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Forestry

C.A. Keffer

Dakota Agricultural College

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W. L. Hutchinson.
DAKOTA

Per _____

AGRICULTURAL COLLEGE

AND

EXPERIMENT STATION,

BROOKINGS, DAKOTA.

Bulletin No. 12.

APRIL, 1889.

Department of Forestry, Horticulture and Botany.

FORESTRY.

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Correspondence is invited upon any question relating to farm interests. Questions relating to farm crops or stock should be addressed to Professor Foster; questions relating to tree culture or to gardening should be addressed to Professor Keffer; questions relating to insects should be addressed to Professor Orcutt; questions concerning the chemical composition of soils or waters should be addressed to Professor Shepard, and questions about the diseases of animals and their treatment should be addressed to Dr. Alloway—all at Brookings, Dakota.

LEWIS McLOUTH, Director.

DEPARTMENT OF
BOTANY, FORESTRY AND HORTICULTURE.

CHAS. A. KEFFER, Superintendent.

FORESTRY.

Scarcely more than a beginning has been made in forestry operations at this station, but the work is of such importance, and the general interest in all subjects connected with tree growing is so great, that it would seem best to describe the work in detail. In the nature of the case, experiments in practical forestry require for their completion a series of years, so that any observations made before their completion must be suggestive, rather than conclusive. And it is a wise precaution on the part of the reader to note carefully the recorded conditions before coming to a conclusion as to the value of results.

In the month of October 1887, a plat of ground containing about three acres, lying north of the college buildings, was planted with tree seeds, the intention being to permit the trees to stand where they grew, and thus secure a windbreak for the buildings and campus. The ground used is at the crest of a slight elevation which slopes to the west for about half a mile, to a small creek. The soil is black with a stiff yellow clay subsoil in which there is a little sand. While not "hard pan" this subsoil is far from being porous in the usually accepted meaning of the word. The same soil is found in all the plantations of this department, and is most common in this part of Dakota.

The varieties planted were box elder, white ash, black wild cherry, honey locust, white oak, burr oak, red oak, black walnut, white

walnut or butternut, chestnut, hard maple, shell bark hickory, basswood, and black locust.

The different kinds were planted in irregular groups, in hills four feet apart, and it was thought by grouping the different varieties, a mixed grove might ultimately be obtained, which would be similar to the natural woodlands of the east. All of the varieties planted save hickory, basswood, black locust, and chestnut germinated.

Almost if not all the box elder and ash grew (these two varieties together forming over half the plantation) but before the third leaf appeared they were attacked by cut worms, which destroyed a great many trees. Box elder and ash seeds were the first to germinate, and these came very regularly, all the seeds having appeared above ground by the middle of May. The hard maple was more irregular, and very many of the seeds failed to germinate. These varieties always send up first a pair of seed leaves. The black wild cherry, the walnuts and the oaks do not send their seed leaves above ground, their first appearance being merely a small shoot.

In planting this plat, the greater part of the seeds were covered one and one-half inches deep; others were covered two and one-half inches and still others nearly four inches. The best stand was secured from the shallowest covering, scarcely a plant coming from those covered deepest.

The number of trees, with the greatest growth of the several varieties, as noted at the end of the season, was as follows:

NO. OF HILLS.	VARIETY.	GREATEST GROWTH.
754	Box elder	24 inches.
12	Oak	5 "
23	Black wild cherry	13 "
665	White ash	11 "
75	Hard Maple	4 "
24	Butternut	7 1/2 "
29	Walnut	8 "
61	Honey locust	11 "

One quart of black wild cherry seeds was planted, from which but 25 hills of plants were secured. The white and black walnuts and oaks germinated poorly also. The seed of hard maple was not good, many seeds being hollow.

The plat was thoroughly cultivated, with hoes and harrow toothed cultivator, until midsummer, after which time the weeds were kept down by scalping with hoes, only the surface of the soil being

disturbed. In November all the trees were hilled up with earth about ten inches.

