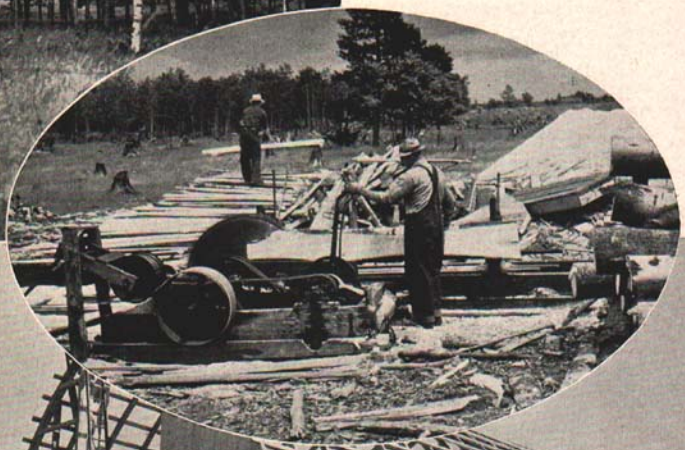
EXTENSION BULLETIN 255

Use of JACK PINE and POPPLE for FARM BUILDINGS

By L. E. BELL and C. H. JEFFERSON



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PREFACE

This bulletin presents the findings of a study conducted in 12 counties in the northeastern part of the lower peninsula of Michigan to determine how and where Jack pine and popple can be, and is being, used in the construction of farm buildings. In carrying on the field work of this study, the authors inspected many farm buildings, both old and new. Information was gathered as to the cost of construction, type of building, species of lumber, structural details, and the durability of the various species—such as their resistance to weathering, decay, and other forms of deterioration.

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Using Jack Pine and Popple for Farm Buildings

By L. E. BELL[1] and C. H. JEFFERSON[2]

ON MOST FARMS IN the northeastern part of the lower peninsula of Michigan there has been a gradual deterioration of buildings for the past 30 years.

Many of the barns and houses were built shortly after the original timber was cut off and are of a style and design typical of the time but which do not meet present-day needs. For instance, many of the barns were built with large mows for storage of loose hay and have large stables for horses but little provision for housing cattle. Today the trend is toward the use of baled and chopped hay, with less mow room needed. More tractors are in use, dispensing with the need for large horse stables, and on most farms additional space is needed for the proper housing of the expanded herds of beef and

[1]Extension Specialist in Forestry.
[2]Former staff member, now with Vermiculite Co., Evanston, Ill.

Fig. 1. Buildings such as this are being replaced by new ones constructed of native material.

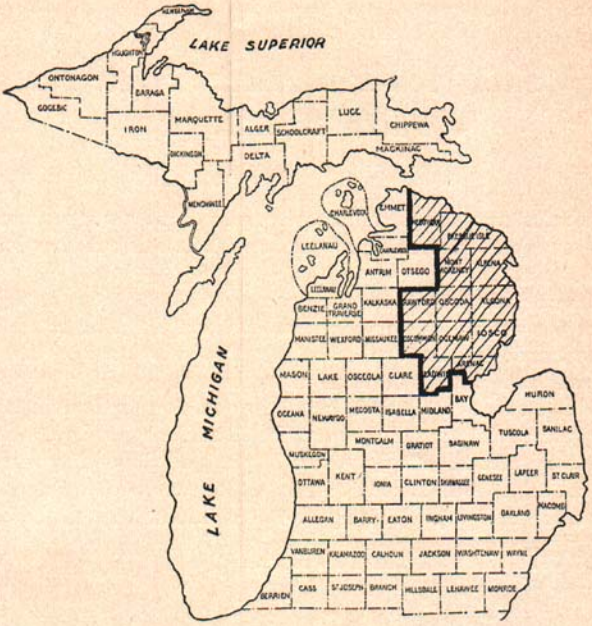

Fig. 2. This map shows the counties where the study of farm buildings was carried on. This is all cut-over land, and Jack pine and popple predominate in the upland forest growth. There are 10,788 farms in the area, with a total of 637,562 acres of farm woodland (1940 census figures). In addition, there are many acres of forest land owned and administered by state and federal agencies. Stumpage can be purchased from these lands by contacting the local officers.

dairy cattle. These changes in building needs make it desirable to remodel some of the buildings.

