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CHARCOAL FROM CHEMI-PEELED HARDWOODS

Removing bark from standing trees with sodium arsenite is an inexpensive but efficient way to produce peeled pulpwood. About 200,000 cords, principally hardwoods, are produced annually by chemi-peeling, a technique that is fast replacing old-fashioned sap-peeling as a means of debarking in the woods.

It appeared that chemical bark removal might be helpful in other fields of hardwood utilization, particularly where very low-grade trees could be used. The production of charcoal is one of these, a form of utilization that is being stimulated by the increasing popularity of outdoor cooking. Because tree quality is generally not a limiting factor, the charcoal market provides an outlet for hardwoods that occupy valuable growing space but are difficult to convert profitably to other products. The chemical treatment itself is easy and economical; publications on the subject by Curtis (1956), Wilcox et al. (1956), and others are available.

Charcoal wood is usually prepared in this way: the trees are cut and bucked to length, and the wood is moved to storage yards for about 12 months' seasoning. Another handling is then required to load it into a kiln. These operations use considerable labor; also, to store enough wood to operate the kiln at full capacity requires considerable space. So, any changes in procedure reducing these requirements would tend to increase profits, or possibly permit paying a little more for the wood.

Some of these handling and storage requirements might be overcome by the simple expedient of chemi-peeling the standing trees and "storing" the wood about a year on the stump. Then, assuming adequate seasoning had occurred, the trees could be felled, bucked, transported to the kiln, and loaded directly, thus saving one handling. Storing wood in this fashion would also reduce the risk of losses from fire, decay, and theft. Furthermore, removal of the bark permits loading kilns with a larger volume of solid wood.

Observations in the Adirondacks indicate that chemically debarked trees can stand in that area for several years without appreciable deterioration (Rushmore, 1959). Susceptibility to decay varies with species and climate, tending generally to increase southward with the lengthening of the warm season. Where possible, stump storage for more than 1 year would permit the stockpiling of larger volumes of wood, and might result in better seasoning.

The Study

A small study was conducted at the Beltsville Experimental Forest in Maryland to test the practicability of chemi-peeling, storing on the stump, and trucking directly to the kiln in a charcoal operation. The trees in a poor-site stand of oaks were treated in early summer by applying sodium arsenite solution copiously to wide basal bark girdles. The trees, of several species representing both red and white oak groups, averaged 9 inches d.b.h. and, though of poor form and quality, were well suited for charcoal production.

Fourteen months after treatment, when much of the bark had loosened, the trees were felled and bucked into 5-foot lengths, and the wood was trucked to and loaded into a cinder-block kiln. The charcoal produced from this peeled wood was compared in yields and general quality with that made from the usual run of unpeeled wood.

The kiln used in the study had a capacity of 548 cubic feet of wood, gross measure, or 3.425 units of 160 cubic feet. In comparing yields, all charges were considered to be to the full capacity of 3.425 units.

Rough or unpeeled hardwoods were not actually cut and seasoned as part of the study. Data for this type of wood were obtained from several burns made by the kiln operator from his own stockpile just prior to firing the chemi-peeled wood. Both types of wood had been seasoned for about the same length of time.

Results and Discussion

The yield of charcoal was over 100 pounds greater per unit of peeled wood than for the same volume of rough wood (table 1). This yield increase of 11 percent is believed to be due principally to the absence of the bark, and the resultant higher volume of wood in the kiln charges. Although bark is converted to charcoal, it tends to increase the amount of fines and dust, thus affecting the yield of usable lump charcoal. And, because bark has a much higher mineral content than the wood, better quality, cleaner charcoal, with lower ash content, is produced from bark-free wood.

  

Left: Applying sodium arsenite solution to wide bark girdle near base of a red oak tree. *Center:* A chemi-peeled hardwood stand 1 year after treatment. *Right:* During stump storage, the bark cracks and loosens; this not only simplifies removal of bark but also hastens seasoning.

Another reason for the higher yield may have been the lower moisture content of the peeled wood when burned (table 1). Hicock et al. (1951) and others have found that, with a given species, yield of charcoal by weight increases as the moisture content of the wood decreases.

A third factor that may have influenced charcoal yields was the difference in soundness of the peeled and the unpeeled wood. In the latter, after a year of air-seasoning in the yard, considerable sapwood decay had developed under the bark; this would tend to reduce yields. By contrast, the bark on the treated trees had cracked and loosened during stump storage, which in turn hastened surface drying and checking of the wood. Decay was much less advanced in these trees than in piled wood. These observations are in accord with those of Rushmore, previously cited.

Based on a cost for the chemi-peeling treatment of $1.55 per rough unit (by tree measurement), and assuming an average bark volume of 15 percent, the treatment cost per unit of peeled wood was $1.82, with labor at $1.40 per hour. Charcoal presently brings from 2.5 to 3 cents per pound wholesale at the kiln. Thus, the value of the extra 100 pounds of charcoal obtained from a unit of chemi-peeled wood more than offset cost of the treatment.

Some question might arise concerning association of the toxic sodium arsenite with a product used in food preparation. In a special study (Wilcox et al., 1956), analyses of pulpwood from chemi-peeled trees showed a uniformly low arsenic content, well under the tolerance allowed for food. Even less should be present in charcoal after undergoing partial combustion during manufacture.

Table 1.--Relative yield of charcoal from chemi-peeled and rough hardwoods

Type of wood	Average volume	Average yield of charcoal	Moisture content of wood when burned
	Units	Pounds	Percent
Chemi-peeled	3.425	3,410	49
Rough	3.425	3,062	65

Summary and Recommendations

Chemi-peeled and stump-seasoned hardwoods in this study yielded 11 percent more charcoal by weight than equivalent volumes of rough wood. Other advantages include: possible saving in wood handling; less risk of losses by fire, theft, and decay; less storage space required at the kiln; and, by eliminating bark, a general improvement in charcoal quality as well as a higher yield.

Anyone with limited yard space for storing wood, or concerned about increasing charcoal yields and quality, might well consider using the chemi-peeling method of preparing his wood. Although this study dealt only with charcoal production, the advantages of chemi-peeling and stump storage would apply in general to other forms of round-wood utilization where peeling and seasoning are required.

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