FOREST TREE IMPROVEMENT PROGRAM FOR THE NATIONAL FORESTS IN THE NORTHEAST

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ABSTRACT--The U.S. Forest Service has been conducting a Forest Tree Improvement Program on the National Forests in the Northeast since 1966. This paper presents a general review of the program giving objectives, organization, species priorities, procedures and accomplishments to date.

A Tree Improvement Program for the four National Forests (Fig. 1) (Allegheny, Green Mountain, Monongahela, White Mountain) in the Northeast was begun in 1966. Objectives for the program are: 1) to produce genetically improved seed for seedling production and/or direct seeding that will yield fast-growing, high quality, pest resistant forest trees; and 2) to develop and demonstrate cultural methods for producing timber and other products by applying sound genetic principles. The program is carried out by the Regional Geneticist, a Zone Geneticist, and three part-time forestry technicians. Additional manpower is provided by the Ranger District where the field activities are performed.

SPECIES

The implementation of the multi-forest and multi-species tree improvement program necessitated the development of species priorities and a sequence of operations. These are essential for planning budgets and programs of work. The following factors are considered when setting species priorities: 1) economic importance on the National Forests, 2) acres of commercial forest land in the various timber types, 3) natural variability within the species,

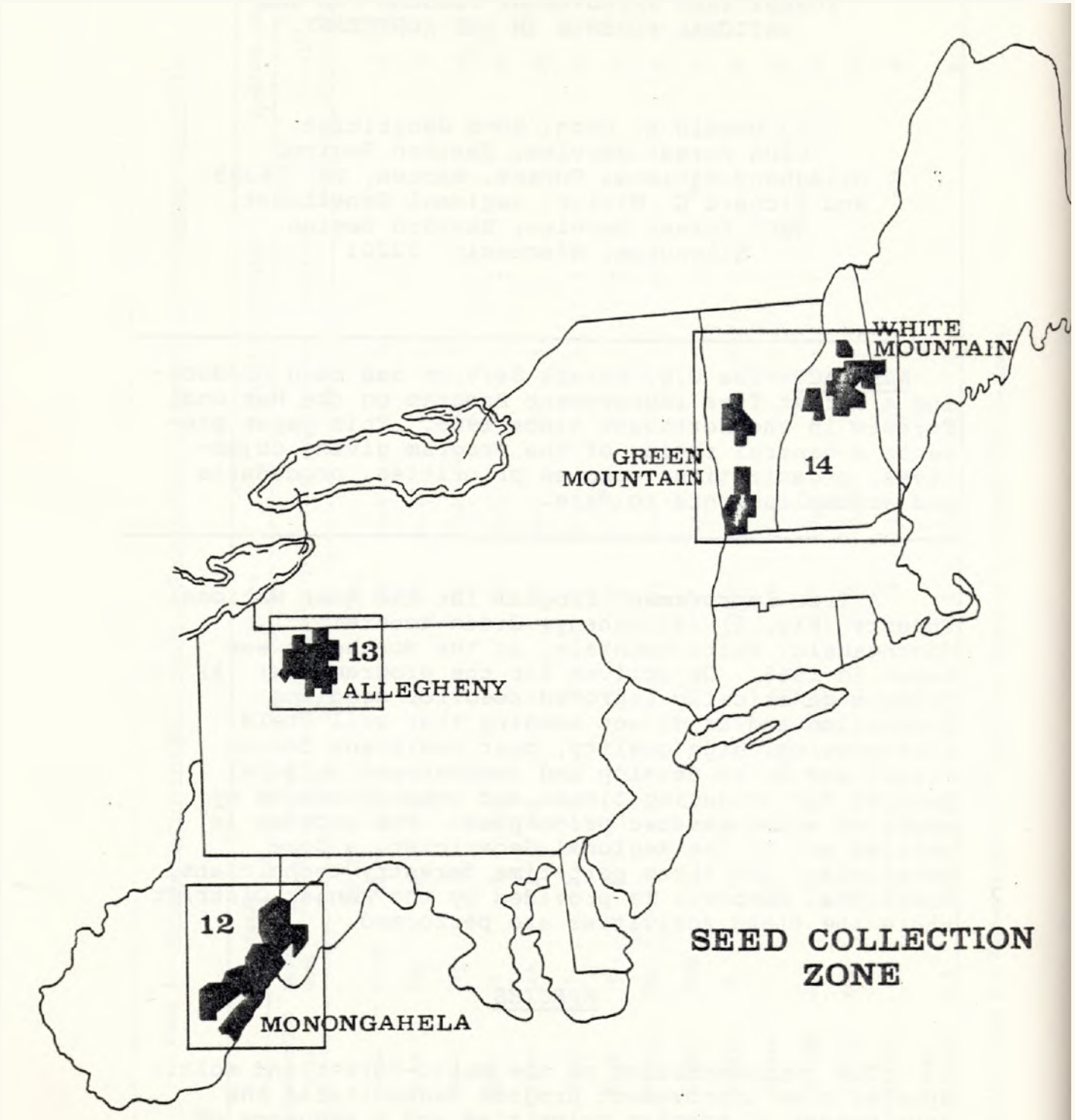


Figure 1.--Location of Eastern National Forests and boundaries of seed collection zones.

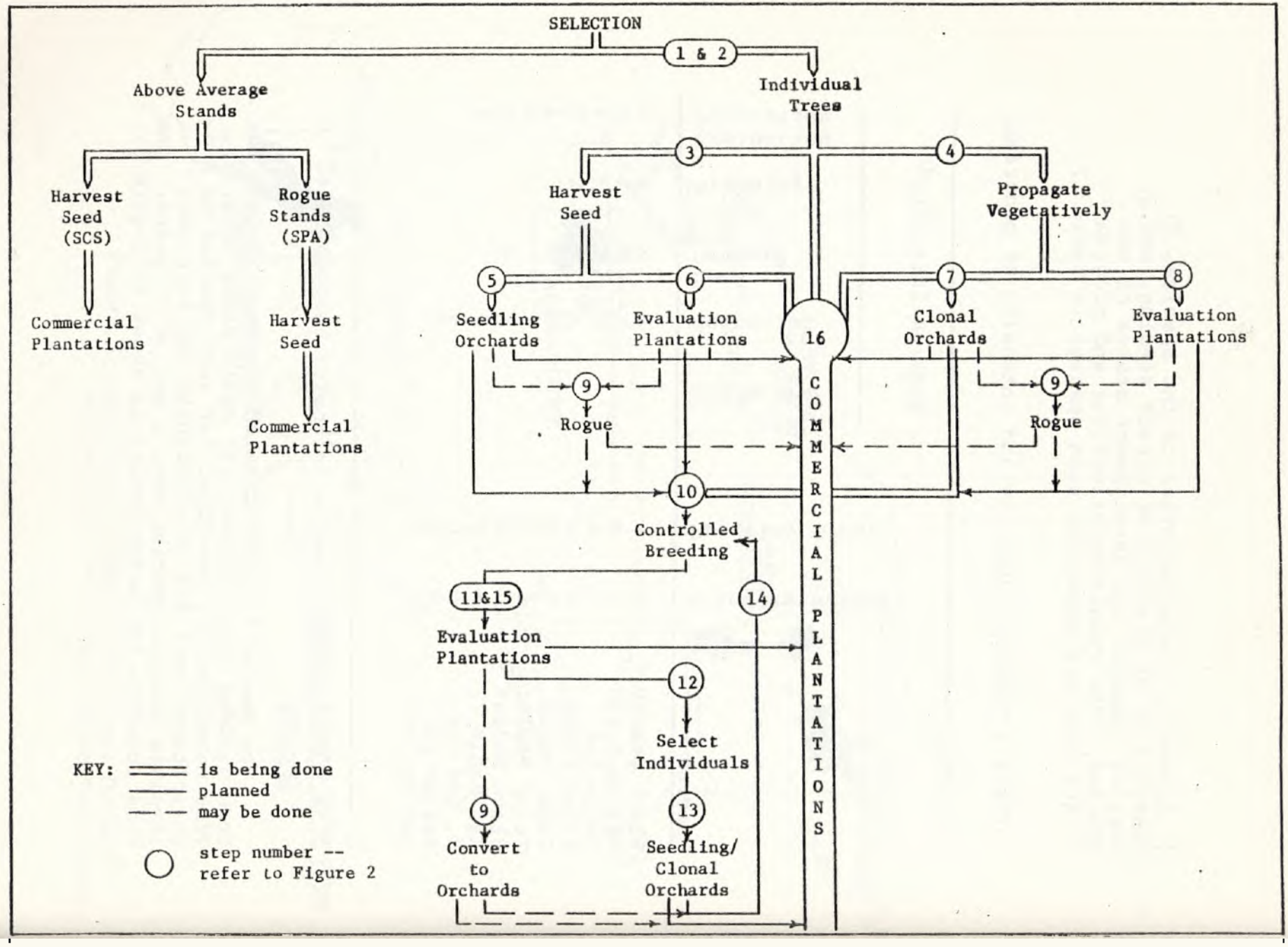
4) flowering characteristics of the species, 5) feasibility of planting or direct seeding, and 6) current research and development status of the species. The resulting priorities and program intensities are shown for each species in Table 1.