The rainfall from Sept. 1st, 1887 to Jan. 1st, 1888 was extremely small, amounting to but 2.7 inches; and consequently the ground was very dry. Little snow fell before January, and the entire snowfall of the winter did not exceed 18 inches; the snow had all disappeared before March 10th, and no rain fell during the month of March. These facts are important when considering the present condition of the trees, as indicated below. The hard maples, oaks, and many of the ash trees were entirely covered in hilling up: These seem now (April 1) to be in fine condition. The box elders, ash, white and black walnuts and wild black cherry are in excellent condition, though the walnuts will not start from the terminal bud.

The ash and black wild cherry are uninjured, box elder is in fine condition, and the walnuts are but slightly damaged. Honey locust is green and bright, save in a few trees in which only tips are injured.

TREES IN THE COLLEGE LAWN.

In bulletin No. 1 the conditions under which the trees in the college lawn are growing, and the methods of planting and culture, were fully explained.

The past season has impressed me more fully with the value of some varieties named in that bulletin, notably the white elm, and the European larch.

The elms have made a fine record for themselves. Although standing in prairie grass, and in many cases without mulch, they made a good growth during the summer of 1888; the foliage was healthy throughout the season, they were quite free from insect pests, and an examination made yesterday shows them in fine condition at this time.

If the European larch does as well under forest cultivation as our few lawn specimens indicate it deserves a prominent place in forest plantations. It came through the severe winter of 1887-8 unharmed, and made a growth of nearly two feet, standing in the lawn. The foliage was healthy and it seemed entirely free of insect visitors. Two thousand larch trees, four to eight inches high, were planted in nursery and given the same culture as the other deciduous trees. Less than half these trees grew—about forty per cent. only making good growth; but the small trees can be bought very cheap, and if planted before the

buds start a good stand should be secured. When grown thick they make a tall straight trunk; planted four feet by four feet they need not be thinned until the trees are of sufficient size for use as poles. The timber is excellent as a substitute for white pine, and can be used for fence posts. The European larch has been successfully grown in northern Iowa in timber plantations. It should be remembered, however, that last year was rather favorable to tree growth and that this tree would probably not stand very long drouths as well as others. So far as observed on the college grounds it has done very well.

The white birch trees in the lawn have fully equalled the growth reported for 1887, though no single tree shows as great growth as was recorded for that year. The observations of the year, on both nursery and lawn grown trees, suggest a modification of the opinion recorded in bulletin No 1. The lawn trees grew unevenly, the north side of all the trees proving much the stronger. While the greater growth of the shaded side of the tree has been observed to a slight extent in several species, the birch shows it to a marked degree and suggests an inability to withstand severe drouths. Five hundred plants each of yellow and white birch, averaging a foot high, were set in nursery in the spring of 1888. An excellent stand and good growth—from eight to twenty-two inches—was secured. Throughout the summer the trees were in fine condition, holding their leaves, as is the habit of the birch where native, until after heavy frosts. As has been said, the autumn of 1888 was extremely dry, and an examination of the birch trees in nursery shows them to have suffered severe injury in consequence. Almost all the new wood is badly shrivelled. In some few cases the trees seem quite dead to the ground. In nearly all, however, the old wood is uninjured, and the branches growing lowest on the stem are sound. The roots are in perfect condition, being fresh and bright. The trees were well cultivated until midsummer, and the ground was kept clean throughout the season. After growth had entirely ceased in the fall the rows were hilled up with a small plow. In hilling up the roots were not disturbed. The birches are the only trees in the nursery that have been materially injured. It may be that in ordinary seasons the young birch trees would escape injury, and after the fine growth made by the trees in the lawn, it would be unfair to condemn them.

The box elder and white ash made about the same growth in the lawn as in '87. While box elder is undoubtedly a valuable pioneer tree, it lacks much of being a desirable timber. The wood has never

been regarded as of especial value, even for fuel, and though it is a rapid grower while young, it seldom makes as fine a tree as does soft maple under similar conditions. Its wood is tough, and it is thus able to withstand high winds. It is found along the frontier of tree growing districts, thus demonstrating its usefulness as a pioneer tree. Would it not be advisable to consider it mainly in this light, and in making plantations, mix with the box elder other species of far greater economic value? Then as the plantation requires thinning, remove the box elders, which will have served an excellent purpose as nurses, and leave the remaining sorts to reach maturity.

