

Are Regional Characteristics of Tree Growth Transmitted
Through the Seed.

by

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In the fall of 1896 the Division of Forestry, U.S. Dept. of Agr., invited the department of K.S.A.C. to cooperate in a test of forest-tree seed from various localities. It was the object of these experiments to prove or disprove the prevalent idea that a species may grow successfully over a wide area when propagated from seeds taken within restricted limits, but that if seed grown in one part of its range be planted in a distant part the seedlings are less hardy than those of native origin and to also take note in regard to the transmission or non-transmission, of regional characteristics of the various species experimented with, through the seed.

Seeds from various distant localities were obtained through the exchange of seeds by the experiment stations cooperating in the experiment, namely; Nebraska, Iowa, Illinois, Ontario, Ohio, Pennsylvania, Kentucky, and others.

The species chosen and planted at each station were as follows:

- Acer negundo (Box elder)
- Juglans nigra (Black walnut)
- Quercus macrocarpa (Bur oak)
- Fraxinus Americana (White ash)
- Fraxinus viridis (Green ash)
- Celtis occidentalis (Hackberry)
- Gleditsia triacanthos (Honey locust)

The per cent of the seed germination from the different states and of the different species planted at this station was as follows:

Box elder
Acer negundo.

(Alabama 5
)
 (Iowa 5
)
 (Illinois . . .20
)
 (Nebraska . . .20
)
 (Ohio 5
)
 (Ontario . . . 10
)
 (South Dakota . 5
)

Hackberry
Celtis occidentalis

(Connecticut . 10
)
 (Iowa 5
)
 (Kentucky . . . 5
)
 (Nebraska . . . 5
)
 (Ohio 20
)
 (Oklahoma . . .20
)
 (Pennsylvania .20
)

Green ash
Fraxinus lanceolata.

(Colorado20
)
 (North Dakota .80
)
 (Ohio10
)

Honey locust.
Gleditschia triacanthos.

(Alabama 60
)
 (Indiana 20
)
 (Illinois . . .10
)
 (Kansas20
)
 (Kentucky 5
)
 (Nebraska 5
)
 (Ohio 5
)
 (Ontario80
)
 (Pennsylvania .20
)
 (Tennessee . . 80
)

their transplanting.

In the growth of the trees there has been a great difference both in individuals of the same species from the same locality and in groups of species from different localities. In as much as all the trees have experienced the same treatment and conditions and all have been kept from injury we must attribute the faults or the good points to the tree or to its seed. Observation persuades us that they rest with the tree.

In the following data are given the average height and diameter of growth of the different species from the different states and also the average hardiness of each group. In ranking the hardiness we took as a basis perfect hardy trees and graded on a per cent of one hundred.

Species.	Source of Seed.	Avg.Height.	Avg.Diam.	Hardiness.
Gledistchia triacanthas	Alabama	9 ft.	2.25 in.	25 per cent
" "	Illinois	25.5	3.5	90
" "	Indiana	19.5	2.5	92
" "	Kansas	28.5	3.75	100
" "	Kentucky	22.5	2.5	85
" "	Nebraska	19	3.	70
" "	Ohio	20	2.25	82
" "	Ontario	17.5	2.5	70
" "	Pennsylvania	19.5	2.5	60
" "	Tennessee	10.5	1.5	45

Species	Source of Seed.	Avg. Ht. ft.	Avg. Diam. in.	Hardiness. per cent.
<i>Juglans nigra</i>	Alabama	5.5	1.5	25
" "	Colorado	8.	1.	20
" "	Georgia	8.5	1.25	22
" "	Illinois	9.5	1.5	45
" "	Iowa	12.5	1.75	80
" "	Missouri	15.5	1.5	75
" "	Nebraska	14	1.75	70
" "	N. Carolina	18	2.5	60
" "	Oklahoma	18.5	3.5	90
" "	Pennsylvania	8.	1.2	55
" "	Ontario	14	2.25	70
" "	Ohio	14.5	1.5	55
" "	S. Carolina	15	2.5	80
" "	Tennessee	11.5	1.75	72
" "	Virginia	14.	2.5	70
<i>Fraxinus</i>				
<i>lanceolata</i>	Colorado	13.5	2.25	95
" "	N. Dakota	15	1.75	85
" <i>Americana</i>	Connecticut	three sprouts		5
" "	Kentucky	8.5	.5	45
" <i>Lanceolata</i>	S. Dakota	18.5	3.75	100
" "	Ohio	19.	2.75	85
<i>Celtis</i>				
<i>occidentalis</i>	Connecticut	21	4.25	40
" "	Iowa	17	2.25	90
" "	Kentucky	21.5	3.	60
" "	Nebraska	21	3.25	90
" "	Ohio	18.5	2.5	80
" "	Oklahoma	19.5	3.5	95
" "	Pennsylvania	16.5	1.75	68

