, round-pointed shovel, tiling spade, and planting bar (left to right).

Several Methods of Planting

There are several good methods for planting trees and each has its merits. Two of the most common and most successful are the hole method, in which any tool can be used with which a hole can be dug, and the grub-hoe slit method, in which only the grub hoe is used. Whatever the method, care must be taken to set the trees upright in the hole, at the same depth at which they stood in the nursery, and to pack the soil firmly about their roots.

Hole method. This method can be used on all types of soils and is particularly well adapted to hardwood seedlings which have long
Fig. 16.—Hole method of tree planting is suitable for all types of trees and soils. Two persons form the planting crew. (See pages 24 and 26 for description of these three operations.)

Fig. 17.—Grub-hoe slit method of tree planting is best for evergreen seedlings or transplants. With this method one person can work alone (see directions on page 26) or two can work together.
taproots. Two persons, one to dig holes and the other to plant trees, form the crew.

First remove a square of sod and dig a hole in the center of this open space (Fig. 16-A). Vary the width and depth with the size of the roots of the tree to be planted. Pulverize the soil that is taken out and pile it in a mound beside the hole (Fig. 16-B). The one who is doing the planting places a tree immediately in each hole before the soil dries out (Fig. 16-C), spreading the roots of the tree in a natural position in the hole. The soil is then worked in around the roots and packed firmly, the feet being used to do the packing after the hole is completely filled.

**Grub-hoe slit method.** The grub-hoe slit method is adapted mostly to evergreen seedlings or transplants since it does not make a hole deep enough for most hardwood seedlings. This method, however, is simple and rapid and is adapted to use in all soils except those that are excessively stony or very loose and sandy. Even in sandy soil it may be used readily after a rain when the sand is still moist. One person can work alone when using this method or two persons can work together, one wielding the grub hoe and one planting the trees.

To plant by the grub-hoe slit method, first clear away a square of sod, strike the blade of the grub hoe in the ground to its full depth at the far side of the open space (Fig. 17-A), raise the handle, and with the same motion twist it to one side slightly so as to open the ground at the end and along one edge of the grub-hoe blade. Insert the tree in this hole in an upright position (Fig. 17-B), shake the tree to spread out the roots, remove the grub hoe, and allow the soil to sink back into the hole. Then tramp this soil firmly into place with the heel (Fig. 17-C).

**Other methods.** The use of furrows has been mentioned previously, and warning is again given not to use furrows on steep slopes unless accurate contour lines can be laid out and followed. Where furrows are used on slopes, the ridge should be turned downhill. In planting in furrows, the trees should not be set on the ridge nor against the land side, but in the furrow next to the ridge (Fig. 18-A).

**Testing the planting.** Whatever method is used, test the planting job occasionally by grasping the tree by the top and tugging at it lightly. If the tree remains firm in the soil, it is planted well; if it loosens, it is planted poorly and should be reset.
Fig. 18.—Three other types of planting
A — The single furrow can be used on sandy soil or other soils if the land is level or if the furrows can be plowed on the contour. When planting in furrows, always set the tree in the furrow, against the ridge.

B — On bottomland, where the site is ordinarily too moist to get trees started, fall plowing of two furrows, with ridges thrown together, will make raised strips on which trees can be planted the following spring.

C — On sides of gullies best results are obtained by placing each tree on a shelf cut in the side of the bank and sloping back slightly. Shelf acts as a small terrace — retarding runoff water, holding moisture, and reducing erosion. Shelf should be at least 18 inches square. Plant tree at point where original surface of slope meets the shelf.

PLANTING WITH SEED AND CUTTINGS

Nut and Oak Trees Can Be Started From Seed

Altho seedlings or transplants are most commonly used for starting a forest plantation, there are a few trees, particularly black walnut and the oaks, which can be started successfully in the field direct from seed. This method is inexpensive since the seed (nuts and acorns) can usually be collected locally. Another advantage is that the long tap-roots of the seedlings can develop without breaking, an accident that often happens to nursery-grown stock.

