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DEPARTMENT OF EXTENSION

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**Forest Windbreaks as a Protection to
the Light Soils of the Columbia
River Basin**

By GEORGE L. CLOTHIER

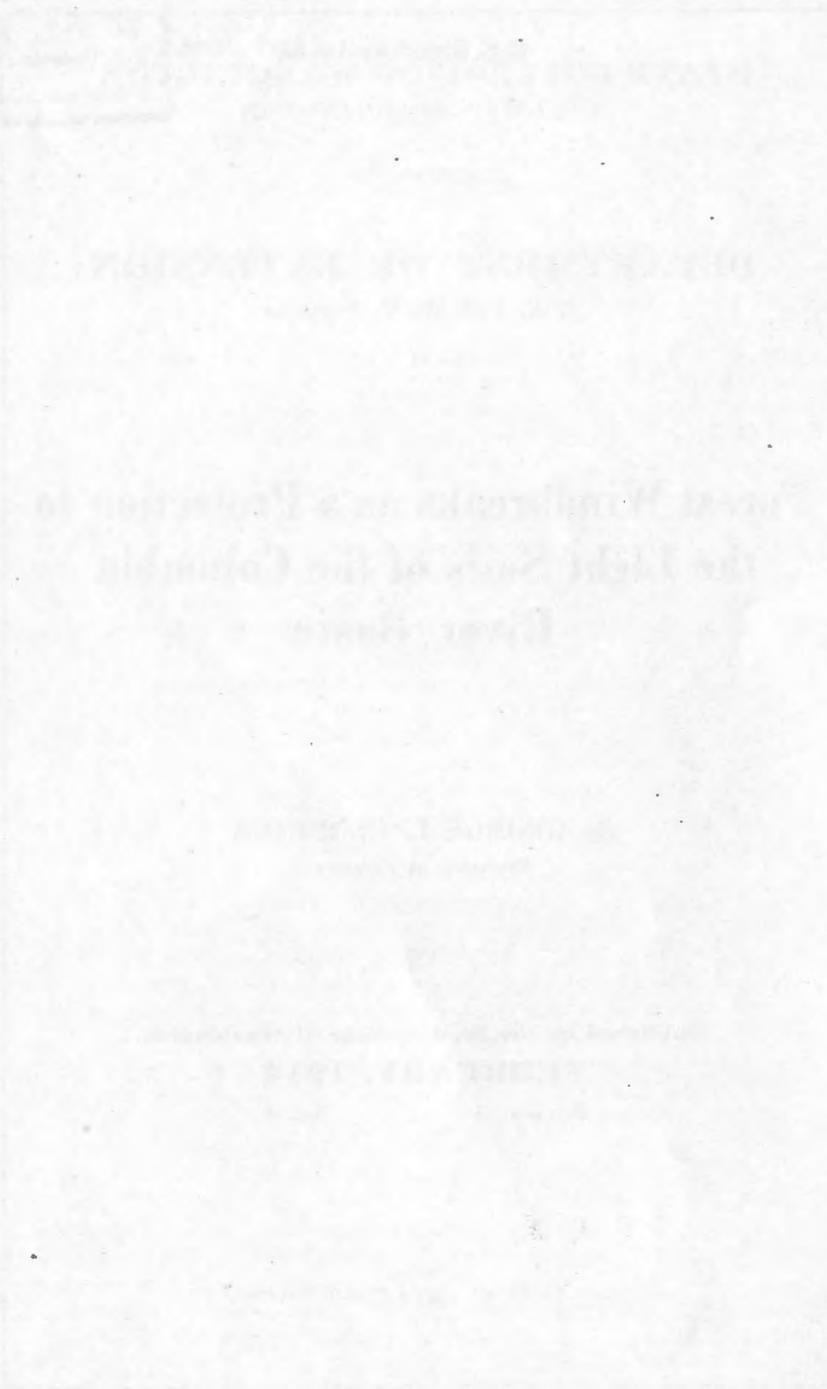
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Forest Windbreaks as a Protection to the Light Soils of the Columbia River Basin in Washington

The use of windbreaks of living woody plants for the protection of the farm home has been practiced for many years in the prairies east of the Rocky mountains. Owing to the newness of the country, windbreaks have not been planted as extensively in the Columbia River Basin as their importance demands. Where irrigation is practiced, the establishment of windbreak plantations is comparatively easy, but the problem is very much more difficult in the non-irrigable arid or semi-arid districts of central Washington. It is these latter districts that are most sorely in need of such protection. The efforts of the writer will be bent in the following pages towards throwing some light on a number of questions involved in successful protective tree planting on the light and easily blown soils of the Columbia Basin, particularly that part embraced in central Washington.