The white ash is slower in growth, both under high cultivation and when standing in lawn, than box elder. It suffered considerably during the early summer from the attacks of a large green worm *Platysamia Cecropia*. The ash tree is healthy, and seems fairly well adapted to this climate. The value of its timber is well known, and it is one of the species which would be useful for mixing with box elder, as suggested above.

Careful observation during the summer of '88 has given me a better opinion of the ability of the soft maple to withstand the wind than I formerly held. Our trees are all young, none being over ten feet high, but I did not find a single branch broken by the winds during the season. Its average growth almost equals the box elder and its wood is of more value.

Basswood has grown fairly well in the lawn, although its native habit is in moist land. Very small trees planted in nursery were almost an entire failure.

The Scotch Pine has succeeded best among the evergreens in the lawn.

Following is a record of the growth of trees in the lawn for the two years, 1887 and 1888:

VARIETIES.	1887.		1888.	
	ft.	in.	ft.	in.
Box Elder - - - - -	2	2	2	6
Cut Leaved Birch - - - - -		9	1	
White Birch - - - - -	3	1	2	8
White Ash - - - - -	1		1	
White Elm - - - - -	1		1	10
Lombardy Poplar - - - - -	4	6	1	3
Oak Leaved Mt. Ash - - - - -		9	1	4
Weir's Cut Leaved Maple - - - - -		5	1	6
Silver Maple - - - - -	2	3	2	
Basswood or Linn - - - - -		9	1	3
Mountain Ash - - - - -	1	6	1	10
Black Spruce - - - - -				7
Norway Spruce - - - - -		6		6
Balsam Fir - - - - -		4		5
Red Cedar - - - - -		8		10
Scotch Pine - - - - -			1	
European Larch - - - - -	1		1	10
Wisconsin Weeping Willow - - - - -	5	6	4	
Arbor Vitæ - - - - -	1		1	
Alder - - - - -	1	3	2	2

THE FOREST TREE NURSERY.

In the spring of 1888, the following varieties of trees, ranging in quantity from 200 to 2,000, were planted in nursery: European larch, yellow birch, black wild cherry, European white birch, box elder, white ash, white elm, cottonwood, soft maple, white walnut, black walnut, white oak, basswood, Scotch pine, white spruce, balsam fir, Norway spruce, Colorado blue spruce, Douglas spruce, arbor vitae, white pine, red cedar, Black Hills native spruce, Black Hills native pine, hemlock, red pine, gray pine.

In addition to these, about 5,000 cuttings including *Populus certinensis*, *P. pyramidalis*, *P. nolester*, *P. pyramidalis suovolens*, *Salix laurifolia*, *S. fragilis*, were planted.

The ground used is near the top of a low ridge, with slight eastern slope. It was plowed ten inches deep, and harrowed until fine. The plat was marked off in rows four feet apart, 165 feet long. A sub-soiler, with a single surface cultivator shovel, was then run through

each row, to a depth of about thirteen inches and the trees were set from 6 to 10 inches apart in the rows thus prepared, and tramped firmly. During the first half of the season the harrow toothed cultivator was frequently used, and the plat was kept entirely free of weeds and grass, the soil at all times being warm and mellow. The benefit of this high culture was apparent both in the excellence of the stand, and in the healthfulness of the trees throughout the season. No remarkable growth was secured; indeed when compared with trees of the same age, planted and cared for at the Minnesota station several years ago under my observation, the Dakota grown box elder, ash and cherry trees did not make more than half as much new wood as was made in Minnesota under similar culture.

In November, after the leaves had fallen from most species, both trees and cuttings were hilled up for the winter. First the spaces between the rows were cultivated fine, and then a small plow drawn by one horse was used to throw the fine earth up to the trees. The plowing was too shallow to touch the roots, and the work seems to have been beneficial.