Seed for planting should be collected in the fall, layered in moist sand or peat moss during the winter, and planted in the spring. (If planted in the fall, squirrels and other rodents may cause severe losses.) It can be stored safely in a pit or in a wooden box placed in a pit, with alternate layers of seed and moist sand 2 to 3 inches thick. The pit must be well drained and should be covered with soil. Red-oak acorns may be air-dried for a short time before being stored, but white-oak
acorns should be gathered and stored as soon as they fall from the trees. The pulpy outer shuck should be removed from black walnuts before they are stored.

Nut planting should be done as early in the spring as possible. Clear a space about 18 inches square, loosen the soil, plant the nut in the center, and firm the soil over it. Where the nuts fail to come up, replant the following year.

Direct seeding is useful in restocking woodlands where it would be difficult to dig holes in the root-filled soil.

**Cuttings Used for Cottonwood and Willow**

Cottonwood, often planted on moist bottomland, and willow, planted along stream banks and the bottoms of gullies, can be planted as cuttings. Cuttings may be bought from commercial nurseries or collected locally. They should be collected in the fall after the leaves have fallen, and stored over winter.

To make cuttings, cut sections 8 inches long from the branches of the cottonwood or willow, being sure that these are taken from one-year-old wood and that each cutting includes at least three buds. To store the cuttings, tie them in convenient-sized bundles and bury them in the soil in a well-drained place. Or place them in moist sand or peat moss in a wooden box and bury the box in the soil.

Planting should be done in the spring as soon as the frost is out of the ground. Place the cuttings in the soil vertically with the buds pointing upward and with one bud above the surface. A planting bar, a light crowbar, or a dibble made from any long, wooden tool handle will be satisfactory for this work. Thrust the bar into the soil deep enough to make a hole to take the cutting, insert the cutting in this hole, then thrust the bar into the soil at the side of the hole and push the soil solidly around the cutting.

**CARE OF THE PLANTATION**

**Provide Protection Against Injuries**

Once a plantation is well established it needs little work other than protection against injuries. Damage from grazing, fire, insects, and disease must be guarded against.

Livestock of all kinds must be kept out of a plantation. They destroy trees by browsing, injure them by trampling, and pack the soil. Land that is needed for permanent pasture and can be successfully developed for this purpose should not be planted to trees.
The best fire protection is *fire prevention*. Careful watch should be kept for fires that may burn into the plantation. The help of neighbors should be enlisted in watching for fires and using care in burning refuse.¹

Forest fires destroy not only the trees themselves but also wildlife and food and cover for wildlife. If the conservation of wildlife is made a part of a reforestation program, sportsmen will be interested in helping protect such plantations from fire. Fire lines made by plowing six to eight furrows around the plantation will give good protection. Where furrows plowed down a slope would increase the erosion problem, a fire line can be made by clearing a strip of weeds and brush and keeping this strip cleared except for a close sod.

Insects and diseases may injure plantations, but this subject is too broad to be discussed here. Protection consists of watching for evidence of outbreaks of diseases or insects, identifying the pest, and applying control measures.²

**Replanting Sometimes Necessary**

Loss of trees in a new planting is not likely to be more than 5 to 10 percent if the job has been well done and the seasons are favorable. If more than 20 percent of the trees are lost, the stand will not be dense enough to develop a satisfactory forest and the fail spots should be replanted. Replanting should be done in the season after the losses have occurred, and if possible stock larger than the original stock should be used.

**Cleaning, Pruning, and Thinning**

Volunteer native growth of inferior trees may come up in a planted field and seriously interfere with the development of the plantation. If this happens, it will be advisable to clean the plantation by cutting back the interfering trees. These need not be cut off close to the ground; they will sprout less if lopped off two or three feet above the ground. A heavy corn knife is a convenient tool for this work.

To produce clean, high-quality, knot-free logs, it is advisable to

¹Detailed information about Illinois forest fire laws is provided in a pamphlet, “Illinois Forestry Laws,” which can be obtained without charge from the Division of Forestry, Department of Conservation, Springfield, Illinois. Distribution of this information to neighbors and local sportsmen’s organizations should be helpful in reducing fires.