Table 1--Species priority and intensity of programs.

Species	Priority Number	Priority Group	Program Intensity[a/]				
			SCS & SPA	Selection	Seed Orchard	Breeding	Evaluation Plantation
Black Cherry	1	A	X	X	X	X	X
Yellow Birch	2	A		X	X	X	X
White Ash	3	A		X	X	X	X
Paper Birch	4	A		X	X	X	X
Sugar Maple	5	B		X	X		X
Tulip Poplar	6	B		X			X
Black Walnut	7	B		X	X		X
Red Maple	8	B		X			X
N. Red Oak	9	C		X			
Balsam Fir	10	C		X			
Red Spruce	11	C	X				

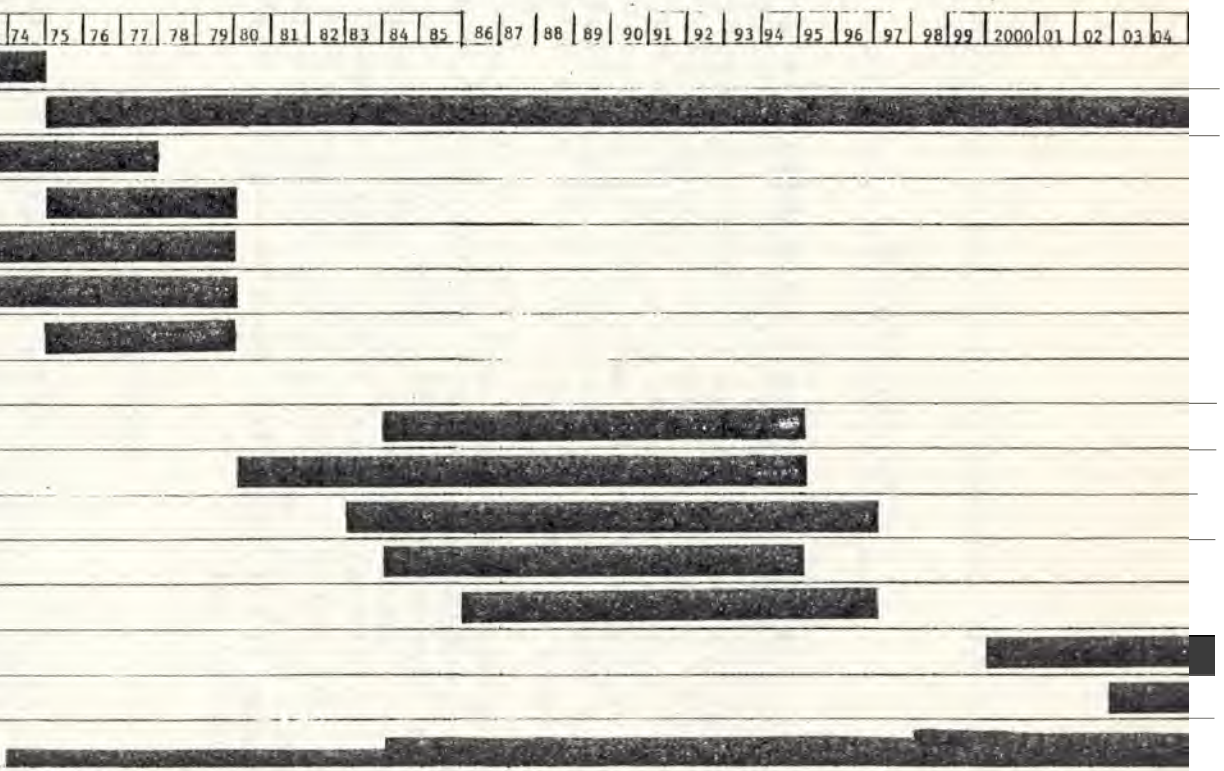
a/ Anticipated program intensity through 1984.

