PITCH x LOBLOLLY HYBRID PINE PERFORMANCE ON A WEST VIRGINIA MINESOIL

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Abstract.--A small plantation of pitch x loblolly hybrid pine was established on a reclaimed surface mine in Boone County, West Virginia, in April 1981. We used 216 hybrid and 216 pitch pine seedlings from 19 pitch pine mother trees and 24 loblolly pine seedlings in the test. The site was covered with a moderately dense stand of sericea lespedeza and K-31 tall fescue. Rows were rototilled to prepare the site for planting. First year survival was excellent--nearly 100 percent. After 5 years, overall survival was 88 percent. Much of the mortality can be attributed to excess moisture. The average height of hybrids was 4.4 feet after 5 years; 13 percent of the seedlings were 6.0 feet or taller. Pitch pines averaged 4.0 feet with only 6 percent of the seedlings 6.0 feet or taller. The acceptable performance of pitch x loblolly hybrid pine on this site indicates it has good potential for planting on reclaimed surface mines.

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There is continuing interest in the field of surface-mine reclamation in finding improved species or hybrids for reclaiming disturbed areas. One hybrid that is currently receiving attention is a cross between pitch pine (Pinus rigida) and loblolly pine (P. taeda). The advantages gained from this cross are the rapid growth rate of loblolly pine and the winter hardiness of pitch pine. Mature trees would produce pulp or other wood products. Little and Trew (1979), reporting the results of 29 progeny tests, cited growth rates in excess of 2 feet per year and survival rates of 100 percent after several years in the test plantings. This publication and another by Little and Wolf (1980) both state that these hybrids have potential for planting on surface mines.

Small test plantings of pitch x loblolly hybrid pines were installed on surface mines in the late 1960's by members of the USDA Forest Service's Surface-Mined Area Reclamation Research Project. Unpublished file reports show that the results of these tests were extremely variable. A planting in Pennsylvania was not winter hardy. The trees sprouted each spring only to be frozen back every winter. Plantings in Ohio, Kentucky, West Virginia, and Alabama had fair to good survival and growth on some sites and complete failure on others. Scarcity of hybrid seed and planting stock

in the 1970's precluded additional testing on surface-mined areas. Research with the hybrids on forest lands continued through the 1970's and new crosses were found that were more winter hardy and adapted to a wider range of site conditions. In the spring of 1981, pitch x loblolly hybrid seedlings representing 19 pitch pine mother trees were made available for testing on surface mines. Five-year results of the test planting are reported here.

THE STUDY AREA

A reclaimed surface mine in Boone County, West Virginia, was selected for the test planting. Mountaintop removal resulted in a nearly flat site at an elevation of about 1,600 feet. The surface material is sandy with a pH of 4.9. Nutrient levels were quite low; PO_4 showed only a trace and K measured 51 ppm. Nitrogen level was not determined. There were no high concentrations of toxic elements.

The 1980 reclamation efforts resulted in a sparse to moderately dense stand of K-31 tall fescue (Festuca arundinacea), sericea lespedeza (Lespedeza cuneata), and birdsfoot trefoil (Lotus corniculatus) on the site.

A plot 150 by 120 feet was laid out for the planting. Rows were marked at 6-foot intervals along the width of the plot. The rows were scarified in preparation for planting by making two passes over each with a 7-horsepower, 20-inch-wide rototiller. Scarification and planting were done on April 21 and 22, 1981. Planting conditions were excellent; the soil was moist, the temperature was moderate with heavy cloud cover, and a light rain fell on April 23. A slight depression across the plot was noted at the time of planting, but it was believed that the depression would not influence the results of the planting.

THE PLANTING

Seedlings for the test planting were provided by the former genetics project of the USDA Forest Service, Northeastern Forest Experiment Station, Durham, New Hampshire. Loblolly pine pollen was mistblown onto pitch pine flowers in a seed orchard to produce the seed. Seedlings were grown in a Maryland Forest Service Nursery. The seedlings from each of 19 mother trees were sorted into two lots: obvious hybrids and obvious pitch pine.

Seedlings of each mother tree and each lot were planted in four-tree linear plots in a random pattern replicated three times. Each replication also has two plots of pure loblolly pine. A total of 456 seedlings was planted, 216 each of hybrids and pitch pine, plus 24 loblolly pine. Seedlings were planted with a mattock at 6-foot spacing in rows 6 feet apart. A single row of mixed hybrids was planted around the experimental area to act as a buffer.