The benefits arising from the use of forest windbreaks are numerous, while the damaging effects upon the adjacent crops are comparatively small. Wherever they have been tried the good they do far outweighs the harm. The protective influence of a windbreak extends from ten to twenty times its height, the protection extending farther as the velocity of the wind increases. Low growing windbreaks to be efficient must occur more frequently than tall. Whether a low or tall growing species can be used will depend upon the available water supply for the roots of the plants. With plenty of moisture in the soil tall growing trees like the poplars, cottonwoods and willows may be used, but where the rainfall is as low as 12 inches and subterranean water is not available, the planter may have to content himself with low growing trees or even shrubs. The native sage brush after it has been grubbed out has been used successfully as a temporary windbreak, by hanging the plants to wires stretched four or five feet above the ground. Such low structures and lines of shrubs of similar height must occur as often as once every four or five rods to produce the desired effect. The orientation of a windbreak should always be determined with reference to the direction of the prevailing winds. In the Columbia Basin the prevailing winds are from the southwest, hence the ideal orientation of the rows of trees should be from northwest to southeast. Since the land boundary lines run north and south and east and west, it may not always be practicable to give the windbreaks a northwest-southeast orientation. If more westerly winds occur than southerly, the planter should run his windbreaks in a north and south direction but where southerly winds prevail the rows of trees should run east and west. This matter will have to be dealt with from the experience of the resident on each individual farm.

The planter in all his plans must keep in mind the appearance of the mature windbreak. If there is a good prospect that his planted trees will reach a height of 50 or more feet the windbreak belts need not be closer together than 60 rods apart on flat lands, but if there is doubt about the possible height growth of the plantation the spacing should not exceed 30 rods, and if shrubs like sage brush must be depended upon, the spacing should be not greater than four or five rods. It will sometimes be possible to take advantage of the topography where the surface is undulating and by placing the windbreaks upon



FIG. 1. A plum thicket in the foreground backed by taller forest trees—an excellent arrangement to divert the wind upward and over the protected area. Pullman, Wash.

the divides reduce the number. In order to economize space the plantations should be as narrow as possible without detracting from their protective value. However, single rows of trees are generally not to be recommended unless the land is under irrigation. A good arrangement is to plant as many as four parallel rows of trees, spacing the rows eight feet apart and the trees in the rows two to six feet apart. Then on the windward side of the belt two or three rows of shrubs or small trees should be planted to direct the wind upward before it strikes the taller trees of the main plantation. The rows of shrubs need not be more than five feet apart. Such an arrangement providing for three rows of shrubs and four rows of trees will occupy a strip of land 39 feet wide. By reducing the shrubs to two rows and reducing the space four inches between each two rows of trees, a belt of this character comprising four rows of trees and two rows of shrubs can be made to occupy a strip thirty-three feet or two rods wide; and such a strip crossing a quarter section of land will contain two acres.

For thorough protection there should be at least six such belts running parallel across and on the boundaries of every flat quarter section, and if spaced uniformly the protected strips intervening will be exactly thirty rods wide. The trees will occupy twelve acres of the land surface but their damaging influence will extend outside the boundaries of the belts to such a degree that we must figure the trees as occupying at least sixteen acres or one-tenth the area of the farm. The far-seeing farmer will not hesitate to devote ten per cent. of the area of his farm to insurance of the other ninety per cent. against destruction by wind, and where the soil blows badly twenty-five per cent. is not too much to devote to protective uses.



FIG. 2. A plum thicket without reinforcement by taller trees will protect the soil from blowing for several rods to leeward.

The part of the Columbia Basin to which this bulletin refers receives less than fifteen inches of rainfall per annum and in some places the precipitation is as low as six inches. Many professional foresters who are only acquainted with the conditions in humid regions have asserted that trees cannot be grown without irrigation where the rainfall is less than twenty inches. The Rocky Mountain states have many examples of natural forests that contradict such a theory, but the fact

is evident to all that trees like other vegetation must have moisture with which to grow.

There are as great differences in demands for moisture among tree species as among agricultural plants. Since our rainfall is very light in the Columbia basin, we must seek for planting the most drouth resistant species available that will endure the climatic extremes of the region.



FIG. 3. Foreground, a row of young Russian Artemisia; background, a willow hedge. Pullman, Wash.

SPECIES TO PLANT.