For several different reasons the remodeling, repair, and replacement of these buildings have not kept pace with their gradual breakdown. Some of the reasons for this is the lack of capital for finished lumber and wages for carpenters. This was especially true during the depression years of the nineteen thirties when the cash return for farm product was very low. By the early nineteen forties, economic conditions changed, farm prices were higher, and farmers were in a better financial position to repair and replace their buildings. Some

buildings were replaced during this period but ideal conditions for this were short-lived, because with our country preparing for war, lumber became scarce. Much of the better building lumber was diverted to military use. The War Production Board set certain monetary limitations on the building of new structures.

All of these factors led to the run-down conditions of farm buildings at a time when farmers were being called upon to increase their livestock numbers, seed greater acreages of crops, and produce their utmost for the all out war effort.

LOW-COST LUMBER

One solution to this problem for the farmers who need new buildings and repairs to their old ones is to get low-cost lumber by cutting their own logs and having them sawed into lumber at a nearby sawmill. By using this low-cost native lumber and doing their own work, they can have buildings that will serve their needs very satisfactorily and still require a minimum outlay of cash. All that is needed is some initiative on the part of the owner, some available standing timber, and a reasonable knowledge of structural details.

Fig. 3. These Jack pine logs are typical in size and quality of those used by the farmers of northeastern Michigan to obtain lumber for local farm buildings.

The question then arises as to the species of trees which can be used. The two species most abundant in the area are popple[3] and Jack pine. Both species have been used little in the past as construction materials because of the prejudice against them. Owing to the small size and "limby" character of the trees, the logs yield a very low percentage of high grade lumber. Most of it has a large number of knots, produces narrow boards, and is in rather short lengths. Neither of the two species has been considered very durable.

However, in our field studies it was found that in the majority of cases the failure of the wood in older buildings was due to faulty construction. These failures could have been prevented if the proper details were followed when the building was being built. It is believed that similar failures can be overcome in the future if more care is exercised in the making of good tight joints and high foundations. By employing newer designs, such as laminated rafters and low side walls, one can use lower grades and shorter lengths of lumber in present-day construction than were used in former years.

JACK PINE

Jack pine lumber is similar in many respects to the southern pine that is shipped into this area. Its strength is about the same for clear wood as southern pine. However, Jack pine is usually more knotty. The wood is not considered durable in contact with the soil—or in a location of high-decay hazard—but serves very well for ordinary farm construction, if kept up off of the ground with good tight joints that do not serve as moisture pockets. The wood rates relatively high in stiffness and nail-holding qualities.

POPPLE

Popple lumber is generally straight-grained, light in weight, moderately stiff, but relatively low in resistance to shock. It shrinks considerably while seasoning and is inclined to warp, unless it is firmly held in place. Warping can be held to a minimum, however, if the lumber is properly piled immediately after it is sawed and allowed to dry out while in the pile. The wood ranks low in nail-holding ability, but has little tendency to split in nailing. It ranks as one of the best hardwoods we have in its ability to hold paint.[4]

[3]Popple in this bulletin is construed to mean trembling aspen, large-toothed aspen, and Balm of Gilead.

[4]Browne, F. L., *Behavior of House Paints on Different Woods*, Forest Products Laboratory, Madison, Wis., December 1934.

Fig. 4. A portable mill sawing popple logs for local use in farm building construction.

AVAILABILITY AND COST OF LUMBER

Both Jack pine and popple are species found in quantity throughout all of northeastern Michigan—and most of the farm woodlands contain one or both species in combination with other hardwood and softwood species such as elm, maple, oak, red pine and white pine. If these other species are available they, too, may be used; but it is the purpose of this bulletin to show how our so-called inferior species can be satisfactorily utilized.

