

FIELD TRIP TO THE SARATOGA NURSERY

NEW YORK STATE FOREST TREE IMPROVEMENT PROGRAM

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The New York State Forest Tree Improvement Program is one of putting in practice available information from all sources. The objective is to improve the quality of plantations made on both private and public lands within the state, through the application of genetics. The steps are essentially selection of quality trees and their propagation to produce seed for sowing. Through genetical means it is expected to constantly improve the quality by selection and hybridization between individuals of the same species or between species. The criteria for quality are somewhat indefinite. However, such things as straightness of bole, rate of growth, wood quality and pest resistance are desirable in any tree improvement program, and are, therefore, basic in the selection phase. The need for such a program is obvious, since quality seed, based upon selected trees, is not available except to produce it ourselves.

The program is therefore, based upon one of progressive improvement. In order to obtain some improvement in the immediate future emphasis is laid on the establishment of seed production areas. These are existing plantations or natural stands now or nearer cone producing age, which are treated to remove, and therefore prevent the poorer quality of trees from producing seed, or to pollinate the better trees. Simultaneously with this program is the selection of the best trees from all species. From these both grafts and seeds are collected, The seed orchards with grafts are not expected to produce quality seed for some years, but will be more improved due to the control and high ratio of selection possible. Seedlings produced from seed production areas and orchards arising from both open and controlled pollinations are expected to be of the highest order, but still further in the future in producing quality seed.

The acres needed for producing quality seed, based upon present knowledge, are shown in Table I. Table II shows the seed orchards and seed production areas, established or planned for the immediate future, Table III shows an inventory of grafted materials on hand, being readied for planting. Table IV shows seedlings at the nursery which will be used for special plantings, for provenance tests or seed producing areas. Table V gives a list of plantations of provenance tests which are being used as a source of information and material to support the tree improvement program. Not shown is a host of plantations, planted since 1928, which also furnish both information and material for the program. These are "forest arboretums" which are used also by other agencies in and out of state. A seed-lot record system long in use in invaluable Co support the program.

The State cooperates with the State University College of Forestry in this program, Some details of this were given at the 12th Northeastern Forest Tree Improvement Conference held at University Park, Pa. in 1964, "Forest Tree Seed Improvement in New York State" by E. J. Eliason and G. R. Stairs.

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LARCH STUDIES

Larch planting and studies of *Larix* species and varietal forms have been an integral part of reforestation in New York State for more than 35 years. While less than 4 percent of the tree production has been of this genus so that it may still be called a minor species the total distribution through 1964 equals some 44 million trees a figure not approached by any other state. The State has some plantations over 50 years old, and a few private plantings may be found approaching 100 years State distribution of planting stock during the first three decades of the century were mostly the European species with the Japanese being introduced about 1930 and gradually increasing over the European Attention to seed sources began about this time S. S Hunt (1932) pointed out the cultural characteristics and growth potential of European Larch discussed geographic races and thus created interest in the species. The first trials with the "Dunkeld Hybrid" were initiated with a seed sample received from Scotland in 1929 and some results were published by Littlefield and Eliason (1938). In 1936 and 1937 more extensive plantings were made with Dunkeld stock and seed obtained from a Scottish seed dealer. This lot was distributed to 14 state and private areas, including Coxsack Forest Data on this lot planted in Saratoga County as compared with other species have been published by Littlefield and Eliason (1956) and by Eliason and Carlson. (1963). Considerable unpublished data are available and further observational work remains to be done Both State and private plantations are being examined for select trees in the Tree Improvement Program. Some of these selections are listed in Table III. The International larch series with 66 lots were outplanted. In 1948 on a Saratoga County area Some data on this were published by Genys (1958).

SCOTCH PINE TESTS

Scotch pine is one of the most variable tree species, due mostly to the wide range of the native sources in Europe.. The species has been widely planted in North America. Due to the frequency of poor forms the species has lost favor as a plantation species for timber. The species has much favor as a Christmas tree species when harvested at an early age. A slow symmetrical growth which maintains good green color during the winter are important criteria for this purpose. The species is tolerant of a variety of planting sites and as there are good forms in some stands and as individual trees, this species should be adaptable for tree improvement through principles of genetics

Many tests for growth and coloration have been made to compare source with growth and color. At the Saratoga Nursery is a small series of plantations which were made in 1960, 1961, 1962. The planting stock was obtained through the courtesy of Mr. C. E. Heit of Geneva N. Y. The following tabulation on the comparative heights and color of several sources of Scotch pine planted as 2-0 seedlings in 1960 and measured after 5 years growth, may be of interest:

