EARLY RESULTS FROM A RANGEWIDE GREEN ASH PROVENANCE TEST

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Abstract.--Two-year-old green ash seedlings from 32 provenances covering 14° of latitude and 32° of longitude in the United States and Canada were outplanted in central Maine. After 4 growing seasons in the field, average survival was 96%. Height varied significantly among provenances, ranging from an average of 98.0 cm for trees from Iowa and eastern Missouri, to 33.2 cm for trees from a provenance in southern Missouri. Trees from the Ohio River valley region generally sustained the most winter damage, while those from other areas suffered little injury due to cold.

Additional keywords: *Fraxinus pennsylvanica*, geographic variation

Green ash (*Fraxinus pennsylvanica* Marsh.) is widely distributed throughout eastern North America. Natural stands are usually confined to bottom lands, but green ash has been successfully planted on upland soils throughout the Great Plains (Fowells 1965).

Early provenance tests, which covered relatively small geographic areas, revealed that green ash seed sources differed in phenology, growth rate, and resistance to drought and winter cold (Wright 1944, Meuli and Shirley 1937). The rante-wide study upon which this report is based was designed to provide a more comprehensive understanding of geographic variation in green ash.

METHODS

Seed collections from 2 to 4 mother trees at each of several locations throughout the United States and Canada were assembled by Kim Steiner at Pennsylvania State University. In May 1978, 1-1 seedlings from 32 of these green ash provenances, as well as 2 provenances of white ash (*Fraxinus americana* L.), were shipped to the University of Maine and outplanted near Augusta, Maine (Table 1). Trees were planted on a 3.6 m x 3.6 m (12 ft x 12 ft) spacing, with 4 replications of 4-tree row plots.

The planting site is a high, west-facing field with a heavy sod cover. SimazineR was used prior to planting to remove the grass in a 1-meter circle around each planting spot. The plantation has been mowed periodically to control grass competition.

Individual tree height to the top of the uppermost live branch has been measured annually. In addition, the number of trees having dieback of the terminal leader attributable to winter damage was recorded in the spring of 1979, 1980, and 1981.

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Table 1.--Location of seed sources included in provenance test of green ash.

Provenance	State or Province	Lat.	Long.
45	cultivated	-	-
138	Indiana	39.4	86.8
141	Ohio	39.4	84.5
165	Illinois	40.0	91.4
169	Illinois	39.0	90.5
173	Illinois	38.2	88.9
177	Missouri	36.7	89.2
193	West Virginia	37.7	80.8
197	South Dakota	45.8	103.5
201	New York	41.8	75.5
211	Ontario	43.0	80.4
214	Alberta	53.6	113.5
225	Minnesota	47.2	95.2
249	Ohio	39.9	82.4
265	cultivated	-	-
269	South Dakota	43.6	103.0
293	Michigan	43.6	86.1
301[a/]	Ohio	40.5	81.9
305	Ontario	44.2	76.8
317	Nebraska	41.0	97.2
321	Nebraska	42.7	103.2
337	Quebec	46.4	71.5
345	Illinois	37.7	89.5
349[a/]	Illinois	37.7	89.2
405	Nebraska	42.0	97.1
409	Nebraska	42.0	97.4
413	Nebraska	43.0	103.6
425	Iowa	42.0	93.6
441	Nebraska	41.9	100.3
469	Missouri	38.6	90.2
505	Ontario	45.5	77.0
509	Manitoba	50.4	95.4
513	Manitoba	50.7	99.5
541	Saskatchewan	50.7	103.6

[a/] White ash (F. americana) included for comparative purposes.

RESULTS

Survival. After 4 growing seasons in the field, overall survival averaged 96%. All provenances had greater than 85% survival, except for #177 from southern Missouri which has repeatedly suffered severe winter damage. Other minor sources of mortality, apart from winter injury, include damage inflicted by mice, groundhogs, deer, insect oviposition, and mechanical injury.

Growth.--Average height in this plantation was 46.6 cm in 1978, and 78.5 cm in 1981 (Table 2). Mean height of provenances in 1981 ranged from 98.0 cm for trees from Iowa and central Missouri (#469 and #425), to 33.2 cm for trees from southern Missouri (#177). Differences in height among provenances were highly significant (Table 3).

Table 2.--Percent of mean plantation height, and percent of trees with winter dieback (averaged over 3 years), for green ash provenance test at Augusta, Maine.

Provenance	Percent of Mean Height 1981	1980	1978	% Winter Damage
469	125	117	108	3
425	125	121	115	4
45	115	109	98	2
409	115	116	120	0
413	115	106	96	2
305	114	111	92	12
441	112	114	101	5
169	112	114	112	13
193	112	113	108	22
165	111	113	114	16
173	111	130	137	37
321	110	110	96	3
197	108	101	86	3
405	106	103	99	2
505	105	102	95	7
201	104	103	103	6
317	103	105	115	12
211	102	88	92	2
509	102	96	96	0
138	99	93	104	19
293	98	93	93	12
269	97	95	87	6
249	90	93	105	14
225	89	86	82	7
265	88	92	100	2
337	87	86	78	4
301	85	91	103	9
345	85	97	113	43
513	85	83	73	3
214	82	75	78	0
349	81	111	111	26
141	80	85	94	24
541	79	73	65	4
177	42	75	112	61
Mean (cm)	78.5	66.7	46.6	-

Table 3.--Analysis of variance for total height in 1981.

Source	D.F.	Mean Square	F Value
Provenance	33	344.18	3.38**
Replication	3	269.01	2.64*
Error	474	101.79	

*sig. at 5% level ** sig. at 1% level

Mean height in 1978 was negatively correlated with latitude of the provenance (r = -.79**; Table 4), but this relationship has decreased with time and may be reversing itself, since growth of the terminal during 1981 was positively correlated with latitude (R = .44*). Earlier provenance tests of green ash in the Northeast found that southern trees were tallest at age 2, but that at age 13 the tallest trees were from the upper Midwest (Wright 1944, Santamour 1963).

Table 4.-- Correlations between height and latitude of origin for trees in the green ash provenance test, Augusta, Maine.

		Mean Height		
	Latitude	1978	1980	1981
1981 Growth	.44**	NS	NS	.72**
Height 1981	NS	NS	.80**	-
Height 1980	-.49**	.70**	-	-
Height 1978	-.79**	-	-	-

Winter damage.--Trees of most provenances have suffered little winter dieback, even though the winter of 1980-1981 was unusually cold. The average number of trees which suffered dieback of the terminal during the past three winters was less than 10% for most provenances. In general, trees from the northern part of the range and from the Missouri River drainage area exhibited little winter dieback, while those from the Ohio and Illinois River drainages were more frequently damaged. This is probably due to the similarity of winter temperature ranges in Augusta to those in Nebraska and Iowa, when compared to the Ohio River region. However, since green ash seed can be dispersed by water (Fowells 1965), the pattern of winter injury might also be influenced by migration along rivers similar to that which Ying and Bagley (1976) observed in cottonwood (*Populus deltoides* Bartr.).

SUMMARY

After 4 growing seasons, green ash seedlings from 32 provenances had excellent survival rates and varied significantly in height. Five of the six tallest provenances were from the central Plains states. Height after four growing seasons was not correlated with first-year height. Trees from the Ohio River valley region were frequently killed back by low winter temperatures, but other provenances had minimal winter damage.

LITERATURE CITED

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