

"GROWING CONIFERS FROM THE SEED".

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"Growing Conifers from the Seed".

In the cultivation of any plant life, the question of the cheapest method of obtaining those plants presents itself. This is especially true of the man who would raise trees. And it doubly emphasizes itself upon the man who would raise his own evergreens.

These trees are extremely hard to raise in a wind swept country like our own, and there are many questions to be solved to find the cheapest and best method, or methods, for propagating them in Kansas and especially in the western portion of the State. The first question which presents itself to the man who wishes an evergreen for an ornamental, is whether he shall obtain his trees from a nursery or raise them from the seed. If there are sent from the nurseries packed as they should be they would cost many times what these nurseries quote them at. Nurserymen offered pines of the Austrian and Scotch species at 35 cents apiece this spring, at Hays City. These were sturdy little trees three or three and one-half feet high and if they had been properly shipped they might have survived, but none lived. About ninety trees, of these same varieties, grown from seedlings set in 1903 at the Hays Experiment Station, were transplanted this spring and about 95% are growing now in May. This indicates that the nursery trees are the dearest in the end. Another consideration, however, is the distance removed from the nursery and the change of climate. If nursery trees are to be used, they should be obtained from the nearest point.

There are many reasons to believe that the tree, grown from Kansas seed, on Kansas soil and acclimated to the drouth and winds of Kansas, has by far the better chance to survive. Firstly the trees

transplanted from the nurseries are, as a rule, moved from an environment entirely different from their final destination. They are accustomed to a cooler, moister and stiller climate than ours, and in transplanting them to a soil that is dry for so large a portion of the year, and to a region where they must endure the high winds of the earlier spring months, as well as the hot winds of late summer, they will at least receive a serious injury if they are not completely destroyed.

If the trees are grown from seed borne upon trees near the locality where they are to be planted, these trees are from an acclimated stock. It is a commonly accepted theory of evolution that any form of life will finally develop a species suited to the climate to which it is removed. Thus when trees are grown from seed grown in the locality in which they are to live they are one step nearer this highly developed species.

There can be only one advantage in planting a tree from a foreign nursery, and that advantage is in time gained. If the trees are desired for small grounds and price is no consideration the larger trees are more desirable. But any planter should beware of "cheap evergreens". An instance of this came under the writer's notice a few years ago. A man bought fifty *Juniperus Virginians* for fifteen cents each. These were Kansas grown and should have proven satisfactory, but the amount of labor expended to grow them made them cost dearly for the few which survived. If Conifers are grown for any purpose where any large number is desired they should be raised from the seed.

If we are to raise Conifers from the seed, we must decide where we are to get the seed. This is not a question that can be answered in an altogether satisfactory answer for all years. If the

seed can be obtained from trees in our own State or from states of like climatic conditions, it would seem as though the question were answered. But most conifers mature a very small percentage of their seed in Kansas and this percent, together with the amount of seed borne, varies considerably each season. One striking variation in the percentage of matured seed was noted in the *Pinus Pungens* which matured the Endosperm in 23% of its seed in 1904 and 85% in 1905. Another instance of this variation was found in *Pseudotsuga Douglassii*. In 1905 a number of young trees were started from seed of the previous season but no percentage was kept. In the seed of 1905 no seed was found in which the seed was not hollow. Thus these things enter into our consideration of a necessity when we discuss the advisability of collecting Kansas grown seed. A good reliable seed house will remove these light seed and the buyer can depend upon it that he is getting good seed. In our Kansas grown seed of *Picea Alba* only 5% were good seed while those obtained from an eastern nursery 95% were fully matured. Another consideration is, as to when the species, or even the trees, will bear seed for all trees do not bear seed each year. Among those noted on the campus at K. S. A. C. which bore seed in 1904 and did not in 1905 were the *Arbor Vitae*. As soon as the cones are mature a few may be taken and placed in a warm or moderately hot oven and dried until the seed may be removed and then some germination experiments may be made to test the seed to find if it will pay to gather in large amounts.

After the seed are obtained the next problem that presents itself is the seed bed. This is of vital importance as to soil, location, preparation and treatment. The seed bed in the most important part of the growing of Conifers and upon the carefullness with which it is selected and prepared depends the success of the

seedlings. Conifers thrive best in a moderately rich loamy soil containing a large amount of sand. If the soil to be chosen for the bed does not contain this, it should be added plentifully and well worked into the soil. Fine gravel is sometimes used as a substitute where the sand is not available. The soil must be loose and of a texture that will not bake.

A few comparisons were made between seed beds with different amounts of sand mixed in them. The original soil was that intended for garden. It had been cultivated for several years and was manured during the winter of '05 and '06, with well rotted manure, at the rate of eight tons per acre. The ground was plowed late in March to a good depth. Some of this received no sand. Some received a light coat which was mixed with the surface dirt with a garden rake. And some of it received a heavier coating that was thoroughly mixed with the soil to a depth of four to six inches.

Pines of the Austrian and other strong growing species did not seem to notice the difference in the bed, but in many instances with others the plants in the bed that was not sanded had a hard time pushing through while some plants were not able to break loose from the old seed wall nor able to lift it through the ground so that they perished. No material difference in the germination could be detected between the bed that contained only surface sand and that which was sanded deeper.

The bed should have good sub-surface drainage, for it is not difficult to get the soil too wet and thus cause the fungous disease "damping off". This disease causes the young seedlings to break off just at the surface of the mulch or soil. The bed should be on a slight slope but not of sufficient angle to permit the surface water to wash it.