If, however, a farmer does not have timber of sufficient size in his own woodlot, it is possible for him to obtain stumpage from either the State Conservation Department or the United States Forest Service. The stumpage can be obtained by making application to the local authorities of either of the two above-mentioned organizations. The Forest Service has a special low rate to farmers within the National Forest boundaries.

One of the chief factors in the cost of lumber and building materials is the labor cost. If a farmer can use his own labor to fell the trees, cut the logs and haul them to the mill, he can save himself many dollars in the final cost of his lumber. After he has the lumber, he can still make greater savings if he will construct his own buildings. As

mentioned earlier in this publication, he must possess initiative and some knowledge of structural details. Some of the construction methods to be followed are set forth in this bulletin.

CUSTOM SAWING OF LUMBER

Anyone who contemplates the use of native timber for buildings on his farm must consider his building plan prior to having his logs sawed. He must determine how many boardfeet of material he will need of the various sizes, such as how many 2 x 4's, how many 2 x 6's, how much one-inch material, and what lengths will best suit his needs. With this knowledge of the bill of material, the owner then should cut his logs into the proper lengths to make the desired material.

For best utilization, it is very important that native lumber be sawed to precise dimensions. Most of the sawmills in northeastern Michigan are small portable mills, operated by farmers who saw lumber for their own use and do some custom-sawing for neighbors. Often the operator is not skilled in the sawing of high-grade lumber. The mill and equipment in many cases may be out of adjustment, or in a bad state of repair because of long periods of disuse or improper

Fig. 5. Green lumber piled in this manner will mold, warp, twist, and cup until it is not suitable for use. Much home-sawed lumber is wasted annually because of improper piling.

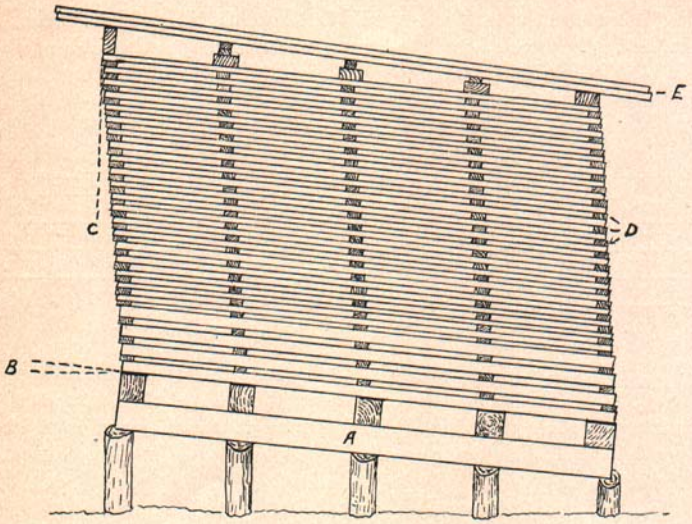

Fig. 6. Side view of a properly constructed lumber pile, showing (A) foundation; (B) slope; (C) pitch; (D) stickers; and (E) roof.

housing. Those conditions result in poorly manufactured lumber difficult to use in the better types of construction.

Poorly manufactured lumber means lumber that does not hold true to its intended dimensions for the entire length—such as wedge-shaped pieces, pieces of irregular thickness or width, and boards with an excessive amount of bark left on the edges. The quality of lumber produced should be the criterion in selecting a mill to saw the logs, rather than the price charged per thousand boardfeet. Money saved in hiring a cheap sawyer will be lost in added carpenter expense, or in the quality of building produced. Time spent in contacting all of the mills in the community to determine which one saws the best quality of lumber will pay good dividends to the log owner.