Species.	Source of Seed.	Avg. Hgt. ft.	Avg. Diam. in.	Hardiness. per cent.
Acer negundo	Illinois	12.5	2.5	85
" "	Iowa	18.	2.5	90
" "	Nebraska	16.5	2.5	95
" "	Vermont	19.5	2.75	96
" "	Ontario	15.5	1.75	75
" "	S. Dakota	17.	2.5	15
Quercus Macrocarpa	Illinois	8.5	1.25	25
" "	Vermont	12.5	2.	70
" "	Pennsylvania	10.	1.5	55
Fraxinus Lanceolata	Ontario	8.5	7.5	45

In comparing the rate of growth of the different species we find that, with two exceptions, the seed from the locality or from a locality of very similar conditions to the one in which they were planted, produced trees of more rapid growth than those of distant localities. But one species of Kansas trees was transplanted to the plot - *Gelditschia trichanthas* (Honey locust) - and it far excelled the others in growth. Of the *Juglans nigra* (Black walnut) those grown from seed gathered in Oklahoma made the best growth. The seeds from which the most rapid growing (*Fraxinus lanceolata*) grew came from ~~South~~ **South** Dakota. Those producing the ^{next} most vigorous, *Fraxinus ~~Lanceolata~~* (Green ash), were obtained from ~~North~~ **North** Dakota. Kentucky seed is credited with furnishing the most rapid growing *Celtis occidentalis* (Hackberry) and *Fraxinus Americana* (White ash). Vermont seed takes the honor of producing the best growing *Acer negundo* (Box elder) and *Quercus morocarpo* (Bur oak).

The per cent of trees, from seeds of the various states,

that grew after being transplanted, are as follows:

Iowa	100 per cent
Kansas	100
Indiana	100
Pennsylvania	100
S. Dakota	100
Illinois	90
Colorado	96
Ohio	95
Nebraska	90
N. Dakota	90
Virginia	90
Missouri	80
Vermont	75
Oklahoma	60
S. Carolina	60
Kentucky	60
Connecticut	50
Tennessee	50
Ontario	48
Georgia	20
N. Carolina	20

In examining the trees we found practically no difference in their habits of growth and their general appearance was the same. The greatest difference in individual trees of the same species and grown from seed of the same locality was to be found among those of seeds from a distant locality. A marked tendency for uniform growth was noted in the trees of local seed and from localities not far removed from the station. The three groups having the most uniform growth were from Kansas, Nebraska, and North Dakota, respectively.

The trees to bloom and leaf first were the *Fraxinus lanceolata* (Green ash) of Colorado. They came in about three days ahead of the same species from North Dakota. The *Acer negundo* (Box elder) came in next, all about the same time. The Honey locust of Illinois were about three days ahead of those of Kansas. Both preceded the others of the same species by five days. The Hackberries from Pennsylvania and Connecticut bloomed about the same time, leading the others by four days. Of the

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Nebraska	90
N. Dakota	90
Virginia	90
Missouri	80
Vermont	75
Oklahoma	60
S. Carolina	60
Kentucky	60
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Ontario	48
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black walnut, those from Ohio were five days behind all others. While for the Bur oaks those of Vermont and Pennsylvania led the rest by a full week.

Word from other stations cooperating with the one at Manhattan in this experiment bring nothing of note other than that mentioned above.

The trees grown from seed of the locality in which they are planted outstrip the others in rate and uniformity of growth, or rather they have thus far, and in all probabilities they can be counted upon to maintain their lead. In regard to their hardiness wide differences exist, that in most cases favor trees of local seed. In blooming and leafing we find the differences are not consistent from year to year.

Of experiments conducted in Germany with highland and lowland spruce we have the following:

"The growth characteristics of highland and lowland spruce are inherited by the seedlings, even when grown under different climatic conditions. Spruce grown from lowland seed decreases in height growth with distance above the sea level, and at a more rapid rate than spruce grown from highland seed.

Seed from Alpine regions when grown in lowlands produce trees which start into growth earlier in the spring, do not grow so high, and stop growing earlier each season than trees grown from lowland seed. Seed selected from trees stunted because of unsuitable soil conditions may transmit these characteristics. On the whole, the experiments of this and other stations and individuals, indicate that in forestry practice the best seeds are those of the locality in which the trees are to be grown."

In sizing up our data we agree with the above author. While

we cannot say with any degree of certainty that what little difference there is in the trees and their growth, discussed above, is due to or transmitted by the seed, we will uphold him in the statement that trees grown from seeds of a certain locality are the best for that particular locality or region.