Another matter of importance in locating the seed bed is it's accessibility to the water supply. For the seedlings must not be allowed to dry out and of course must be watered artificially. It is quite an expense to keep these watered and the closer to the supply the less this expense will be. In watering, also, care should be taken to prevent damping off.

Again a condition that is necessary to success with the seedlings is a wind break. Conifers will thrive in a cool soil. Therefore the best location for a seed bed will be on a north easterly slope, thus protecting it from our strong south and west winds. If possible it should be surrounded on these two sides with a windbreak of larger trees. Strong hot winds are fatal to the young conifers if they are not protected.

In preparing the seed bed all the care given to a garden seed bed should be used. The ground should be plowed the fall before to a depth of 8 or 10 inches. This should be well spaded and pulverized just before the seed are planted. The soil cannot be fined too much. If sand or gravel is to be added it should be thoroughly mixed with the soil.

In determining the size of the seed bed several things must be considered. The width should not be greater than four to six feet, or wider than is convenient to weed and care for. The middle of the bed should be easily accessible from the side thus preventing the packing caused by the caretaker's feet if he is obliged to get into the bed. The system of planting will also effect the size of the bed. If the seed are planted in drills with room left between for cultivation, there may be any number in the bed. But this cultivation presses and hardens the dirt about the young seedlings, and is objectionable. If they are sown broadcast then the long narrow bed

are a necessity.

The system of planting depends upon the nature of the ground and the desires of the planter. Sown in drills gives the greatest ease of cultivation, but a large amount of space is lost. Broadcasting saves space but looses accessibility for weeding. Also the seedlings are more apt to "damp off" if there is not a free circulation of air. This system also saves the material for shading. The method that seems best and the one used in these experiments was a combination of the above. A furrow was made the width of the hoe and the seed broadcasted therein, another row was made at a distance of about eighteen inches. Three of these rows constituted a bed in one trial. In another, six rows were used which makes the bed difficult to weed or take notes upon. This method combines the good points of the other two. More plants per square foot are possible than when sown in drills. It allows better cultivation than when the seed are sown broadcast. It allows free circulation of air among the plants. The saving of space is of great importance when the weeding, watering and shading is done.

The seed should be planted to a depth of one-fourth to one-half inch according to the species. The dirt should be lightly firmed over them and the surface of the bed raked over or loose dirt thrown on to prevent hardening.

After the seed are sown the surface of the bed should be covered with a light mulch. To make it as near natural as possible pine needles or fine leaves of the broad leaved species of trees should be used. If none of these are accessible, fine wheatstraw or chaff may be used. The leaves will conserve the moisture much better than the straw. The mulch should be very thin and should not remain on the bed longer than just as the seedlings begin to push through

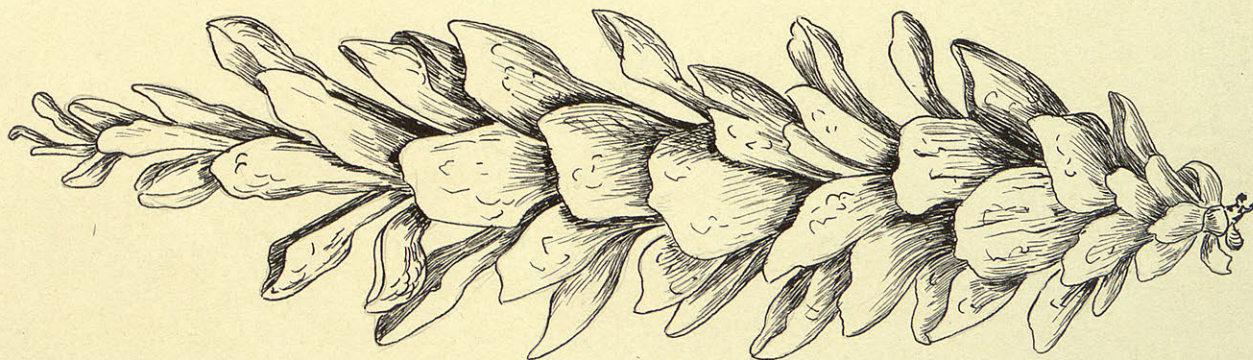
the surface of the soil. If left on for long thereafter it may cause the damping off of the young plants. This was observed to quite an extent upon some young cedars (*Juniperus Virginiana*) in the spring of 1905. As soon as the mulch was removed and the soil stirred the trouble ceased. The mulch may be entirely removed or it may be raked between the rows as a conserver of moisture. It will also aid in suppressing the weeds.

All conifers must be shaded during the earlier period of their lives. This shade may be of any material. It may be of branches of trees or some lattice work. A good screen is made of wire netting with laths woven in. Either of these may be used when the high shade is made, but for the low shade, which must often be removed, a frame of convenient size to handle, with laths nailed across, is the best. The lath should be nailed from one to two inches apart.

The shade may be placed high enough to permit cultivation beneath it. And in the east where large beds are used, with room for horse cultivation, they are practical. But in our western country where high winds prevail they are out of the question. The high shade necessitates side shading also. The low shade here serves as a wind break, and the sides may be boarded up as a further windbreak. The shade should remain at least during the first two years of the seedling's life, and with some tender species even longer is necessary.