To reduce competition by sericea lespedeza, Roundup (glyphosate) [2/] was sprayed around each tree on June 14, 1982, and again on July 11, 1983. A protective shield was mounted on the spray nozzle of the backpack sprayer to prevent herbicide drift onto the pine seedlings. Control of competing vegetation was not complete, but cover was reduced by about 50 percent. There are no plans to continue chemical control of the herbaceous competition as most of the pines are now taller than the sericea.

RESULTS

Only four seedlings died the first year. Three of these were in the moist depression. During the second and third growing seasons, there was additional mortality of 7 percent. This represents 36 seedlings, 30 of which were in the moist depression. At this point it became evident that some condition of microsite was influencing survival of the seedlings. Survival and growth data were then separated by favorable site and wet site. Figure 1 shows the planting layout, location of the depression, location of the four seedlings that died the first year, and location of seedlings that died in the second and third growing seasons.

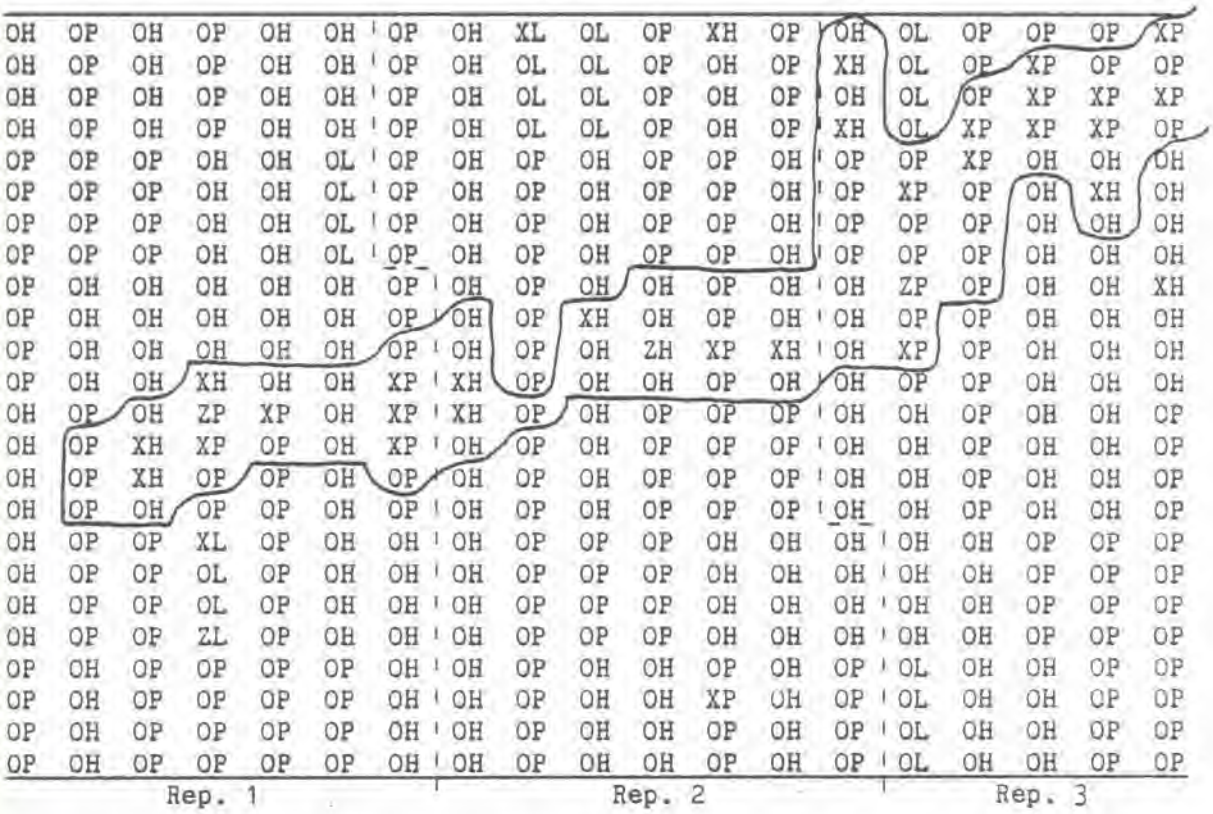
The boundary of the wet site was established by visual examination. Criteria used to delineate the boundary were presence of moss (species unidentified), absence or poor development of the seeded herbaceous species, and cracks in the surface resulting from drying of saturated soil. In all, 374 planting spots were designated favorable site--180 hybrids, 170 pitch pines, and all 24 loblolly pines. By contrast, there were 82 planting spots on the wet site--36 hybrids and 46 pitch pines.