The conifers or needle-leaved trees are by nature more drouth resistant than the broad-leaved, and since they hold their leaves all the year round they are the best species to plant for windbreaks. There is a great difference among the conifers in drouth resistance. The yellow pines and junipers are very drouth resistant while the hemlocks, spruces and firs require a greater amount of moisture for best results. The writer believes that western yellow pine, Utah juniper, mountain red juniper, western juniper and jack pine deserve a trial in this region. Farmers attempting to plant conifers should make a study of all the literature available on the subject, since these plants are very difficult to transplant. If the roots of a young pine tree are exposed to the atmosphere for but half an hour at once the tree in all probability will never start growth again no matter how carefully it is handled subsequent to the exposure. Reputable nurserymen always

pack the roots of coniferous nursery stock for shipment, in damp sphagnum moss. As soon as a consignment of coniferous nursery stock has been received by a purchaser, the plants should be unpacked and the roots dipped in thin mud known as "puddle" and then the little trees should be carefully "heeled in" to prevent the roots from drying out. The place selected for heeling in the stock should be protected from wind and sun. At the time of planting, a few plants at a time are removed from the trenches as needed and are carried in baskets with their roots buried in wet moss to where the workmen are doing the planting. Extreme care should be exercised to prevent the roots from being exposed to the air for more than a minute or two at a time.



FIG. 4. A willow windbreak at Pullman, Wash. The willow is desirable only where the rainfall exceeds 15 inches or where irrigation is available.

Of the broad-leaved trees, the following can be recommended for the sage brush region: Black locust, osage orange, honey locust, Russian mulberry, hackberry, Russian wild olive and green ash. Of this list hackberry, Russian wild olive and green ash may be grown successfully at altitudes up to three or four thousand feet above sea level. Osage orange, Russian mulberry and Russian wild olive are by nature low bushy trees seldom exceeding thirty feet in height. They are very drouth resistant and for that reason should be used extensively, but the osage orange and mulberry should only be planted where there is sufficient heat for their thrifty growth. These latter trees do well in a climate adapted to peach and grape culture.

Besides the use of trees, shrubs may be successfully employed either alone or in combination with trees as windbreaks. The native sage brush alone is excellent for this purpose. When clearing the land, strips of sage brush a rod wide should be left to alternate with tilled strips four or five rods wide. The writer is sure that if the

early settlers in the Columbia Basin had understood the nature of the climate and had left twenty to twenty-five per cent. of the area of the farms in sage brush, properly distributed, there would not be today so much abandoned blown-out land in the region. Where the native sage brush has been destroyed, the Russian artemisia which is also a sage brush plant may be used for windbreak purposes. Russian artemisia is easily propagated from cuttings. Other shrubs that de-

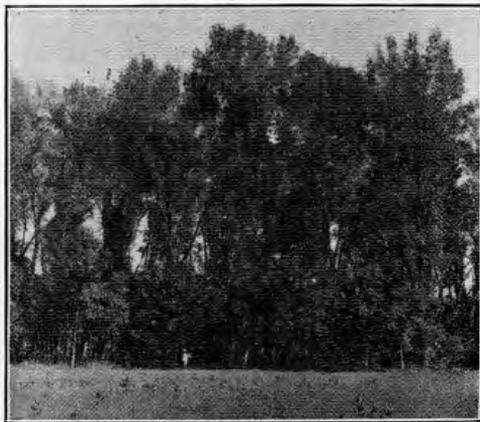


FIG. 5. Two storied windbreak of cottonwood and green ash in Nebraska, an ideal arrangement where plenty of moisture is available. (Courtesy of U. S. Forest Service.)

serve a trial in the region are the wild plums, choke cherries, wild thorn and wild rose. Even domesticated fruit trees may be made to serve as windbreaks. Seedlings of the peach, plum, cherry and apple are very easily grown where they are to stand permanently, simply by dropping the seeds in furrows in the autumn and covering the same with a plow. If planted thick as a hedge should always be, peach, plum and apple trees make excellent windbreaks and are quite drouth resistant. Seedlings should be used because of the cheapness of the plants, and these fruit tree windbreaks should not be looked upon as in any sense taking the place of the orchard.

A word of caution here with reference to the trees that ought not to be planted might prove of value. Maples and box elder are by nature adapted only to moist situations, hence are absolutely worthless in arid situations. Many trees that have done fairly well at Pullman will fail with the low precipitation and in the light soils of the Columbia Basin. Among these may be mentioned all the eastern oaks and the English oak, all the basswoods, all the sycamores, all the poplars, willows, and cottonwoods except where sub-irrigation is available, all the white pines, all the firs, all the cedars (except the junipers sometimes called cedars), all the walnuts and hickories and all the

birches. From this list it is readily seen that if the planter consults a nursery or seed catalogue for his information, he is much more likely to attempt the impossible than to hit upon the species adapted to his peculiar environment. Don't attempt to plant the catalpa or the eucalyptus in Washington, as both these trees are worthless in this part of our country.