In the development of the conifer seed there are two kinds of cones; the pollen cone or micro-sporangia, and the ^{ovary} bearing cone or megasporangia. The pollen grain is the microspore, and the ovary is the megaspore. These two cones are of the strobilous type, that is, they are arranged in spirals. A large amount of pollen is

borne for the means of scattering it by the wind and this necessitates a large amount of very light pollen. Stories have been told of showers of sulphur when high winds have blown this pollen for some distance from the coniferous forest. As soon as the pollen grains fall upon the scales or carpels of the megasporangia they settle to the tip where there are usually two ovules. Usually but one of these are fertilized. The microspore soon develops the "pollen tube" which absorbs the tissue of the enclosing case of the megaspore and makes its way to the egg. The sperm mother cells follow through the tube and one of the two unites with the egg cell and fertilizes it. The other is absorbed. The endosperm of the conifers is developed before fertilization takes place. Fertilization does not take place in most of the conifers for a year after pollination. As soon as the egg is fertilized the cone as well as the seed develops rapidly and the most of the cone grows in a few months even though it takes two seasons for its development.



Pinus strobus... (White pine)

The white pine is a large forest tree. The bark is nearly smooth except at the base of the old trees. The branches are distributed evenly about the axis and at regular intervals along the bole. The foliage is dark green, glaucous, and flexible. Its foliage is unlike that of any of the other pines. The leaves are borne in fives.

The cones are long, slender, and cylindrical. They are three and one-half inches long. The scales are broad tumcate, and do not end in a sharp spine. They are but slightly thickened at the apex. When open they stand wide and loose.

The cones must be gathered early after maturity, as they soon open, scattering their seed. The cones mature in August, and should be gathered before the end of the month. To tell the maturity of the seed of any pine, make a cross section of the cone. If the seed shows a white, fairly dry section, and the surrounding tissue of the seed or cell wall shows a darker brown than the tissue of the cone, the seeds are mature and may be gathered and stored.

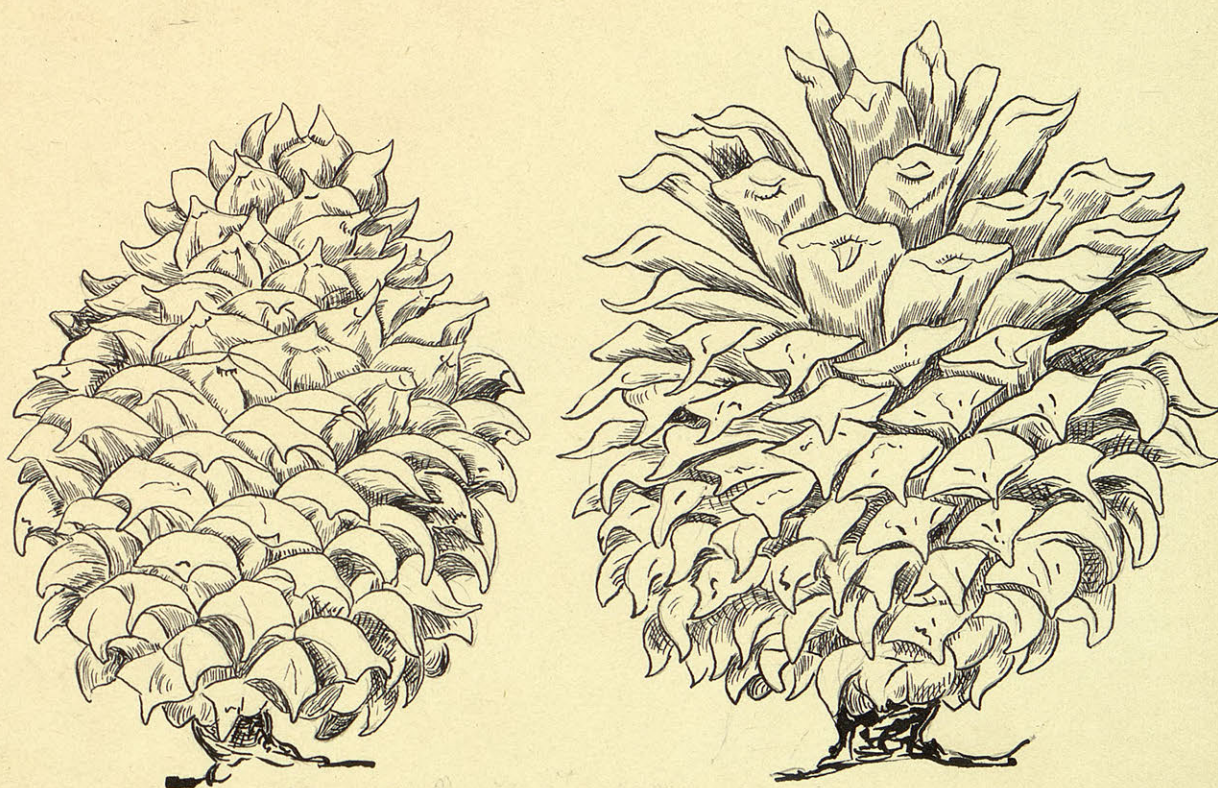
The cones of this species are readily gathered as they are not firmly attached to the tree.

The cones soon open when all the seed may be shaken through a screen of sufficient mesh to permit the seed to pass and retain the cones. The cones were gathered August 20th, and the seed all removed September 4th, a period of fifteen days.

Pine seeds in general are best kept in a cool dry place for winter, but may be stratified in sand.

In making cross section of the seed but 40% were found with the endosperm developed.