Source	No. Trees Measured	No. of Seed Lots	Mean Ht. in ft.	Color ^{1/} Score	Remarks
Spain	235	10	1.9	4.4	Darkest green with slowest growth
France	141	6	2.8	4.0	
Scotland	48	2	3.2	2.9	
England	24	1	3.4	3.0	
Yugoslavia	24	1	3.4	2.4	
Boonville, NY	22	1	3.6	3.9	Medium growth and green
Germany	64	3	3.8	2.9	
Austria	46	2	4.3	2.8	
Belgium	24	1	4.6	2.7	Fastest growth but yellowish

^{1/} 1.0 to 5.0 ranging from yellow winter color to dark green.

LITERATURE CITED

- Hunt, S. S. 1932. European Larch in Northeastern United States. Harvard Forest Bull. 16 (This study was completed after Hunt became employed by the N. Y. S. Conservation Dept.)
- Littlefield, E. W. and E. J. Eliason 1938. Observations on a Plantation of Dunkeld Hybrid Larch in New York, Jour. For Vol, 36, No. 12, pp. 1188-1192
- Littlefield, E. W. and E. J. Eliason 1956. Report on an Experimental Plantation of Several Species of Larch in New York. Zeitchrift fr Forest genetik und Forst pflanzenzchtung 5 Band Heft 5-6.
- Eliason E. J. and Donald Carlson 1963. Comparative Volume Production of Some Species of Larch. Notes on Forest Investigation No. 46, N. Y, S. Conservation Dept.
- Genys, John 1958. Geographic Variation in European Larch New Hampshire Bull. 13.

Table I.--Acres needed for seed production

Species	Annual production in trees	Plantable trees per lb.	Annual needs in lbs	Av. seed production per acre	Acres + 50% safety*	Acres per million
Wt. pine	4,000,000	4,000	1,000	20	75	19
S. pine	6,000,000	15,000	400	20	30	5
Red pine	4,800,000	8,000	600	5	180	37
Wt. spruce	12,000,000	18,000	666	25	39	3
N. spruce	8,000,000	8,000	1,000	20	75	9
Larch	4,000,000	6,000	666	10	99	25
Misc. species	1,200,000	12,000	100	20	7	6
TOTAL	40,000,000	--	4,432	--	505	--

* Experience has indicated a reasonable safety factor of 50% against unforeseen and uncontrollable losses. Lake States (Rudolf) allows 100%.

Table II.--Seed production areas and seed orchards

Species	Total acres needed	Seed production areas		Seed orchards		
		Acres needed	1966*	Acres needed	Grafts needed**	1966*
White pine	75	25	20	50	7,500	30
Scotch pine	30	20	26	10	1,500	6
Red pine	180	140	42	40	6,000	-
White spruce	39	26	26	13	1,950	1
Norway spruce	75	50	-	25	3,750	5
Larch	99	50	16	49	7,350	15
Misc. species	7	5	-	2	300	-
TOTAL	505***	316	130	189	28,350	57

* Planned for completion by July 1, 1966.

** Based on 150 grafts per acre (as of August 10,068 grafts on hand - table 3). The number of seedlings from open or controlled pollinations planted for seed orchards or seed production areas will start with the normal spacing 1,000-1,500 per acre, which will permit future selection.

*** The ratio of seed production to seed orchard acres varies with the nature of the species. Under a plan of "progressive improvement" the total acreage may remain the same but the older areas will be replaced with the more improved ones.

