

# GUIDE TO USE OF WOOD AS AN ALTERNATE MATERIAL IN AGRICULTURAL IMPLEMENTS

June 1942



(Report)

UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE  
FOREST PRODUCTS LABORATORY  
Madison, Wisconsin  
In Cooperation with the University of Wisconsin

## GUIDE TO USE OF WOOD AS AN ALTERNATE MATERIAL IN AGRICULTURAL IMPLEMENTS

A. O. BENSON, Wood Technologist  
C. C. BELL, Forester

The past few months have witnessed the development of shortages in several important raw materials used in farm equipment prior to the war. Due to the necessity not only of maintaining but even considerably increasing the production of farm crops the shortage of such raw materials as iron, copper, rubber, etc., cannot be permitted to stand in the way of an output of essential farm equipment.

The notable developments in farm equipment have come in the present generation largely because of the substitution of mechanical for animal power. Steel has replaced wood in many places where it is the better material for the use. At the same time steel in various forms has been used in some items where wood can serve without much change either in service or design. Right now it is important that all items of equipment be thoroughly analyzed with the objective of using wood wherever it is adaptable in an effort to conserve metals that are essential in the war program. It is not necessary to go beyond the uses where wood can be used to advantage to arrive at totals that represent substantial savings of metal and rubber.

On the basis of information, both from manufacturing plants and Laboratory research, subject matter is presented in this report that will be helpful to manufacturers and to others looking for opportunities to replace critical materials.

### Implement Parts of Similar Use Requirements

Many implements in the agricultural machinery field have parts or assemblies for which the requirements are similar. It is possible, therefore, to group items on a use requirement basis even though the implements embodying these parts may be quite dissimilar. For instance, Guide Handles may be set up to apply to all walking implements, such as plows, planters, cultivators, hillers, and diggers. The function of the guide handles for these various implements is the same, and a material that is suitable for one is suitable for another. Naturally plow handles must be capable of withstanding greater loads than garden cultivators. But, essentially, if wood will serve for one it will serve for the other.

Table 1 is a listing of parts of similar service requirements where wood has been used with satisfaction in the past or where it is reasonable to conclude that it can be used now as a means of reducing the drain on critical metals. At this time mere preference for a given material cannot be a deciding factor; it is a matter of necessity to use the most serviceable and economical material that is available in quantity. Wood, right now, is a material that meets these conditions in numerous cases.

Table 1.--Grouping of farm implement items on basis of similar use requirements

Suggested form of wood stock

Typical use groups	Lumber	Dimension stock	Plywood or fibre board
Beams.....		X	
plows, cultivators			
Conveyor chutes.....	X		
elevators, shellers, threshers			
Conveyor slats.....		X	
binders, elevators, pickers, loaders			
Floors.....	X		
wagons, spreaders			
Framework.....	X	X	
peanut pickers, poultry batteries, feeders, grinders			
Handles, guide.....		X	
plows, cultivators, planters			
Hitch parts.....		X	
wagons and other horse-drawn implements			
Hoppers.....	X		X
drills, fertilizers, lime sowers, planters, feeders			
Levers.....		X	
harrows, mowers, rakes, plows			
Panels.....	X		X
hammer mills, incubators, threshers, shellers			
Poles or tongues.....		X	
wheeled implements, wagons			
Reels.....	X	X	
binders, combines			
Running gears.....		X	
wagons, manure spreaders, rakes, drills			
Skids.....	X	X	
engines, portable feeders and brooders			
Tanks.....	X	X	
watering, storage, spraying, cooling			

Table 1 also indicates what seems to be the logical form of wood product to use for the various parts. In solid form wood can be bought as lumber in whatever quality classes or grades the manufacturer may elect to use. As dimension or ready-cut stock it is available from both sawmills and plants specializing in fabricated parts. Also millwork and furniture plants may be looked to as potential suppliers of machined and ready-to-use parts.