Other factors that should be mentioned in regard to the use of home-sawed lumber are the dimensions, thickness, and width that it should be sawed. If the lumber is to be planed or sized, then it should be sawed to full dimension. If rough lumber as it comes from the saw is to be used in the building, then it is advisable to have the lumber sawed ¼ of an inch less than the full dimension.

This means that a 2" x 4" would be sawed 1¾ inches by 3¾ inches. In the case of 1-inch boards, it is suggested that they be sawed ⅞ of an inch. A hardwood board sawed ⅞ inch thick will shrink about 1/16 of an inch, making it 13/16 inch when it is ready to use.

The reason for doing this is to make the dimensions of rough lumber conform more nearly to those of standard yard lumber, and to increase the yield of lumber from a given number of logs. *This less-than-full-dimension sawing is suggested only for rough lumber that is to be used in farm buildings. This statement does not apply in the case of sawmill operators planning to sell grade lumber on the open market.*

SEASONING OF LUMBER

As previously mentioned in this bulletin, green lumber should not be used in buildings. As soon as lumber is sawed, it should be piled into a well-built pile (Fig. 6) and allowed to season for at least 10 months. The following rules should be observed in making a good lumber pile:

1. Select an open, well-drained site.
2. Build a solid foundation, with a slope from front to back of 1 inch per linear foot.
3. Have the foundation high enough so the lumber will be 18 inches off the ground to permit free circulation of air.
4. Remove all weeds and trash from around the pile. This will allow better air circulation to hasten drying. The removal of trash will also reduce the fire hazard.
5. Pile the thicker lumber near the bottom of the pile. The weight of the pile above will reduce warping of heavy dimension stock.
6. Lumber of varying thickness should not be piled in the same layer.
7. Stickers should be placed between each layer of lumber. The stickers should be placed not more than 3 feet apart and directly above one another. Air-dried stickers will help to prevent mold and discoloration of green lumber.
8. Build the pile so that the front end has a forward pitch of 1 inch for each foot in height to prevent rainwater from entering.
9. Cover the pile with a roof made of a double course of boards lapped half so as to shed rain and melting snow; low-grade or scrap lumber is suitable for this purpose.

CONSTRUCTION DETAILS NEED ATTENTION

As previously suggested, popple and Jack pine are less durable than most of the common structural lumber to which the farmers in Michigan have been accustomed. However, when popple or Jack pine has been used to replace more durable woods and extra precaution has been taken to protect it—either by the application of some wood preservative or by a modification in construction details—the results have been encouraging. A survey of farm buildings constructed of Jack pine and aspen indicates that such buildings, properly constructed and maintained, will last 25-30 years.

It is particularly desirable to keep these relatively non-durable woods away from constant contact with moisture. Therefore, the sill

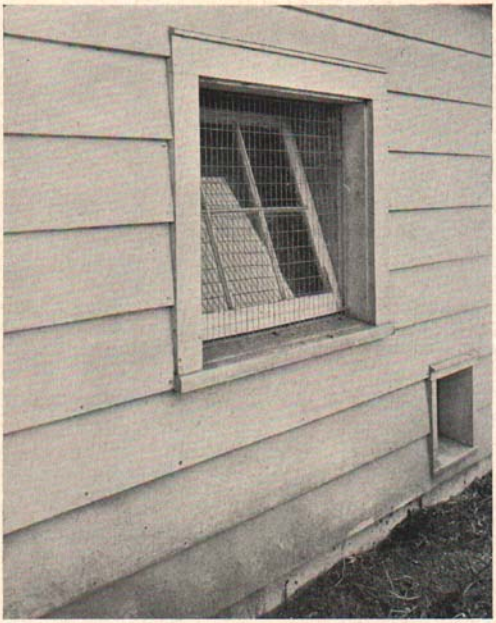

Fig. 7. Good window construction, showing tight joints and drip cap. (Compare with Fig. 8.)

Fig. 8. Window construction without drip cap. This picture shows paint failure owing to moisture seepage around window frame and trim.

should be placed not less than 12 inches above grade level, and preferably 18 to 24 inches.