Table III.--Inventory of successful grafts, August 1965

Year grafts made:	1960-1961		1961-1962		1962-1963		1963-1964		1964-1965		Total	
Species and source	Clones	Grafts	Clones	Grafts	Clones	Grafts	Clones	Grafts	Clones	Grafts	Clones	Grafts
White pine Northern N.Y.	7	40	13	56	9	281	3	200	-	-	32*	577
White pine Southern N.Y.	-	-	-	-	7	164	20	841	-	-	27*	1005
White pine N.Y. plantations	-	-	-	-	-	-	32	1999	24	1766	56	3765
White pine B.R. resistant	-	-	11	101	-	-	-	-	-	-	11	101
White pine Miscellaneous	-	-	-	-	-	-	2	37	-	-	2	37
Total white pine	7	40	24	157	16	445	57	3076	24	1766	128	5485
Scotch pine N.Y. plantations	3	3	3	4	4	98	-	-	24	1507	34*	1612
Norway spruce N.Y. plantations	-	-	15	133	6	41	15	253	20	777	56*	1204
W. white pine N.Y. plantations	-	-	2	11	-	-	8	324	-	-	10	335
White spruce Northern N.Y.	12	42	3	11	-	-	-	-	-	-	15	53
Douglas-fir Needle cast resist.	-	-	-	-	-	-	4	31	9	157	13	188
Eur. larch N.Y. plantations	1	19	9	63	8	66	-	-	4	43	22	191
Jap larch N.Y. plantations	-	-	3	16	10	217	-	-	20	479	33*	712
Hybrid larch N.Y. plantations	-	-	6	98	-	-	3	44	3	39	12*	181
Misc. larch N.Y. plantations	-	-	5	38	-	-	-	-	-	-	5	38
Misc. species N.Y. plantations	-	-	3	20	6	25	4	24	-	-	13	69
									Grand total		341*	10,068

* Number includes some regrafts.

Table IV.--Summary of seedbeds for tree improvement, Saratoga Nursery

Species	Year sown	No. of sources	Replica-tions	Actual source	Cooperating agency
Norway spruce	1963	4	2	4 locations in Austria	Fed. Exp. Sta., Vienna, Austria
"	1964	4	2	" " " "	" "
"	1965	20	2	20 locations in Canada and Europe	Mark Holst Petawawa Exp. Sta., Ontario
"	1965	21	2	21 single tree selection in N.Y.State plantations	
White spruce	1965	15	1	15 lots of seed collections from storage	
"	1965	2	2	Seed samples from white spruce grown in Denmark	Herbst Bros., Seed Dealers
"	1965	34	1	Control-pollinated seed; 5 trees in Otsego 15 Seed Prod. Area	Pollination by Dr. Stairs, Syracuse
"	1965	27	4	27 single trees selected on Lewis 23 Seed Production Area	
Scotch pine	1964	9	1	Single tree collection from Schoharie 20 Seed Production Area	
"	1964	17	2	Test of using "yellow" pollen as tracer	
"	1964	4	1 to 16	From trees produced from X-rayed seed	
"	1965	12	1	12 single-tree selections in N.Y.; trees used in grafting program	
Red pine	1964	14	1 to 9	14 single-tree selections Otsego 13 Seed Prod. Area	
European larch	1964	3	2	3 locations in Austria	Federal Exp. Sta., Vienna
Douglas-fir	1965	5	1	From 5 trees apparently resistant to needle cast	Schoharie 20 Exp. Area
Sugar maple	1965	244	5	Provenance study from natural range of species	U.S. Forest Serv., Burlington, Vt.

Table V.--List of provenance plantings in New York

Species*	Years planted	County and state area	No. of sources	No. of replications	Planting design	Data taken	Publications and remarks
Scotch pine	1940 1941 1942	Herkimer No. 1	43	3 each yr.	Lots in order	1956	N.E. Forest Exp. Sta. No. 166 "Results of 1938 IUFRO Test" Schreiner, Littlefield & Eliason
Norway spruce	1942	Otsego No. 9	34	One	Random	1962	Submitted for publication "Spruce Tests" by Baldwin, Eliason and Carlson
Larch sp.	1948	Saratoga	66	One	Random	1954 1958	1958 Data used by John Genys "Geographic Variation in Euro. Larch", N. H. Bul. 13
Larch sp.	1963	Madison No. 12	33	Six & nine	Super latin square	-	Severe deer damage 1964-65 winter
White pine**	1965	Washington No. 1	15	Four	Random	-	Part of Univ. Maryland test
Jack pine***	1965	Washington No. 1	39	Four	Random	-	Seed collections by Petawawa Sta. Trees grown by H. Baldwin
Eur. larch	1965	Washington No. 1	3	Four	Random	-	3 Austrian sources. Exp. Sta. Vienna
White spruce	1965	Washington No. 1	30	Four	Random	-	Cooperation of M. Holtz, Petawawa
White spruce	1965	Schenectady No. 1	24	Four	Random	-	Cooperation of M. Holtz, Petawawa

* First 3 seed received through the IUFRO (International Union of Forest Research Organizations).

** Additional lot planted by State College of Forestry on Tully Forest, Cortland Co.

*** Duplicate lots planted at the Pack Forest, Warren Co. and Tully Forest by State College of Forestry.