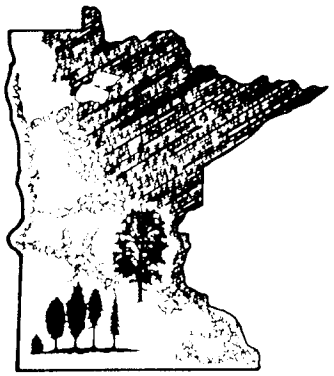

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THIRTY-FIVE YEARS OF TEST RESULTS ON FENCE POSTS TREATED WITH PENTACHLOROPHENOL

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ABSTRACT

The service lives of fence posts of five Minnesota species were appreciably increased by treatment in 1942 with a 5 percent oil solution of pentachlorophenol. The best results (over 30 years of durability) were obtained with jack pine and black ash, for which penetration and distribution at the ground line were deepest and most uniform. The service lives of aspen, paper birch and cottonwood, for which penetration and distribution at the ground line were not as satisfactory were still greatly increased to about 15 years. The service life of red and white oak was increased slightly.

Shortly before World War II pentachlorophenol had been tested and found to be among the effective and practical preservatives for millwork - windows, doors, etc. However, there was question at that time relative to the permanence and effectiveness of oil solutions of pentachlorophenol as preservatives for products, such as posts, poles and cross ties, that are used in soil contact, products for which service life conditions are far more severe than they are for millwork.

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Because oil solutions of penta, as pentachlorophenol is generally known, appeared to have considerable promise as preservatives for fence posts in Minnesota, the University of Minnesota College of Forestry in 1942 installed a durability or service life study of seven species of Minnesota woods that were available and which had considerable promise for extensive use as fence posts if their durability or service life could be considerably increased through preservative treatment at reasonable cost.

In the spring of 1942 about 100 posts of each of the seven species were cut, peeled and air seasoned until late July and early August, when their moisture content was determined to be about 15-25 percent, sufficiently dry to treat reasonably well with oil solutions of preservatives. The treating solution was prepared by diluting a penta concentrate received from the Chapman Chemical Company of Memphis, Tennessee with kerosene to bring the penta concentration to 5.0 percent by weight. Because oil solutions of penta appeared to be well adapted to farm or other small scale treatment of fence posts, treatment was accomplished by soaking the posts in an upright position in 50 gallon oil drums with one end removed. One third of the posts of each species was treated for 24 hours, 16 hours with the butt ends down and 8 hours with the top ends down. The same number of posts of each species was treated for 48 hours, 36 hours with the butts down and 12 hours with the tops down. The remaining posts of each species were not treated and constituted the controls or checks and indicated the natural durability of the woods involved. After treatment the treated posts of each species were sorted into three groups for setting in service tests at the University's:

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Figure 1. Service plot at the Cloquet Forestry Center. Leaning posts are those that failed the 100 pound pull test in 1955, when the photo was taken. Most of these failures were cottonwood and aspen posts. The soil at this test site is very sandy.

Figure 2. Post service test plot on the St. Paul Campus, 1971. The soil is a well drained sandy loam.

Figure 3. Service test plot at the Southern Agricultural Experiment Station at Waseca in 1971. The soil of this plot is a heavy loam but is fairly well drained.

(a) Cloquet Forest Research Center in northeastern Minnesota, near Duluth; (b) on the St. Paul Campus in St. Paul; and (c) at the Southern Agricultural Experiment Station at Waseca in southern Minnesota. These service test plots are shown in Figures 1-3.

Although the soils at these 3 service test sites differ considerably, the soil at Cloquet being very sandy, that at St. Paul a sandy loam and that at Waseca a moderately well drained heavy loam, no difference in service life of the untreated posts was discernible during the early years of the study. In consequence of this observation, the results from all three exposure sites were grouped as shown in Table 1. Posts were tested annually for the first 10 years after installation and then at 2-3 year intervals thereafter by applying a 100-pound pull with a special lever device developed by the Department of Agricultural Engineering at the University.

In the 35 year service period, 1942-1977, all but three treated jack pine and one treated black ash post have failed. The results summarized in Table 1 show the average service life of treated posts with the life of untreated posts shown in the footnote of the table. Table 1 also shows the amount of preservative absorption by species, in pounds of 5% penta oil solution per cubic foot of wood.

It is evident from the results shown in the Table that there is essentially no difference between service life of posts of each species given 24 and 48 hour treatments. This finding is consistent with those of other investigators and indicates that in cold-soaking treatment most of the treatment in case of longer soaking cycles is absorbed in the first one-half of the time involved. From these tests it would appear that treating for longer than 24 hours cannot be justified for the species involved.

The best results were obtained with jack pine and black ash, which in cold-soaking treatment have better and more uniform penetration of preservatives at the ground-line. These results with jack pine and black ash are in contrast to those on aspen, cottonwood and paper birch, all of which may show as much or more preservative absorption as jack pine and black ash, but which have very much shorter average service lives because most of the penetration and absorption is in the six inches from the butt or top and ground-line penetration and absorption - both important to long service life, are usually far less and much more variable than those for jack pine and black ash.

Even white and red oak, which have heartwoods of some natural durability may have benefited slightly by treatment because the treatment improves the durability of the sapwood, or outer light colored wood of these species, which normally is no more durable than the sapwoods of aspen and birch.

Although a few of the treated jack pine posts are still serviceable after 35 years, their condition when inspected in 1977 appeared to be such that they were certain to fail in the next year or two. Postponing this report until these few posts failed would not appreciably affect the service life shown in the table, so the figures given can be regarded as the average service lives for the species involved.

In conclusion it is evident from the results of these service life studies of fence posts of seven Minnesota species treated in 1942 by cold-soaking in a 5 percent oil solution of pentachlorophenol that surprisingly long service lives result for such species as jack pine and black ash and that the service life of aspen and cottonwood posts was increased several fold.

Table 1. Average Service Life of Fence Posts from Seven Species Treated with 5 Percent Pentachlorophenol in Oil.

Species	Length of Soak Treatment	Number of Posts Set	Absorption of Preservative Solution	Service Life*
	(Hours)	(Number)	(lbs./cu. ft.)	(Years)
Jack Pine	24	67	2.27	35
Jack Pine	48	65	2.62	35
Black Ash	24	70	2.99	33
Black Ash	48	70	3.60	34
Paper Birch	24	70	3.02	16
Paper Birch	48	70	3.54	16
Cottonwood	24	59	3.24	14
Cottonwood	48	60	4.17	14
Aspen	24	69	3.69	15
Aspen	48	70	3.24	18
Red Oak	48	60	1.47	14
Red Oak	48	60	1.39	14
White Oak	24	30	1.48	18
White Oak	48	30	1.39	17

*The average service lives of untreated posts in years were: jack pine 7.5; black ash 4.5; paper birch 4.1; cottonwood and aspen 3.8; red oak 12; and white oak 16.

Figure 4. Appearance of some treated posts after 30 years in the Cloquet test plot. Posts #1 and #2 (left side) are jack pine; #3 and #4 are black ash; #5 and #6 are paper birch.

Figure 5. Appearance of some of the posts from the Waseca test plot after 25 years of service. Posts #1 and #2 (left side) are jack pine, #3 and #4 are black ash.

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