The White Pine is more delicate to warm weather and will need more protection than other pines.



Pinus pungens---(Table mountain pine)

Pinus pungens, Table Mountain Pine.

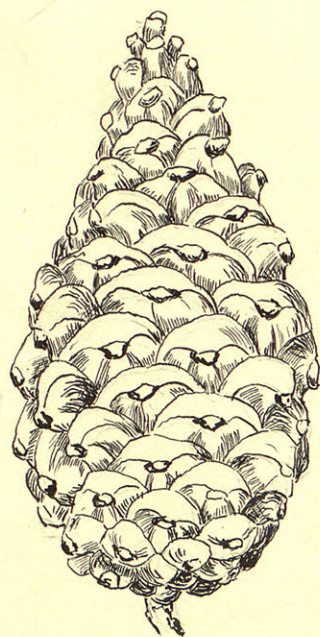
The Table Mountain Pine forms a very ragged open head. It is a tall tree with crooked branches. There seems to be no regularity in the way the branches are borne, as they extend at irregular intervals and at different angles. The leaves are borne in twos, are light, yellowish green. This color is heightened during the winter months.

Its cone is ovoid, very compact, heavy and hard. The scales are tipped with long and very sharp spines. When the cones open they are nearly globular. The cones are long persistent remaining on the tree for several years.

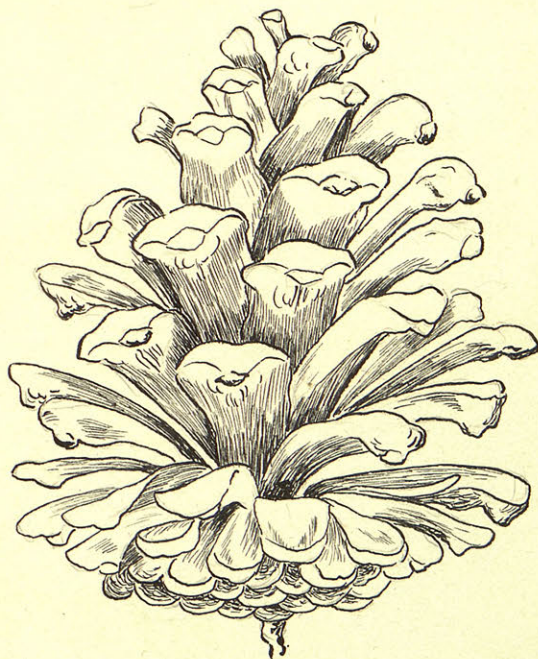
The spiny carpels and stout stem of the cone make it difficult to gather the cones. A knife or a pair of pruning shears are a necessity.

The seed are also difficult to remove from the cone. They open slowly, and it is several seasons before they entirely open, under natural conditions. Very few begin to open until the spring months. The cones were placed in a warm dry attic where the sun shown upon them, and they did not open. They were then sprinkled with water and placed upon the boilers of the greenhouse. Here they partially opened and by repeated wettings and dryings they were mostly opened. But they did not open entirely, or extend their scales completely.

That conifers do not mature equal amounts of seed each year was nicely shown here. This pine developed 23% good seed in 1904, and 85% in 1905. These are very slow germinators. The seedlings send up six or seven first leaves.



Pinus austriaca



(Austrian Pine)

Pinus austriaca, Austrian Pine.

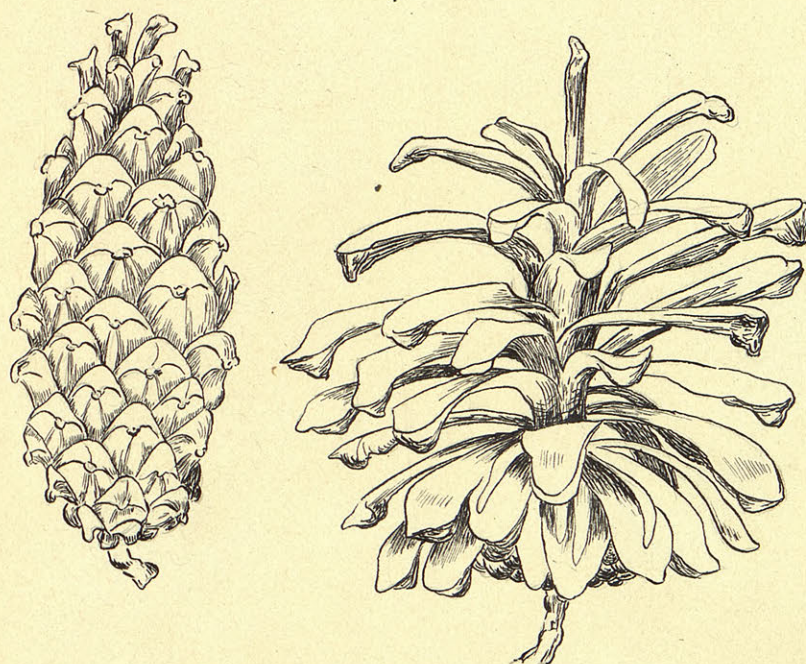
This is a very large tree forming a pyramidal head. The branches are evenly distributed about the bole and at regular intervals along its length. The branches stand perpendicularly to the trunk. Leaves five to seven inches long, two in a sheath, and of a dark green color.