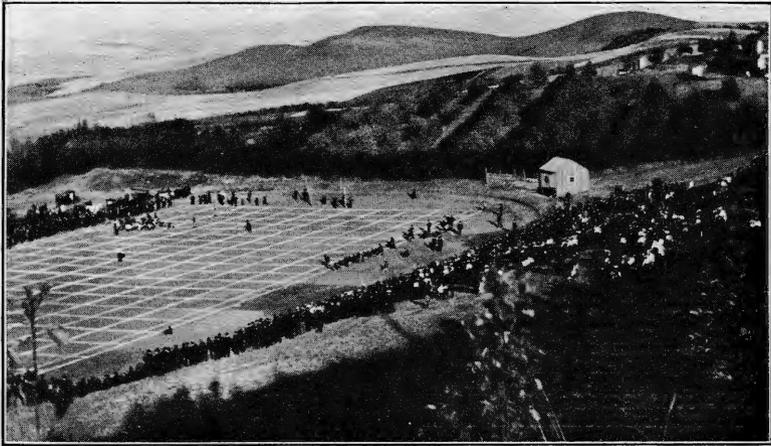


FIG. 6. An apple hedge on the campus of the State College of Washington.

The Chinese arborvitae deserves a trial on a small scale as it is very drouth resistant, but it requires a great deal of heat and for that reason probably would grow only in the hottest parts of the Columbia Basin. Others of doubtful value which must be tested before we can either recommend or proscribe them are the elms, mesquite, European larch, Scotch pine, Austrian pine and Monterey cypress. The species that planters in this region may use with prospects of succes are few and for that reason the farmer-planter should proceed cautiously if he would not waste his money and efforts.

CULTIVATION.

A windbreak plantation needs as much care until it gets started as an orchard. Of course where the native sage brush is left, no care will be necessary except the exclusion of fire and livestock. Tumbleweeds pile up in a windbreak in the autumn, increasing the fire danger very much, but these weeds, if allowed to decay on the ground, add humus to the soil and promote the thrift of the trees. During the first few years, the tillage of the spaces between the rows of trees should be directed chiefly to the conservation of the soil moisture. At the same time every possible effort should be put forth to increase the

humus in the soil, since the soils of this region are naturally extremely deficient in this very valuable substance. As the trees advance in age less tillage will be necessary and the owner should make an effort to get herbaceous vegetation established under the shade of the trees, which will be beneficial to both soil and trees. Grasses are very antagonistic to trees and should be kept out of the plantation. Certain types of leguminous plants are very valuable for a forest soil cover. Such are the beggar ticks, Lespedezas and annual clovers. Limited

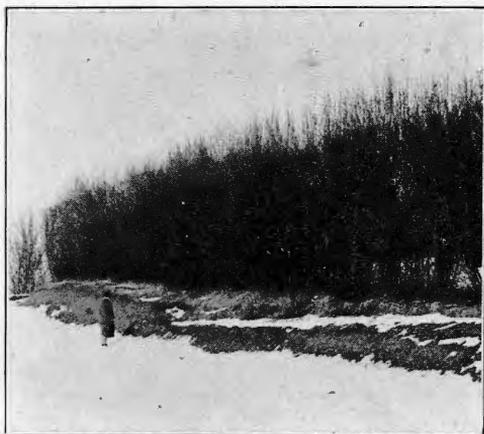


FIG. 7. A near view of the same apple hedge, shown in Fig. 6.

quantities of the seeds of these plants may probably be obtained from the U. S. Department of Agriculture. Seedsmen handle the burr clover, crimson clover, and Japan clover, all of which may be recommended as soil improvers.

If the owner of a windbreak is desirous of perpetuating it, he must keep close watch upon the thrift of the trees to prevent their deterioration. When the trees approach maturity, their crowns thin out as a result of natural crowding. At this stage, shrubs or young trees of shade bearing qualities should be planted under the crowns and between the rows of the old trees to prevent harmful plants from gaining a foothold and sapping the life from the trees. Grass of any sort in a forest plantation is probably the worst type of vegetation that could possibly gain entrance. The osage orange and hackberry are good shade bearers. Some of the junipers also endure shade. Sumach, dogwood, wild currant bushes, wild gooseberries, snowberry, service berry, choke cherry and wild plum bushes are all worth trying as undergrowth to keep the ground shaded in a mature forest plantation.