In sheet form plywoods and dense fibre and mineral boards will give service in many cases comparable to that rendered by sheet metal or solid lumber. Where coverage is the chief purpose to be served plywood of two general types based on adhesive used in manufacture is in the picture: (1) Ordinary or interior type for equipment kept inside or operated outside only in dry weather, and (2) weather-resistant or exterior type for equipment that may be subject to longer periods of exposure to the weather or to other damp conditions. The compressed fibre boards also come strongly into the picture for coverage purposes. Especially where there is some fire hazard, as in incubators, the mineral boards, such as asbestos-cement or gypsum compositions, have special virtue.

Designs may need altering to make changes from sheet metal to these materials; curved surfaces may have to give way to flat ones, because neither thick plywoods nor wall boards as normally manufactured will take extreme curvature.

Wire used extensively in some poultry equipment may be replaced by wooden dowels or wooden lattice work.

### Choice of Woods for Farm Implements and Equipment

Table 2 deals with the selection of species for the component parts of farm implements and equipment. The list is not complete from the standpoint of kinds of machines, but broad types of implements are represented. For items not included some comparable machines appear in the list, and conclusions can be drawn with respect to the adaptability of wood for the use and the kind of wood that would be suitable.

No attempt has been made to list all the woods that might be used for the various implement parts. In some cases the use requirements are not exacting, and the list of satisfactory woods might be extended to include any species commonly available. The recommendations for woods take into consideration a number of factors, namely, strength properties, ability to stay in place, decay resistance, resistance to wear, availability, price, and others. The choice of a wood is based on a combination of these factors. Occasionally a certain wood is exceptionally adapted to meet an outstanding requirement, as, for instance, the ability of hickory to withstand the vibration and shock to which a pitman rod is subjected. Broadly, however, woods fall into property groups, and within these groups there is often considerable latitude for selection. There are the dense (or heavy) hardwoods, such as oaks, elms, hickories, ashes, maples, birches; the nondense (light-weight) hardwoods represented by such species as the cottonwoods, basswood, yellowpoplar; the dense softwoods, of which southern yellow pine, Douglas-fir, and western larch are examples; the nondense softwoods, such as the soft pines, true firs, spruces, and cedars. Naturally there are no sharp lines separating one group

from another, but on the average the dense hardwoods are stronger than the nondense, the dense softwoods stronger than the nondense, and the dense softwoods are stronger than the nondense hardwoods. Thus, there are cases where a use requirement is such that the choice of wood may be from more than one group. Where strength is a requirement, the dense hardwoods or dense softwoods include the suitable woods; where the use is chiefly a matter of coverage the suitable wood will most likely be found among the nondense hardwoods or the nondense softwoods.

Strength properties alone do not govern the choice of woods. Woods with excellent mechanical properties may not be available in the sizes required, they may not be obtainable through regular lumber market channels, or they may be had only at prohibitive prices. Insofar as possible these various factors have been given weight in preparing table 2.

### Alternate Names for Species

U. S. Forest Service nomenclature has been used here in listing woods. In some cases this differs from the commonly accepted commercial or trade nomenclature. In order that there may be no misunderstanding the chief instances where differences occur are pointed out in the following tabulation:

<u>Nomenclature in Lists</u>	<u>Common Trade Name</u>
Red pine	Norway pine
Water tupelo	Tupelo
Sweetgum	Red gum
Baldcypress	Cypress
Sugar maple	Hard maple, rock maple

When oak is listed it is meant to include the commercial white oaks or commercial red oaks. White ash includes the ashes accepted in the white ash group. Hickory includes the true hickories as distinguished from the pecan hickories.

Southern yellow pine includes principally longleaf, shortleaf, loblolly, slash, and pond pines. The dense wood of any southern pine has practically the same strength and characteristics as the dense wood of any other southern pine, and the lighter pieces are more or less alike. Where high strength values are important, longleaf pine or dense southern yellow pine have been suggested. The term "dense", when used in connection with southern yellow pine and Douglas-fir, refers to lumber graded under a density specification.