The cone is conical, two and one-half to three inches long. The scales are much thickened at the apex and end in a blunt protuberance instead of a sharp spine. They are distributed, from one to four about the branches upon which they are borne. They are very hard and grow fast to the branch upon a short stem, and in gathering them they must be cut from their support. The cones do not open readily and may be gathered at any time during the winter months, but continued freezing and thawing opens them. Each cone averages 50 seeds.

These cones also opened slowly in storage, and were treated as were Pungus cones, and they opened readily after the first sprinkling. A fact was noticed here and was proven in other cones. That was that the seed, from the apex of the cone, which opens first, contain the highest percentage of fully developed and good seed. In this pine this was quite noticeable, the earlier seed taken contained 79% good seed, while the later ones only 55%, a difference of 24%

These seed showed a short period of germination, twenty-five days.

The first leaves of the seedling are eight in number, the second set sixteen.



Pinus sylvestris (Scotch Pine)

Pinus sylvestris, Scotch pine.

A medium large tree with irregularly open head. Bark has a reddish hue. The leaves are light in color, yellowish in winter. They are two to four inches long, and are borne two in a sheath.

The cone is tapering and narrow, two to three inches long by three-quarters to one inch thick. The scales are but little thickened at the apex and end in protuberance like projections. The cone is irregular in shape. It does not turn as soon as most pines, but remains a dark green.

The cones are easily gathered by hand picking.

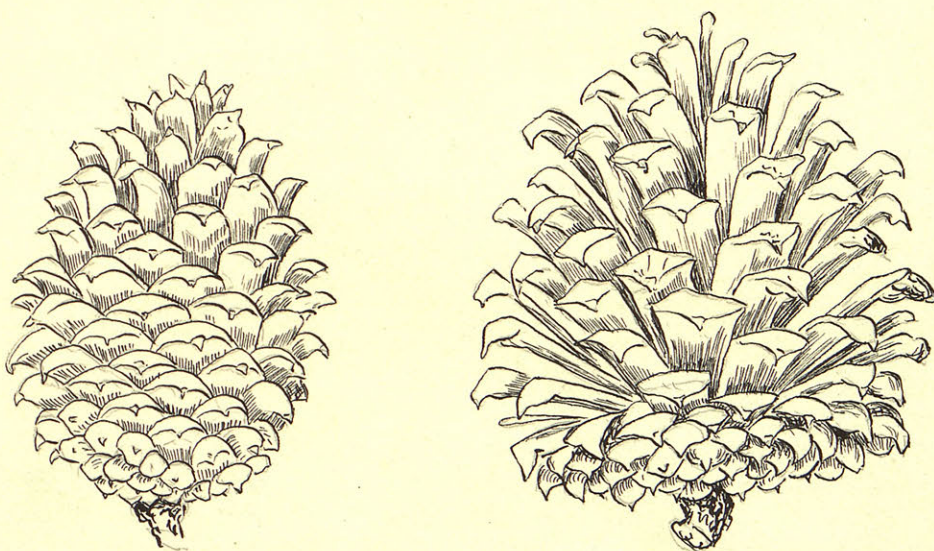
The cones mature and begin to open in October. The seeds mature in September, and the cones may well be gathered in that month, but care must be taken in storing, as they are far from dry. A large number heat when placed two thick in the drying trays. The

cones will open and the seed may readily be separated by late winter. But many of the cones do not open at all. These are mostly immature cones, and when left on the trees till late fall they mature.

There are about fifty seed per cone.

Sixty per cent of these seed matured their endosperm.

The seedlings have six leaves first leaves.



Pinus rigida (Pitch pine)

Pinus rigida, Pitch pine.

This is a medium large tree. The branches are irregular and crooked. The leaves are arranged in threes, and are dark green. They grow along the trunk as adventitious branches.

The cone is ovoid-conical, two to three inches long. They become nearly globular when open. They are borne in clusters. The scales are thickened and acutely at the apex. They are tipped with a recurved spine.

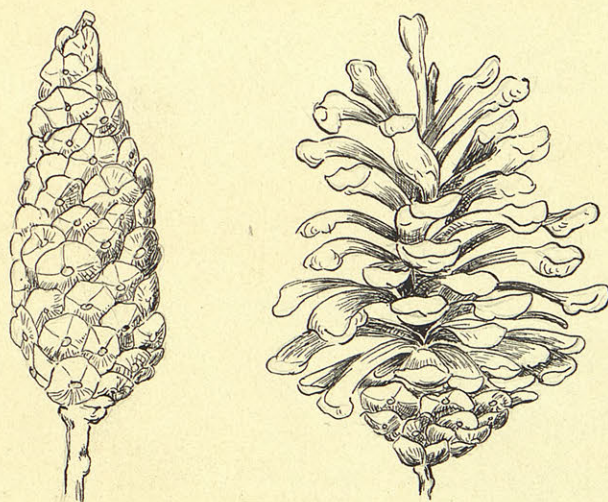
The cones are strongly attached to their support, and, with

the spiny carpels, this makes it difficult to gather them.

The seed mature in October, and the cones should be gathered in that month, as they soon open after maturity.

The cones open readily and evenly, and it is but a short time after they are placed in proper storage until the seed may all be removed from the cones.

The cone contains about 95 seed, of which 80% are good seed. Its seedlings send up six leaves.



Pinus divaricata (Jack pine)

Pinus divaricata, Jack pine.

This is a small slender tree, rarely over fifty feet high. Branches spreading, forming medium loose head. Leaves, stiff, stout, somewhat curved, spreading, are crowded along the branches, and are borne in twos. They are seldom over two inches long.