Where cultivation of a forest plantation is impracticable, mulching the soil is to be recommended. When this is once begun, it is neces-

sary to continue the practice as the roots will come near the surface and be injured by later plowing. If the farmers of this region would save all their straw, and all other vegetation that is too frequently burned and put it back into the soil for increasing the humus, the land would grow both crops and trees better than it ever has done in the past. The writer believes that the humus problem is the greatest problem of the Columbia Basin, and tree culture will throw as much light on this problem as any other type of agriculture. Forests, wherever found, are great humus producers, and cannot thrive without the continuance of conditions favoring the production of humus.

HOW TO SECURE THE PLANTING MATERIAL.

When a farmer decides to plant forest trees, the first difficulty which he usually encounters is to obtain the young trees at a cost that will make it possible for him to accomplish the desired result. There are few forest nurserymen in the United States, and they are chiefly located in the Mississippi Valley and in the Atlantic Coast region. The majority of nurseries in the country quote forest seedlings, but the trees have usually been bought of some eastern wholesaler and have been packed and repacked, shipped and reshipped before they reach the planter, till they have lost a large part of the vitality which they originally possessed. Besides, the prices charged are so high as to be prohibitive. For successful windbreak plantations from 1,500 to 2,500 young trees are required per acre. The farmer cannot afford to pay more than \$5.00 per thousand for these young trees and he ought to get the trees for half that price. There are reliable nurseries in the country that sell forest nursery stock direct to the planter for prices ranging from \$1.50 to \$5.00 per thousand. Tree planters often make the mistake of demanding large sized trees from the nurseries, which very materially increases the cost of producing the stock. The great majority of forest trees are most successfully transplanted when one year old or at not to exceed two years of age. Broad leaved seedlings should be 12 to 18 inches tall for best results and conifers 6 to 12 inches. The small sized tree is much more easily transplanted than the large, is much more likely to grow, and costs very much less. At the end of five years, the tree transplanted at one foot in height will usually have outgrown the tree five feet tall transplanted at the same time. So there is nothing gained in the long run by the use of the large nursery stock. If the nursery stock cannot be purchased for the prices indicated above, the planter would better establish his own nursery and grow his own nursery stock. Literature describing the forest nursery can be obtained from the U. S. Forest Service at Washington, D. C.

Willows and cottonwoods are most easily grown from cuttings which should not cost more than \$2.00 per thousand. The so-called Carolina poplar is nothing but a cottonwood and should be sold at prices accordingly. The Lombardy poplar is also closely related to the

cottonwood and grows exceedingly well from cuttings. As previously stated in this bulletin, these trees are not to be recommended where a constant supply of soil water is out of reach of their roots.

METHODS RECOMMENDED AND SEASONS FOR PLANTING.

All evergreen trees should be planted in the spring a few days later than is the usual time for setting out an orchard. In the Columbia Basin, the most opportune time varies from the first to the last of April, the earlier date being best for the southern part of the state



FIG. 8. Single row of Lombardy poplars planted in Oregon to protect an orchard. The plantation not dense enough to afford complete protection as is shown by encroaching sand in the background. (Courtesy U. S. Forest Service.)

and for low altitudes. It is generally quite desirable to water coniferous trees immediately after planting, and if a prolonged dry, hot period should occur early in the season, a number of applications of water may be necessary. For this purpose, a tank mounted on a wagon as is used by steam threshing outfits is a very useful equipment. The water should be applied during a cloudy day or near sundown. After watering, dust should be raked over the surface of the saturated places to prevent the soil from baking.

The deciduous trees should preferably be planted in February or March. Occasionally there are seasons when fall planting is to be preferred, but this is only when there is an open warm winter. The deciduous trees are not as exacting as evergreens with reference to watering, but a liberal application at a time when there seems to be about even chances for and against the life of the trees will often more than pay for the labor it costs.

The broad leaved trees are most economically planted in lister furrows. The planter with his spade makes a slit in the bottom of

the furrow into which the lower part of the root of the little tree is inserted. With one or two strokes of the spade enough soil is applied to the roots to prevent drying out and to hold the little tree in place. A wheel cultivator drawn by two horses following the planters fills up the furrows and completes the planting operation. In this way the work is mostly done by horse power at comparatively small expense. While the broad leaved trees will endure more exposure than the conifers, it is best not to allow the roots of these to become dry. For this reason wet burlap should be wrapped around the roots of the trees as soon as they are removed from the trenches, and the trees should be kept thus protected until their roots are inserted into the openings in the soil.

The total cost of planting a farm windbreak ought not to exceed \$25.00 per acre. When we consider that every planted acre properly placed will, in the long run, protect ten acres from destructive blowing, the outlay does not seem large. If this method of reclamation and conservation were applied by every land user in the Columbia Basin, it would mean many millions of dollars of added wealth to the State in a few years.