²To identify forest tree pests, send specimens of their damage to Extension Forester, University of Illinois, Urbana, or obtain a copy of Circular 509, “Protecting Shade Trees From Insect Damage,” from the farm adviser in your county or from the College of Agriculture, University of Illinois, Urbana.
prune planted forest trees. The trees are planted close together so that they will make rapid, straight height growth and will kill off the lower side branches by shading. The dead side branches, however, may persist for several years, and each branch forms a knot as long as it stays on the tree. Pruning need not be done until the trees are 3 to 5 inches in diameter at breast height, and then only the best trees should be pruned. The trees selected for pruning should be spaced about 12 to 15 feet apart so as to make a final stand of 200 to 300 trees per acre. The poorer trees will come out eventually in thinnings.

Evergreens should always be pruned with a saw. The branches should be cut off flush with the bark of the main stem. It is not harmful to remove a few live branches, but pruning should be confined to the lower half of the tree. In black-locust plantations early pruning may be necessary to assure development of straight fence posts since these trees often fork. Orchard pruners may be used for locust and some other hardwoods. The branches removed should be left on the ground to decay and return to the soil.

**COSTS AND RETURNS**

**Costs Range From $12 to $18 an Acre**

The cost of establishing a forest plantation will often determine the amount of planting that can be done in any one year. Costs will vary with the cost of the trees, including shipping charges; prices of labor and planting experience of the labor; type of ground cover, kind of soil, and method of planting.

Two men working together may plant anywhere from 500 to 1,000 trees a day. Under these conditions costs will run from $12 to $18 an acre. If trees are purchased from the Division of Forestry of the State Department of Conservation at $5 a thousand, the cost of establishing plantations will average about $15 an acre. With more expensive trees, the cost will be proportionately greater.

It should always be kept in mind that careful planting is worth more than low cost. A hurried job may mean a heavy loss of trees and necessitate replanting, which may make the cost double what it would have been with careful planting in the first place.

**Returns From Illinois Plantations**

Altho it is hard to say what returns may be expected from any one kind of tree over a period of years, the outlook for future timber prices
is bright. The value of standing timber seldom goes down and will probably tend to rise. Furthermore planting costs are being reduced by the development of less costly planting stock, better planting methods, and the availability of information that will help a tree planter do a better job. The landowner who plants trees today can do so at minimum expense and can probably expect greater returns from his wood crop in the future than he could expect on the market today.

Some forest plantations in Illinois that have reached merchantable size indicate what can be expected from reforestation.

European larch in Bureau county. A 55-year-old planting of European larch in Bureau county when measured in 1937 was found to contain trees over 20 inches in diameter at breast height that scaled 30,600 board feet of merchantable timber to the acre (Fig. 7, page 14). Occasionally a few trees had been taken out to furnish lumber for building or repairs, and every tree cut three 16-foot logs besides the topwood. This is by no means as good growth as these trees could have made had they not been overcrowded for the past twenty years. Studies of stumps showed that the trees had made about three-quarters of their growth in the first 35 years. Based on 1937 price of lumber
commonly used for the purpose for which the larch was used, this plantation had a value on the stump of $460 an acre.

**White pine in Wayne, Ogle, and Grundy counties.** A plantation of white pine in Wayne county grew trees 12 inches in diameter at breast height in 25 years. If this growth continues, these trees will make good merchantable logs in 40 years, totaling about 40,000 board feet an acre and worth at least $600 on the stump, which represents an annual earning of $15 an acre. White pine planted on sandy soil in Ogle county has reached 14 inches in diameter in 33 years and will be merchantable as saw logs when 50 years old. Another plantation of white pine, in Grundy county (Fig. 20), contained 27,000 board feet to the acre and reached merchantable size in 50 years.

![Fig. 20.---Merchantable pine logs were produced in fifty years in this white-pine plantation in Grundy county. When this photograph was taken there were about 27,000 board feet of timber to the acre.](image-url)
Christmas trees. The growing of Christmas trees deserves more attention in Illinois. These trees are shipped from as far as the West Coast while thousands of acres in this state lie idle and subject to soil erosion.