The cone is oblong conic, upwardly curved, from one to two inches long by one-half inch thick, and smooth. The scales fit closely, and the transverse ridge of the scales is a simple line with a minute central point in place of a spine. When young the scales

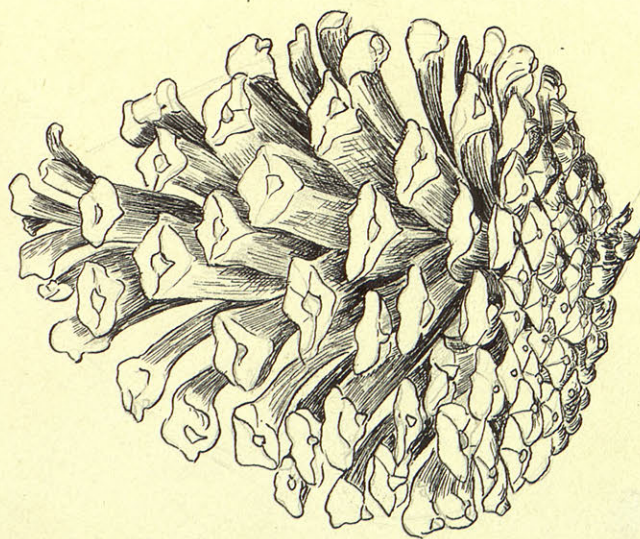
are spiny tipped. The cones open widely, and become slightly oval. They are numerous, and remain on the tree for several years. Some open the first season after maturity, but many do not open for one or more years and some never open.

The cone is securely attached, and is difficult to remove without shears or a knife.

That they open slowly makes the time of gathering less a matter of importance, but because the earlier developing cones contain the larger percentage of good seed and open first, October is the best time to gather.

No method was found to gain a large amount of seed, as but few cones open. The price of this seed is above all other pine seed, and yet the cones are numerous on the seed trees and they fully develop 70% of their seed.

When the young trees push through the ground they have four or five short slender leaves.



Pinus echinata... (Yellow pine)

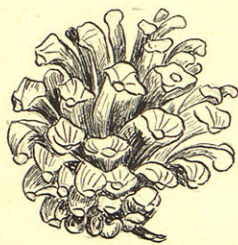
Pinus echinata, Yellow pine.

A tall and medium stout forest tree. It forms a compact head with spreading branches. Leaves, slender, more flexible than most except *strobis*, two to four inches long, borne in twos or threes, and dark green.

The cone is oblong conical, resembles that of *rigida*, about two inches long and nearly spherical when open. The scales are thickened and tipped with a spine at the apex. The spine is deciduous.

The cones should be gathered in October, as they open similarly to those of *rigida*. These, too, may best be gathered by cutting, as they are well grown to the branch.

The seeds soon fall from the cones after storing for a time. Each cone contains an average of 90 seed, of which in 1905 only 12% were good. The young seedling sends up five first leaves.



Picea montana
(Dwarf mountain pine)

Pinus montana, Dwarf Mountain Pine.

This is a low tree, or shrub. It forms a low semi-spherical head and spreads wider at the base than it grows high. The trunk branches in all directions at the surface of the ground, and these gradually curve upward. The foliage is a dense dark green.

The leaves are two and one-half to three inches long, and are borne two in a sheath.

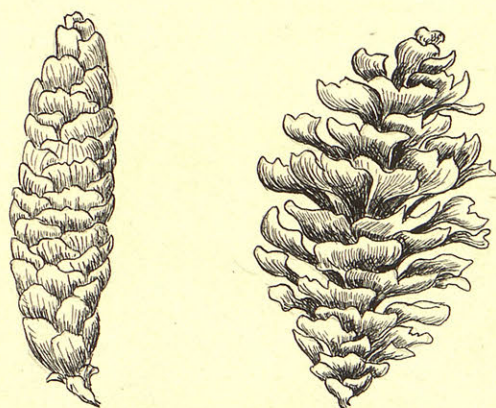
Its cone is small, oval, three-fourths to one inch long by one-half inch thick until it opens, when it is globular. The scales are narrow and less wedge-shaped than the common pines. They are but slightly thickened at the apex.

The cones are readily secured by hand picking.

The seed are ripe in August, and the cone soon opens, but many hang on until September before they open. The best time, as with all pines, is to gather the early maturing cones, thus for montana, in August.

The cones open readily, and the seed fall out.

About 50% of the seed are matured. The young seedling sends up about six leaves.



Picea canadensis.....(White spruce)

Picea alba (or *canadensis*), White Pine.

A slender tree reaching a maximum height of one hundred and fifty to one hundred and seventy-five feet, but usually much smaller. The branches form a regular pyramidal shaped head if allow-

ed to grow in the open. The leaves are pale, glaucous, slender and stiff.

The cones are about two inches long, cylindrical, light brown and of a light weight. The scales are very thin. Their margins are entire. The cones are borne numerously about the top branches of the tree. They fall the first winter, soon after scattering their seed.

The cones are easily gathered by hand picking.