The Region 9 Forest Tree Improvement Program has been divided into sixteen (16) basic steps (Fig. 2). Time schedules are developed for each species to show anticipated work and to coordinate the work that involves several species over a period of years. The time schedule for black cherry is shown in Figure 3.


SELECTION
1 & 2
Above Average Stands
Individual Trees
Harvest Seed (SCS)
Rogue Stands (SPA)
3
4
Harvest Seed
Propagate Vegetatively
Commercial Plantations
Harvest Seed
5
6
7
8
Seedling Orchards
Evaluation Plantations
16
Clonal Orchards
Evaluation Plantations
9
9
Rogue
Rogue
Commercial Plantations
10
COMMERCIAL PLANTATIONS
Controlled Breeding
11&15
14
Evaluation Plantations
12
Select Individuals
13
9
Convert to Orchards
Seedling/ Clonal Orchards
KEY: is being done
planned
may be done
step number -- refer to Figure 2

FORESTS: ALLEGHENY & MONONGAHELA SEED ZONES: 12 & 13 SPECIES: BLACK CHERRY LOCATIONS OF SEED ORCHARDS AND EVALUATION PLANTATIONS: ALLEGHENY & MONONGAHELA

STEP	DESCRIPTIONS
1	Individual Tree Selections
2	Additional Selections as Required
3	Collect Half-Sib Seed (Steps 1 & 2[1])
4	Propagate Vegetatively (Steps 1&2)
5	Establish Seedling Seed Orchards (Step 3)
6	Establish Half-Sib Evaluation Plantations (Step 3)
7	Establish Clonal Seed Orchards (Step 4)
8	Establish Clonal Evaluation Plantations (Step 4)
9	Rogue Seed Orchards or Evaluation Plantations (Steps 5, 6, 7 & 8)
10	Controlled Breeding (Steps 5,6,7,8&9)
11	Establish Full-Sib Evaluation Plantations (Step 10)
12	Select Individuals in Evaluation Plantations (F_1, F_2, etc.) (Step 11)
13	Establish Advanced Generation Orchards (Step 12)
14	Controlled Breeding (Steps 12 & 13)
15	Establish Advanced Generation Full-Sib Evaluation Plantations (Step 14)
16	Establish Commercial Plantations with Improved Seed (Steps 3-9 & 11,13&15)



1/The numbers in parentheses refer to previous steps that this action is dependent on.

Figure 3.--Black cherry tree improvement time schedule.

SEED COLLECTION

The four National Forests have been assigned to three seed collection zones (Fig. 1). The Allegheny and Monongahela Forests were assigned to separate seed zones due to latitudinal and elevational differences. Because of their close proximity, the Green Mountain and White. Mountain Forests were placed in the same zone. Data collected in evaluation plantations will provide a base for evaluating the seed zone boundaries.

Seed production areas and seed collection stands have been established for red spruce (Green Mountain), white pine (Monongahela) and black cherry (Allegheny). Seed has been collected from these areas and from individual select trees, and has been used for bare-root nursery stock, containerized stock and direct seeding programs on the National Forests. As seed becomes available from seed orchards, these areas will be phased out.

SELECTIONS

Individual trees showing fast growth, good form, and pest resistance are found on the National Forests by trained technicians. All of the parents to be used in the first generation black cherry, yellow birch, and paper birch seed orchards and evaluation plantations have been selected, although additional outstanding phenotypes will be mapped, recorded, and preserved when they are reported. An active search for selections is currently being conducted for white ash and sugar maple, with a lower priority assigned to locating red oak and red maple. The number of selections included in the program are shown in Table 2 by species and general location of the select tree.

Table 2--Number of selections by species and National Forest.

