MORTALITY OF NEWLY GERMINATED SOUTHERN PINE SEEDLINGS FOLLOWING INUNDATION

R. D. McReynolds
Southern Forest Experiment Station, U. S. Forest Service
Oxford, Miss.

A recent study at Oxford, Miss., tested the ability of newly germinated southern pine seedlings to withstand submergence lasting up to 20 days.

Loblolly (Pinus taeda L.), longleaf (P. palustris Mill.), shortleaf (P. echinata Mill.), and slash pine (P. elliottii Engelm.) seeds were germinated in number 10 food cans in a greenhouse, submerged in a small outdoor concrete pool, and then returned to the greenhouse for observation. Four tests were made, representing seasons from late winter through early summer. In the first three tests, 25-day-old seedlings were submerged for periods varying from 1 to 20days. In a fourth test, 10-, 15-, and 25-day-old seedlings were submerged for 10 days.

Dates of sowing and submergence were scheduled so that all seedlings in each test could be removed from the water the same day. Maximum and minimum water temperatures at seedling level were measured in each test and the free oxygen content of the pool water was recorded for each of the last three tests.

At the end of each 3-week observation period, all seedlings had either died or resumed normal height growth. Those submerged for 12 or more days lost all their presubmergence foliage, but replaced it with new foliage from terminal bud growth.

The first test, in which the seedlings were inundated for 1, 2, 3, 4, or 5 days, was inconclusive; all seedlings survived and resumed growth within 3 days after removal from the pool.

Results of the remaining tests are summarized in table 1. Longleaf survival was unexplainably erratic in May, and a total failure thereafter. Shortleaf survived well following April submergence but virtually failed after June inundation. Though loblolly and slash survived submergence reasonably well, it is doubtful that the seedlings inundated for 20 days could have lasted much longer, since all presubmergence foliage had died. In the fourth test, no seedlings younger than 20 days survived.

The progressively poorer survival of seedlings of similar age submerged for similar periods of time but later in the season is illustrated in table 2. Seasonal deterioration is apparently influenced by conditions other than water temperature and dissolved oxygen. The survival of seedlings removed In July, for example, was lower than that for seedlings removed in June, despite a shorter period of submergence in water with the same mean temperature and a higher oxygen content.

This exploratory study indicates that:

1. --At ages of 15 or 20 days, loblolly and shortleaf pine seedlings have developed some resistance to flooding; most 25-day-old loblolly seedlings can survive 20 days of flooding, but shortleaf pine die off when flooded longer than 12 days.

2. --Longleaf pine seedlings, 25 days old, are damaged by flooding of any duration and completely killed if flooded more than 12 days.

3. --Slash pine seedlings begin to survive 10 days of flooding when 25 days old; up to 60 percent of seedlings of that age can survive 20 days of flooding.

4. --Summer flooding is more damaging than spring flooding.

TABLE 1.--Study conditions and pine seedling survival in tests 2, 3, and 4

Date seedlings were removed from pool	Range in water temperature	Range in free oxygen dissolved in water	Age of seedlings when submerged	Length of submergence	Survival			
					Lob-lolly	Long-leaf	Short-leaf	Slash
	°F.	Ppm	Days	Days	Percent	Percent	Percent	Percent
May 3.....	57-73	8.8-11.3	25	3	90	4	77	80
			25	6	64	3	26	66
			25	9	84	44	82	49
			25	12	83	21	71	65
			25	15	14	1	48	46
June 19.....	70-84	7.4-8.0	25	12	66	0	6	42
			25	14	64	0	6	60
			25	16	72	0	2	58
			25	18	84	0	3	68
			25	20	80	0	4	61
July 30.....	74-85	7.5-9.8	10	10	0	0	0	0
			15	10	0	0	0	0
			20	10	5	0	6	0
			25	10	28	0	11	12

TABLE 2.--Survival of 25-day-old seedlings with respect to season of submergence

Days submerged	Removal date	Survival			
		Loblolly	Longleaf	Shortleaf	Slash
		Percent	*Percent*	*Percent*	*Percent*
3	March 14	100	100	100	100
3	May 3	90	4	77	80
12	May 3	83	21	71	65
12	June 19	66	0	6	42
10	July 20	28	0	11	12