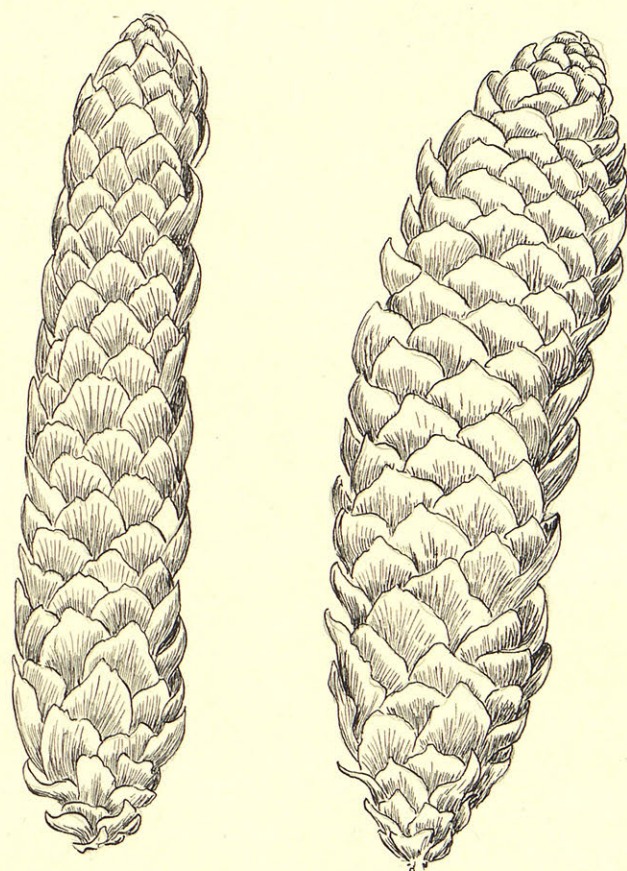
These seed mature in September and October, and should be gathered in those months.

The cones soon open, and the seed may readily be beaten out.

The seed is largely immature and many wings of the seed develop with only a small beginning of a seed attached. Only 5% of the full grown seed showed a well developed endosperm.

The leaves of the seedlings are much shorter and are finer than those of the pines. It sends up six first leaves.

(Over)



Picea excelsa....(Norway spruce)

Picea excelsa, Norway Spruce.

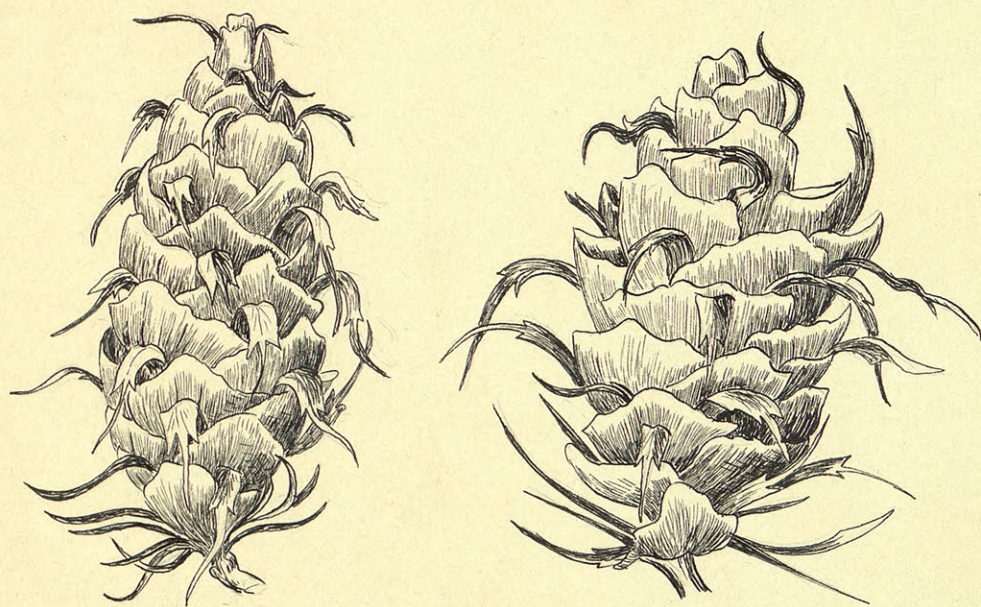
This is, in its native state, a large tree with stout bole and branches. The leaves are a deep green and are borne stiff and erect along all but the lower side of the twigs.

The cones are four to seven inches long, and are slightly curved. The scales are thin and entire.

The cones are readily secured by hand.

The seed mature in October, but the cones are slow to open.

So few trees bore cones in 1905 no experiments were carried on.



Pseudotsuga Douglasii ----- (Douglas spruce.)

Pseudotsuga Douglasii, Douglas Spruce.

The Douglas Spruce is a tall slender tree, with loosely arranged head, the branches having no definite position with regard to the trunk. They droop a trifle, and the twigs which bear the leaves are pendent. The leaves are a light green, one inch to one and one-fourth inches long. They are usually evenly distributed about the axis.

The cone is two to three inches long by one and one-fourth inches thick. It is ovoid. The scales are thin, cordate, with long toothed bracts extending beyond them. The bracts are papery.

The cones hang persistently to the branches and must be cut off in gathering them. They are often covered with a waxy pitch which adds to the disagreeableness of gathering. The seed ripen in August, and the cones should be gathered in that month.

The seed will fall from the cones if stored in a warm, dry

place, but the cones do not open regularly.

Seed of this cone were planted in the spring of 1905 from the previous year's crop. Small trees were started, but no percentage kept. In the cones of 1905 no good seed were found. Good seed were received from an eastern seed house, and contained 90% fully developed seed.



Tarix Europaea, European Larch.