The sheathing and siding should extend 1 or 2 inches below the sill to cover the joint between the sill and the foundation, but at no time should the siding extend to grade level. Weeds and rubbish should not be allowed to accumulate around the foundation, because they shade the building, retard drying, and hasten decay (Fig. 9).

Entrapped moisture in the joints around door and window trim many also result in rapid decay. It may not be practical to eliminate these joints entirely, but a large part of the moisture will be shed by making square-edged, tight joints, and by filling all joints with

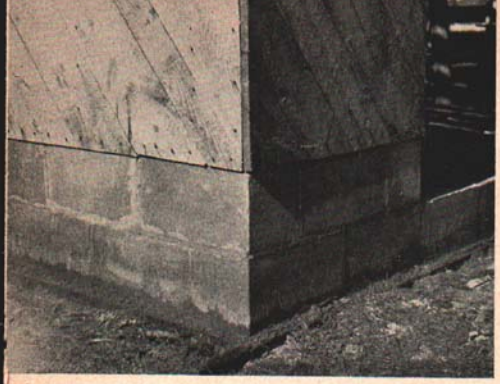

Fig. 9-a. A well-constructed foundation of concrete blocks set on a footing of solid concrete.

Fig. 9-b. Siding in constant contact with ground moisture decays rapidly.

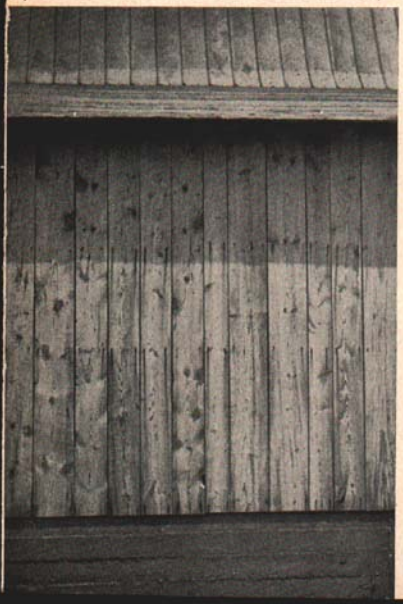

Fig. 9-c. The vertical Jack pine siding is protected against ground moisture by the 2-foot concrete foundation.

Fig. 9-d. The Jack pine siding already shows indication of decay at ground line after only one year of exposure.

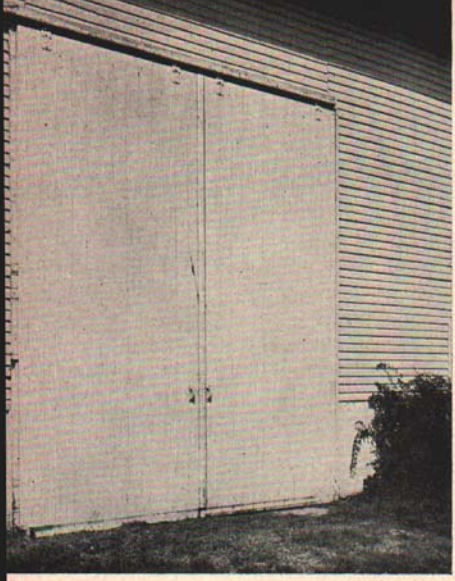

Fig. 10. A well-constructed barn door with no obstruction to hold moisture.