The condition of the larch and birch trees has been noted. Black wild cherry made a fine growth, trees a foot high frequently doubling in size. During July a number of the cherry trees withered, and it was found that a ring of bark from one half to one inch broad where the tree entered the ground, was dead. I know of no cause for the difficulty, unless whipping by the winds should explain it. The trees which survived—fully 75 per cent. were perfectly healthy, and at this date the wood is bright and fresh to the tips and the roots are in perfect condition.

The ash trees, and to some extent the box elders, were partly denuded of their leaves in June by a large green worm (*Platysamia cecropia*.) These were removed, and for the remainder of the season the trees were in fine health. Less than one per cent. failed, though 2,000 of each variety were planted. To-day the box elder is slightly killed at the tips, not more than one inch, while the ash is green and good to the terminal buds. This is explained partly by the difference in the habit of growth of the two trees, the box elder never ripening the end bud, as in the ash.

The white elm, 1000 trees of which, (10 to 12 inches high) were set in the nursery, has done even better than in the lawn. It has had few insect pests, the leaves were perfectly healthy throughout the

season, and the year's growth was well matured, being at this date in fine condition. Scarcely a tree failed to grow.

Five hundred cottonwood trees, ten to eighteen inches high, were planted. These made the largest growth of the nursery trees. In August a mildew appeared bearing yellow spores on both surfaces of the leaves, but no observable damage resulted. The cottonwood beetle (*Lina Scripta*) shaped like the potato beetle, though smaller, yellowish with small black spots on the wings, fed for some time on the leaves, and efforts to destroy them were but partially successful. Neither mildew nor beetle was strong enough to prevent the steady growth of the cottonwood, which while young seems thoroughly at home in our soil.

The soft maple trees did not make as fine growth as the elms, birches, cherry or box elder, though growing in the same plat and seemingly in as good condition when received.

Two hundred white oak trees twelve to twenty-four feet high, were set. Most of these lived through the season, but they made only slight growth. A number of oaks of the same lot were planted in the lawn, but of these none grew.

Of 500 basswood trees, four to eight inches high, scarcely a dozen lived, and these made but very little growth.

The white and black walnut, 200 trees of each being planted, made a satisfactory growth and were in fine health throughout the season. They seem now to have suffered but little from the winter, the black walnut being rather the more damaged of the two.

Following is a table showing the growth of the above named varieties:

NAME OF VARIETY.	MAXIMUM GROWTH.	MINIMUM GROWTH.	AVERAGE GROWTH.
Betula lutea (B. exceclsa) Yellow Birch	22 inches.	3½ inches.	9 inches.
Prunus serotina. Black Wild Cherry	15 "	7 "	8 "
Betula Alba. White Birch	22 "	6 "	8½ "
Negundo aceroides. Box Elder	24 "	3½ "	14 "
Fraxinus Americana. White Ash	18 "	6 "	11 "
Ulmus Americana. White Elm	30 "	6 "	15 "
Populus Monilifera. Cottonwood	49 "	10 "	26 "
Acer dasycarpum Soft Maple	14 "	7 "	8 "
Salix Alba. White Willow	36 "	9 "	26 "
Juglans Nigra. Black Walnut	11½ "	2½ "	4 "
Juglans cinerea. White Walnut Butternut	11 "	2 "	2½ "
Titlia Americana: Basswood or Linden	5 "	2 "	2½ "
Quercus Alba. White Oak	4 "	1 "	2 "
— CUTTINGS. —			
*Salix Laurifolia. Lanral leaved Willow	37 "	15 "	28 "
*Salix Fragilis. (A Russian Willow.)	39 "	9 "	27 "
*Populus Certinensis	36 "	15 "	26 "
*Populus Pyramidalis	33 "	10 "	25 "
*Populus Pyramidalis suavoluns	27 "	10 "	19 "
*Populus Nolester	27 "	8 "	20 "

* Imported from Russia by Professor Budd of the Iowa Agricultural College.

Few trees of recent introduction seem so promising for culture in Dakota as the Russian willows and poplars. P. Certinensis is especially a good growing tree, and I am informed it has succeeded well for five years in Faulk county, on the farm of Mr. James Smith of Cresbard.

Salix Laurifolia is the most beautiful tree of the genus; it has large dark glossy green leaves, broader than in any other species. It is most useful as an ornamental tree.

