United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory

Research
Note
FPL-RN-0254

August 1987

Kiln-Drying Time of Split Oak Firewood

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Abstract

Split, undebarked, oak firewood kiln-dried at 140, 180, and 220 °F was dried from 52 to 20 percent moisture content (dry basis) in 260, 90, and 30 hours. Pieces stacked parallel to the direction of airflow dried as quickly as pieces piled randomly.

Keywords: Firewood, fuelwood, energy, kiln drying, oak

Simpson, William T.; Boone, R. Sidney; Chern, Joseph; Mace, Terry. 1987. Res. Note FPL-RN-0254. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1987. 5p.

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Introduction

Since the energy concerns that started in the early 1970's, the use of firewood in stoves, furnaces, and fireplaces for home heating has increased. During the 1980-81 heating season, 28 percent of U.S. households, about 22 million, burned 42 million cords of firewood (Skog and Watterson 1986). Household fuelwood consumption has grown to an estimated 49 million cords or about 4 billion cubic feet of solid wood for the year ending in November 1984 (U.S. Department of Energy 1986). This amount is substantial in comparison to the 14 billion cubic feet harvested for other wood products in 1983 and is roughly two-thirds as much as the amount of roundwood used to produce lumber (5.7 billion ft^3 in 1983) (U.S. Department of Agriculture, Forest Service 1985).

Wet firewood is difficult to burn in home burners, and prolonged use adversely affects the performance of heating systems. For good combustion, firewood should have no more than 20 percent moisture content. For good burning performance, firewood must air-dry for one summer season or longer. Solar kilns reduce the drying time compared to air drying, but still require from 1 month under ideal solar conditions to 3 to 4 months under adverse solar conditions (U.S. Department of Energy 1983). Kilns similar to conventional lumber kilns can be expected to reduce drying time even further because they are capable of higher temperature than solar kilns. Maviglio (1986) reported on kiln drying split hard maple firewood from 50- to 15-20 percent moisture content at 140 to 200 °F in 3 days.

This study was conducted to determine the time required to dry split oak firewood in a typical lumber dry kiln. This information will help firewood producers evaluate the feasibility of kiln drying firewood.

Experimental

Approximately six cords of split, undebarked oak firewood in 14- to 18-inch lengths were dried in twelve 4- by 4- by 4-foot pallets having wire sides and bottom. These open-sided containers allowed air to circulate through the firewood (fig. 1). The wood was dried in a conventional steam-heated kiln in three runs of four pallets each at 140, 180, and 220 °F. Vents were kept closed during drying, but because of natural leakage from the kiln, the equilibrium moisture content conditions were 4 percent or less throughout all kiln runs. Airflow through the pallets was variable-from 0 to 400 feet per minute. Steam spray was not used and would not be necessary for drying firewood because there is no need to maintain high humidity to prevent checking.

In each of the three kiln runs, two of the four pallets of firewood were stacked so the length of the pieces was parallel to the direction of airflow, and in the other two pallets the firewood was piled randomly (fig. 1). Four sample pieces from each pallet were periodically weighed during drying to estimate moisture content. Later, these sample pieces were ovendried to determine moisture content at various times during drying.

Figure 1: -Wire pallets showing random and parallel stacking of split oak firewood for kiln drying. (M87006-2)

Results

The drying times for the experimental conditions are shown in figure 2. The average initial moisture content was 52 percent (dry basis). As expected, the drying time decreases as temperature increases. The times required to reach 20 percent moisture content were as follows:

Loading method	Drying temperature (hours)		
	140 °F	180 °F	220 °F
Parallel stacks	226	97	34
Random stacks	287	87	29
Average	257	92	32

Times ranged from a low of slightly more than 1 day (29 to 34 h) at 220 °F to a high of 11 to 12 days (226 to 287 h) at 140 °F. An analysis of variance showed that the effect of drying temperature on drying time was statistically significant, but that the differences in drying times observed for stacking versus piling were not statistically significant. Parallel stacking is more efficient than random piling because of kiln capacity and energy use, but the increased effort required to stack parallel should also be considered.

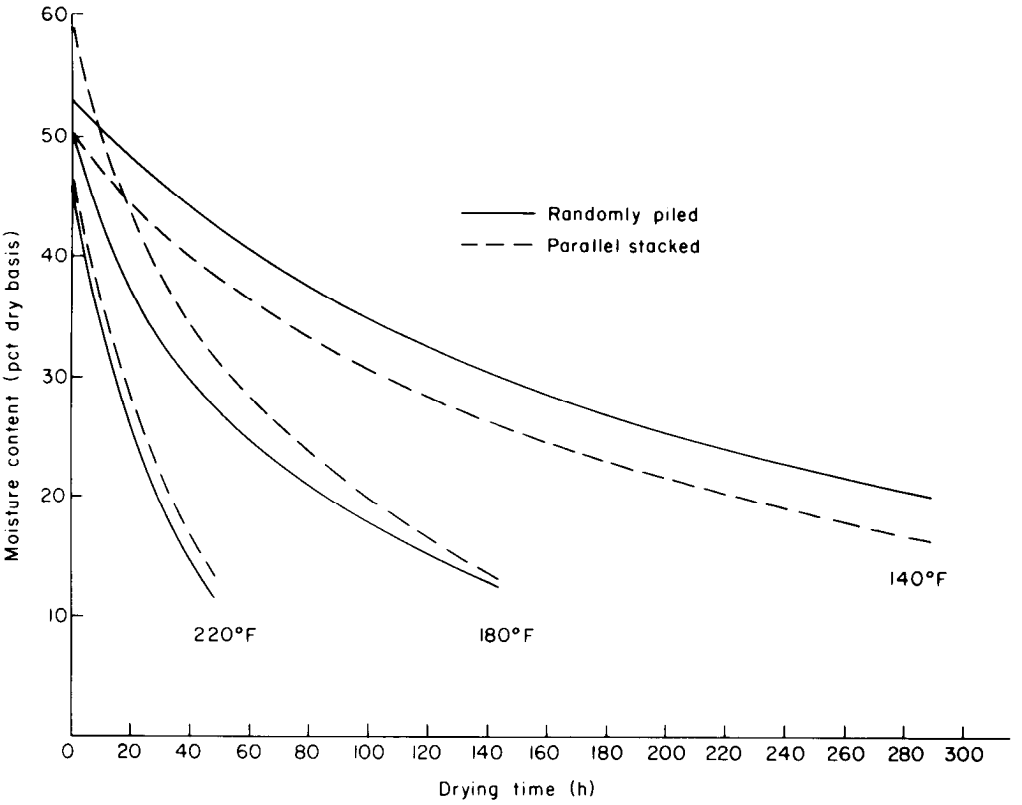

Figure 2: –Drying time of split oak firewood at three drying temperatures with wood stacked parallel to airflow (dashed lines) and randomly (solid lines) piled. (ML87 5410)

Conclusions

Split oak firewood in 14- to l8-inch lengths can be kiln dried from 52 to 20 percent moisture content in about 260, 90, and 30 hours at 140, 180, and 220 °F, respectively. The required drying time differs only slightly if the pieces of firewood are stacked parallel to the direction of airflow or if they are piled randomly.

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Acknowledgment

Ener-Con, Inc., of Hartford, WI, supplied the firewood.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1987/542-039/60007

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for the United States of America.