The European Larch is a large, fast growing species. The head is a thick mass of branches. The leaves are borne on pendent twigs. They are about one inch long, or shorter, light green, and deciduous.

The cones are ovoid, about one to two inches long, and are composed of numerous close fitting scales which open tardily and not widely.

The cones are readily gathered by hand picking, but the pendent twigs upon which they are borne often break off, filling the collected cones in the basket with trash.

The seed are difficult to separate from the cones because of the closely fitting scales. These were allowed to dry for a long

period and then beaten out, but a large percentage were left in the cones.

Taxodium Distichum, Bald Cypress.

This species attains a height of about one hundred and fifty feet. It forms a broad symmetrical head. The leaves are linear, flat, about one-half inch long, light green and deciduous. The branchlets fall in centarun like leaf stalks.

The cone is compact globular, but slightly longer than thick. The seed are peculiarly shaped and resemble the scales of the cone.

The cones should be gathered before the first frost, as this frost causes them to fall apart. They may be hand picked, or allowed to fall on the ground, upon something spread beneath the tree, after they are frosted.

The scales are smaller than the seed and may be separated by screening.

This species did not develop any fully developed seed during 1905.

Juniperus Communis, Common Junipers.

This is a low tree or shrub, making a maximum height of twenty-five feet.

The branches are spreading forming a low flat or conical shaped tree. The leaves are sharp pointed, about three-fourths of an inch long, light below and marked with white stripes above, usually found in threes. The foliage is not so thick as in virginiana.

The cone is about one-fourth to three-eighths of an inch in diameter, globular, and black or dark blue when fully matured. They require two years to mature, and both mature and immature or green cones may be found in late autumn.

The cones are difficult to gather because of the prickly

pointed leaves and the secure attachment of the cones.

The cones may be gathered any time after late August.

Juniperus Communis matured no good seed in 1905.

Juniperus Virginiana, Red Cedar (or more properly American Savin)

This species forms a tree from twenty to one hundred feet high. In the forest it grows tall and straight with small head, but in the open it forms a pyramidal shaped head with the lower branches touching the ground.

The head is dense and compact in a well shaped tree, but it is apt to be of loose construction. The leaves are scale like and overlap. In vigorous growth the leaves form pointed leaves similar to the leaves sent up the first year.

The cone is berry like, and from one-eighth to one-fourth inch in diameter. It is of blue color, covered with light colored bloom. The scales of the cone are fleshy, aromatic, tenaceous and resinous. Each cone contains from one to four seed with an average of two.

The cones do not fall until the following season after they are formed, and they may be gathered any time during the winter months.

If a well fruited tree is found the gathering of the seed is lighter work, as they are borne in large numbers at the terminal end of the branches.

The seed are not easily removed from the cones because of the sticky covering. It has been often said that the covering was the cause for the tardy germination of the seed, but the scales were removed by several different methods, and in none was the germination hastened. If the seed are soaked in a strong hydroxide the covering becomes soft and loses its tenaceous qualities, and may be washed

out without difficulty. Some were rubbed between brick and the covering removed in that way.

The best method to store Juniper seed was found to be to stratifying them in sand for a period of two winters. They must be spread out thoroughly if stored in bulk, as the moist cover causes mould. The seed have a very hard and thick seed-case, and makes the stratifying the better method of storing.

More experiments were carried on with this species, for germination, than in any other.

It is often said that if the seed pass through the stomach of a bird that the juices acting thereon will hasten their germination. This theory was disproved by a careful experiment of feeding the seed to a pair of turkeys. They were fed the berries for a period of three months, and under different conditions, and no satisfactory results obtained. The birds would not eat the berries even when they had fasted until ravenous. They would pick corn out when the two were mixed and seldom take a berry. They were fed hidden in a mixture of bran or a meal and the berries. Another fact was discovered that when the birds were given plenty of "grit", gravel or sand, no seed would pass through them. In the whole experiment less than one per cent of the seed passed through the grinding of the turkey's stomach, and at no time was two per cent made to pass through even given no sand or gravel.

The one method to be recommended is to stratify the seed in sand early in the fall and allow to freeze through the winter, bury at a sufficient depth to keep cool through the summer, again raise and allow to freeze through the second winter and plant in the early spring. The seed treated in the above manner produced a large percentage of seedlings.

The seed will in all likelihood grow almost as good a percentage of trees if planted and allowed to freeze for the two years.

This species only developes about thirty to fourty per cent of its whole number of seed.

An experiment was carried on to test the vitality of the seed that had a well developed endosperm. Five species were used. Only one of these, however, was sufficiently early in its germination to prove the theory, but the Bull pine seed showed 91% with white fresh endosperm when a cross section was made. 89% of these germinated in a germinator of cloths suspended above water, with one end in the water. 79% have germinated after planting and are still germinating. This seems to be sufficient evidence that, even if, in the Gymnosperms, the endosperm developes before fertilization, in those seeds that are not fertilized the endosperm dries up, and that this is a safe test for the vitality of conifer seed.

A number of species of conifer seed were secured from an eastern seed house, but only a few have come through the ground for they were not planted until the twentieth of April.

Of those coming through, the seedlings of the pines show an irregular number of first leaves ranging from four to ten, and not at all regular in any species. The Red Cedar sends up two first leaves. The spruces from four to seven. The Arbor Vitaes two.

In all it would not be recommended to obtain Kansas seed for a large planting, but for the farmer, if he keeps watch of the seed years of the different species, it would be more profitable to plant seeds grown in his own locality.