The cottonwood beetle, mentioned above, infested all the Russian poplars, and did considerable damage, many of the trees not maturing the terminal bud, but the wood is perfectly clear, and the damage doubtless was limited to checking growth.

THE EVERGREENS.

About 10,000 evergreens, of the varieties noted above, were planted in the same way as the deciduous trees.

All the trees save as noted below were from the seed bed and had not been previously transplanted. Most of them were but four to eight inches high. As soon as received from nursery they were unpacked, their roots were puddled, and they were heeled in, the tops being covered with straw. Care was taken not to permit the roots to dry in the least. The evergreens were not planted until all the deciduous trees were set, as they start growth later; the buds had scarcely begun to swell, however, before all were set. They were placed in subsoiled rows, four feet apart and from four to eight inches apart in the row. As soon as a variety was planted the space between the rows was filled even with the tops of the trees with straw. During the summer the straw mulch was removed twice, and the ground was cultivated until perfectly fine, after which the mulch was replaced. Grass and weeds were removed from the rows by hand four times during the season, this being all that was necessary to keep the plat clean.

In November the entire plat was again mulched to the tops of the trees, the spring mulching having partly decayed. An examination made March 27th. shows that but very little damage was done during the winter. The foliage of Douglas Spruce is quite badly browned near the tips, but the wood and buds are bright. Norway spruce and balsam fir also suffered slightly, while the pines seem uninjured.

Below is given a table showing the number of trees of each kind planted, and the number alive at the end of the season. As is well known, it is customary for nurserymen to grow seedling conifers under shade one year—a method that seldom fails—but I had followed the plan above indicated in Minnesota with gratifying results, and thought it worthy a trial. In a dry season it would scarcely be recommended, and yet when the cost of material and the time required for making

the shade is considered, and also the added difficulty of cultivation under shade, it is an open question whether heavy mulching is not at least as good for young evergreens as the old way. It certainly is a plan that any farmer can easily try, and thus secure his conifers for timber planting much cheaper than ordinarily at nurseries. Throughout the summer the ground beneath the mulch was moist at the surface. None of the trees that lived showed appreciable injury of foliage: it will be noticed that a comparatively small percentage grew. In some cases this is easily explained. The red cedar, while well grown trees, heated in the box during transit from the nursery and so were almost an entire failure. One lot of arbor vitæ trees were evidently seedlings from the woods, as also were the Black Hills varieties. The spruce from the Hills were much stronger plants than the pines.

It is but just to say that the best conifers received were from Robt. Douglas & Sons of Waukegan Ill., and the best deciduous trees came from the Esmond, Dak. nursery.

THE EVERGREENS.

NAME OF VARIETY.	TREES REC'D.	ALIVE END OF SEASON.	SIZE WHEN REC'D.	GROWTH.		
				MAX.	MIN.	AV'G
*White Pine (<i>once transp.</i>)	500	500	10-14 in.	3	1/2	1 3/4
*Red Cedar.	500	47	8-10 "	4	1 1/2	3
*Hemlock.	500	2	6-10 "	1		
*Arbor vitæ from woods.	1000	159	6-15 "	5	2	3 1/2
Arbor Vitæ (nursery.)	500	161	4-8 "	2 1/2	1	1 3/4
*Red Pine.	200	None				
*Gray Pine.	500	77	4-8 "	2	1/2	3/4
*-Pine from Black Hills.	500	145	4-6 "	2	1/2	3/4
Scotch Pine(once trans'p.	500	430	8-15 "	6	1/2	4
White Pine.	2000	1221	4-8 "	3	1	2
Blue Spruce.	200	148	4-8 "	4	1	2
Douglas Spruce.	200	174	5-10 "	3	1	1 3/4
Balsam Fir.	500	239	4-8 "	4	1	2 1/4
Norway Sdruce.	500	440	5-10 "	6	1	3
White Spruce.	2000	952	4-8 "	3 1/2	3/4	2
Scotch Pine.	2000	870	4-8 "	4	1	2 3/4

*These were not mulched, but thoroughly cultivated.