From one Christmas-tree plantation in Livingston county set out in 1932 with 1,200 trees to the acre an average of 40 cents a tree was being realized in the winter of 1936-37. About 1,000 trees an acre survived, and at this rate the plantation was worth about $400. Costs were about $50 an acre, leaving a net earning of $70 an acre a year. This plantation is on better soil than would ordinarily be reforested, but if it took these trees 15 years to become marketable, the return would still be about $20 an acre a year.

Black locust in Schuyler county. The black locust is another tree that produces a marketable crop, in the form of fence posts, in a short time, but this tree should not usually be planted with other trees. In 1931 a planting of black locust was made on badly eroding land in
Schuyler county to stop gullies from cutting into good cropland. These
trees completely checked the erosion and in six years cut 500 fence
posts to the acre (Fig. 10, page 18).

**Other Illinois hardwood plantings.** In a recent study of some
early plantings of hardwoods in Illinois, considerable variation in
growth was noted between species and between soil sites. Black-
walnut plantations on good cropland have produced 16,000 to 20,000
board feet to the acre in 50 to 60 years. A 67-year-old cottonwood
plantation on good silt loam in Henry county contained 73,000 board
feet to the acre. A bur-oak plantation on brown silt loam produced
13,000 board feet in 57 years. Red oak and white oak on the same soil
produced 8,000 and 7,500 board feet respectively in 45 years. Osage
orange on tight clay in Montgomery county yielded 922 seven-foot
fence posts to the acre in 36 years.

**Mixed plantings have advantages.** It is often desirable to plant
a mixture of trees, some of which can be cut early to bring in returns
that will help pay the carrying charges for the timber crop to be cut
later. European larch planted with white pine or red pine can be cut
for posts or poles. Spruce planted with pine can be cut for Christmas
trees. Thinnings in pine plantations can be utilized for mine props or
fence posts to bring in an early return. In such a plantation in western
Illinois, Norway spruce was used to fill in spaces where the pines had
failed. At the end of seven years 75 percent of the spruce trees were
ready to be used for Christmas trees.

**Values Besides Direct Cash Returns**

The ultimate cash value of the timber is of course to be considered
in a tree-planting enterprise, but there are other benefits besides dollar
returns to be derived from reforestation.

Only by the planting of trees can thousands of acres of Illinois land
be successfully protected from rapid runoff of water and serious losses
of soil. On such land reforestation is profitable regardless of the cash
value of the trees. Not only is the planted area protected, but damage to
good cropland lying adjacent to it is prevented, and water is held on the
land rather than wasted in streams or loosed in destructive floods.
FOUR PUBLIC AGENCIES are actively helping Illinois farmers and landowners who are interested in establishing woodlands and forests and utilizing their products to the best advantage:

Nurseries from which young trees can be obtained are operated by the DIVISION of FORESTRY of the STATE DEPARTMENT of CONSERVATION, Springfield.

Advice on planting problems can be obtained from the EXTENSION SERVICE of the UNIVERSITY of ILLINOIS COLLEGE of AGRICULTURE and the STATE NATURAL HISTORY SURVEY, Urbana, thru the Extension Forester.

In soil-conservation districts the U. S. SOIL CONSERVATION SERVICE is assisting cooperating farmers in establishing plantations.
FOREST PLANTING IS THE SOLUTION to the problem of idle or eroded land on many Illinois farms. Acres of once good crop land or timber land can be saved from further destruction by plantings of trees. Field windbreaks will help to lessen wind erosion. Sandy wastes can be redeemed. And these wooded acres will provide a haven for wildlife, an economic as well as a recreational asset to any farm or community.

To start a farm plantation is neither costly nor difficult. Maintenance is simple. And added to the other benefits are the ultimate returns to be realized in usable or marketable timber.

Where other generations have thoughtlessly destroyed, this generation has an opportunity to build.