Species	National Forests			
	Allegh.	Monon.	G. Mt.	W. Mt.
B. Cherry	103	50	2	-
Yellow Birch	59[a/]	8	33	37
White Ash	10	10	10	1
Paper Birch	-	-	9	38
Sugar Maple	-	-	27	12
Tulip Poplar	74[b-/]	18	-	-
B. Walnut	34[c/]	2	-	-
Red Maple	19	3	4	-
N. Red Oak	20	-	-	-
Balsam Fir	-	-	8	22
Total	319	91	93	110

[a/] Includes 10 selections from Canada and 40 selections from Lake States.

[b-/] Includes 70 selections made on state and private lands.

[c/] Includes 34 selections made on state and private lands.

OUTPLANTINGS

Seed was collected from the select trees when crops were present. Evaluation plantations were established as soon as seed was available from at least 20 selections. As a result, evaluation plantations for a single species have been established over a period of several years. Each year's planting is assigned a unique number and treated in our records as a separate plantation.

As the Forest-Service does not operate any nurseries in the Northeast, the planting stock has been raised in the State nurseries of New Hampshire, Pennsylvania, Vermont, and West Virginia. One black cherry plantation was established with containerized stock grown in a greenhouse at Kane, Pennsylvania. This technique was very successful and will be used more in the future.

If large variations are present in the seedbeds, seedling heights are measured and analyzed before lifting. During the packaging operation, seedlings are sorted and packaged so that the mean height of each family plot in each plantation will approximate the overall mean of that same family. This should help us interpret data collected in the future. Statistics regarding the seed orchards and evaluation plantations are shown in Tables 3 and 4 respectively.

Table 3--individual seed orchard statistics.

Species	Orch No.	Forest	No. of Families	No. of Reps.	Acres	Yr. Estab.
Black Cherry	100	Allegh.	17	4	1	1969
Black Cherry	102	Allegh.	50	4	2	1970
Black Cherry	103	Monon.	50	4	2	1970
Black Cherry	104	Allegh.	55	4	2	1972
Black Cherry	105	Monon.	55 /	4	2	1972
Black Cherry	106	Allegh.	150[a]	8	6	1976
Black Cherry	108	Allegh.	65	8	4	1974

Table 4--Statistics on evaluation plantations.

Species	National Forest	No. of Families	No. of Sites	Total Acres	Year Est.
Black Cherry	Allegh.	17	3	3	1969
Black Cherry	Monon.	17	2	2	1969
Black Cherry	Allegh.	50	2	4	1970
Black Cherry	Monon.	50	3	6	1970
Black Cherry	Zoar Valley[a]	50	1	2	1970
Black Cherry	Monon.	42	1	2	1971
Black Cherry	Allegh.	55	2	4	1972
Black Cherry	Monon.	55	3	6	1972
Yellow Birch	Green Mt.	28	3	5	1973
Yellow Birch	White Mt.	28	2	3	1973
Yellow Birch	Monon.	19	1	1	1973
Yellow Brich	Green Mt.	25	2	4	1974
Yellow Birch	White Mt.	30	2	4	1974
Yellow Birch	Monon.	24	1	1	1974
Yellow Birch	Green Mt.	44	2	4	1975
Yellow Birch	White Mt.	44	2	4	1975
Yellow Birch	Monon.	30	1	1	1975
Yellow Birch	Green Mt.	39	3	3	1976
Yellow Birch	White Mt.	39	2	2	1976
Black Walnut	Monon.	34	3	4	1976
Tulip Poplar	Monon.	40	1	2	1973
Tulip Poplar	Monon.	20	1	1	1974
Tulip Poplar	Zoar Valley[a]	6	1	2	1973
Tulip Poplar	Zoar Valley[a]	25	1	1	1974
White Ash	Allegh.	36	1	2	1976

[a] In cooperation with New York State Department of Environmental Conservation.

MEASUREMENTS

Data on survival and height are collected following the first, third, fifth, and tenth growing seasons. Other observations such as degree of competition, insect and disease damage, and flowering are taken on an "as needed" basis. Data on diameter and stem form will be collected when the plantations are five years old.

Data collected in 6 year old black cherry evaluation plantations show family height means varying from 60 percent to 155 percent of the overall plantation mean. Although the ranking of many families changes from one plantation to another, some show a consistent superiority at all locations. A similar trend has been noted for other species in the program, however, these data are from even younger plantations.

RECORDS

An ADP system has been developed to maintain the identity and status of all plant material used in the tree improvement program. The system also summarizes, maps, and analyzes the data collected in seed orchards and evaluation plantations.