At age 3, survival of both the hybrids and pitch pine was 99 percent on the favorable site; loblolly was 88 percent. Average heights were 25.6 inches for the hybrids, 24.4 inches for the pitch, and 31.9 inches for the loblolly. Survival on the wet site was 69 percent for the hybrids and 60 percent for the pitch. Average heights were 15.4 inches for both species (Davidson 1984).

With minor exceptions, the same patterns of survival and growth were recorded after five growing seasons. Hybrid survival on the favorable site was 97 percent, pitch was 96, and loblolly was 83. Average height of the hybrids was 55 inches with a standard deviation of 17 inches. Pitch averages 50 inches with a standard deviation of 16 inches. Average for the

2/ This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended. CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish and other wildlife--if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

loblolly pines was 80 inches with a standard deviation of 19 inches. Average 5-year height growth for hybrids versus pitch pine shows that 13 out of 19 hybrids grew faster than the pitch pines (table 1).



O = seedlings alive after 3 years; Z = seedlings that died the first year
X = seedlings that died the second and third year; _____ = boundary of moist depression; H = hybrid pine; P = pitch pine; L = loblolly pine

Figure 1.--Plantation arrangement, orientation of moist depression, and location of dead seedlings.

Survival and height of the hybrids on the wet site was 56 percent and 32 inches with a standard deviation of 10 inches. Pitch pine survival was 52 percent and average height was 28 inches with a standard deviation of 11 inches.

An evaluation of the 1985 growth increment of individual seedlings showed that 24 hybrids from 13 different mother trees grew 2 feet or more. Only four pitch pines, representing three mother trees, attained this growth level. Twelve of the twenty surviving loblolly pines had grcwth of 2 feet or more.

Table 1.--Overall fifth year survival and average height (in in.) of pitch x loblolly hybrid pine

Seed source no.	REP 1		REP 2		REP 3		TOTAL	
	Surv. %	Hgt.	Surv. %	Hgt.	Surv. %	Hgt.	Surv. %	Hgt.
					*			
54C	100	44	100	66	--	--	100	55
54H	100	76	100	72	--	--	100	74
57C	100	67	100	57	50	36	83	56
57H	100	55	100	47	100	49	100	50
58C	75	41	100	67	100	51	92	54
58H	75	70	75	44	50	42	67	53
60C	75	44	100	41	--	--	88	43
60H	100	47	100	41	--	--	100	44
62C	50	41	100	61	75	29	75	46
62H	75	45	100	69	100	63	92	60
65C	50	37	100	39	50	57	67	43
65H	100	61	75	34	75	57	83	52
66C	50	32	100	41	25	71	58	42
66H	100	55	75	38	100	48	92	48
67C	75	33	100	49	50	69	75	48
67H	50	24	75	45	100	60	75	47
68C	75	44	100	50	--	--	88	47
68H	100	55	75	40	--	--	88	48
70C	100	59	100	40	75	24	92	43
70H	100	58	100	51	100	57	100	56
71C	75	42	75	40	100	24	83	34
71H	100	57	100	37	100	37	100	43
73C	100	55	75	54	75	37	83	53
73H	75	56	75	62	100	48	83	54
75C	100	63	100	50	100	44	100	52
75H	100	65	75	28	100	52	92	50
76C	100	39	100	71	100	52	100	54
76H	100	56	100	34	100	46	100	45
77C	75	15	100	61	100	38	92	40
77H	100	75	75	25	75	52	83	53
78C	100	61	100	56	100	39	100	52
78H	75	78	100	59	100	43	92	58
79C	100	68	100	54	100	52	100	58
79H	100	54	100	77	100	61	100	64
80C	100	37	75	31	75	50	83	39
80H	100	43	50	21	75	28	75	33
81C	100	56	100	38	50	48	83	47
81H	100	67	100	56	75	75	92	65
LOB	100	93	75	85	100	76	92	84
LOB	25	46	100	97	100	56	75	73

*Not planted.

SUMMARY AND CONCLUSIONS

After 5 years, the pitch x loblolly hybrid pine, the pitch pine, and the loblolly pine seedlings are all doing well on the favorable site. Survival of the hybrid and pitch pine is excellent, 97 and 96 percent respectively. Loblolly survival is good, 83 percent, and its growth is best with an average height of nearly 7 feet. Hybrid growth is slightly better than pitch pine, but both are satisfactory for minesoils.

Variations in survival and growth due to a wet condition on part of the test area has weakened the study. However, this situation emphasizes the need to match species to site. Pitch x loblolly hybrid pine and pitch pine, like other hard pines, perform best on moderately well to well-drained sites.

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