Spruce includes any of the spruces, regardless of species, which may be available in lumber form to the fabricating plant.

Rock elm refers to the true rock elm only, and not to the elm of other species sometimes designated in the trade as rock elm.

Table 2.--Substitutions in specific implement parts and by kinds of wood

Equipment and parts	Serviceable woods
Binders, combines (grain, rice, etc.)	
Decks	:Oak, sugar maple, southern yellow pine, : Douglas-fir
Reel	:Southern yellow pine, red pine, Douglas- : fir, ponderosa pine, yellowpoplar, : basswood
Divider board	:Southern yellow pine, oak, white ash, : sugar maple, yellow birch, cottonwood, : yellowpoplar, Douglas-fir
Pitman rod	:Hickory, sugar maple, white ash, oak
Lever	:Hickory, white ash, sugar maple, oak, : yellow birch.
Rein guide	:White ash, oak, sugar maple
Rollers	:Sugar maple, yellow birch, southern : yellow pine, oak
Conveyor slats	:Yellow birch, beech, sugar maple, hickory, : pecan, oak, white ash
Brooders (poultry, battery type)	
Framework	:Oak, sugar maple, yellow birch, southern : yellow pine, Douglas-fir, white ash
Corn shellers (hand and power)	
Hopper, bang board	:Cottonwood, sweetgum, water tupelo, black- : gum, southern yellow pine, Douglas-fir
Cob stacker	:Southern yellow pine, Douglas-fir
Base	
Frame	:Oak, sugar maple, beech, white ash, : southern yellow pine, Douglas-fir
Panels	:Cottonwood, yellowpoplar, basswood
Grain and feeder elevators	:Southern yellow pine, Douglas-fir, ponderosa : pine, white pine, spruce
Cultivators (tractor, sulky)	
Lever	:Hickory, white ash, sugar maple, oak, : yellow birch
Diggers (walking units)	
Handles, beams, and levers	:Oak, white ash, hickory

Table 2 (continued)

Equipment and parts	Serviceable woods
Drills	:
Hopper	: Yellowpoplar, redwood, baldcypress, : southern yellow pine, western hemlock, : cottonwood, sweetgum
Footboard	: Southern yellow pine, oak, white ash, : sugar maple, Douglas-fir
Wheels (see wagons)	:
Levers	: Hickory, white ash, sugar maple, oak, : yellow birch
Elevators (portable)	:
Conveyor chute	: Southern yellow pine, Douglas-fir, western : larch, cottonwood, baldcypress, redwood
Conveyor cleats	: Oak, southern yellow pine
Chute derrick	: Oak, southern yellow pine, Douglas-fir, : western larch
Wagon hoist derrick	: Oak, southern yellow pine, Douglas-fir, : western larch
Hopper	: Southern yellow pine, Douglas-fir, : western larch
Ensilage and hay cutters	:
Feeder sides	: Southern yellow pine, Douglas-fir, western : larch, yellowpoplar, oak, white ash, : cottonwood, basswood
Conveyor slats	: Oak, sugar maple, beech, yellow birch, : white ash, pecan
Feed grinders	:
Hopper	: Southern yellow pine, Douglas-fir, : yellowpoplar, baldcypress, western larch
Stand	: Oak, sugar maple, white ash, beech, : yellow birch
Skids	: Southern yellow pine, Douglas-fir, western : larch, any dense hardwood
Feeders, hog	:
Hopper	: Southern yellow pine, western larch, : Douglas-fir, western hemlock, white : pine, red pine
Cover	: Southern yellow pine, Douglas-fir
Trough	: Oak
Skids	: Southern yellow pine, Douglas-fir, : western larch, any dense hardwood
Feeders, poultry	:
Stand and trough	: Southern yellow pine, Douglas-fir, redwood, : baldcypress, cedar, cottonwood, ponderosa : pine, basswood, sweetgum