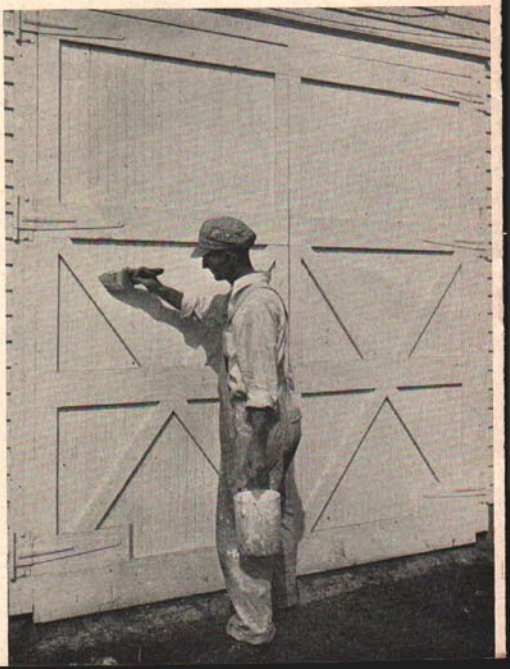

Fig. 11. Doors with exterior trim and cross-braces provide ledges that hold moisture. Unless frequently painted, these doors depreciate rapidly.

putty. Since plain surfaces provide no ledges or joints where moisture may accumulate, all bracing for barn doors should be on the inside rather than on the outside (Figs. 10 and 11).

Drip caps over windows and doors also decrease the amount of moisture retained in the joints around such openings (Figs. 7 and 8).

PORCHES

Porches and porch floors, including the joists to support the floor, are subject to considerable moisture. Although popple and Jack pine would not ordinarily be recommended for this type of construction, both have been used. They can be made to give better service if the space beneath the porch is well ventilated. Open porches are preferable, but if the foundation is enclosed, openings should be left on each side for free circulation of air. Such openings may be screened if desirable to keep out rodents.

ROOFS

In recent studies, Jack pine shingles that have been in service from 8 to 10 years indicate satisfactory durability. However, too great emphasis cannot be placed upon the proper method of laying

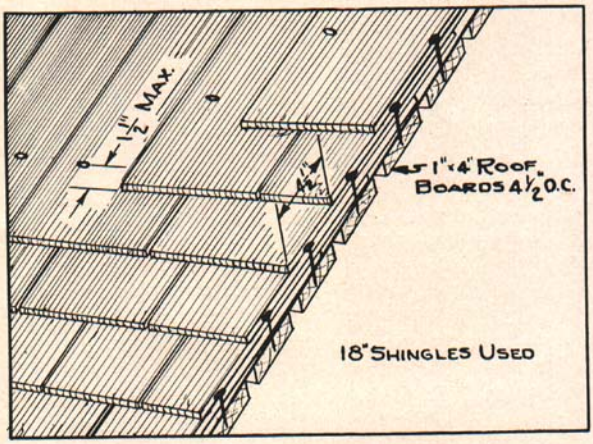

Fig. 12. Details of laying shingles, showing length of shingle exposed to the weather, proper nailing, correct side lap to eliminate exposed joints, and uniform roof boards.

Fig. 13. An excellent roof deck, using sound uniformly sawed roof boards, properly spaced for nailing shingles. This construction is preferable to that shown in Fig. 14.

shingles of relatively non-durable woods such as popple and Jack pine. The primary consideration is to lay these shingles so as to obtain rapid run-off and maximum circulation of air around the shingles to hasten evaporation.

Wood shingles have never been recommended on roofs of less than ¼-pitch, and perhaps the roof pitch should be increased to ⅓ for popple or Jack pine shingles. To prevent warping, only sound, edge-grained shingles, cut from well-seasoned bolts, should be used. Commercial shingles are sawed 16-18 inches or 24 inches in length, and

the better grades are 2/5 inch in thickness at the butt ends. Popple or Jack pine shingles should be sawed in lengths from 18 to 24 inches, with the butt ends at least ⅝ inch thick. These shingles should be laid with a quarter of their length to the weather.

Open sheathing, forming what is called a "slat deck," is recommended when laying untreated native shingles. The spaces between the roof boards or slats let the air circulate around the shingles, which hastens drying and reduces the decay hazard. The width of roof boards and the space between them will depend upon the length of the shingle which is exposed to the weather. If an 18-inch shingle is laid 4½ inches to the weather and the nails uniformly spaced not more than 1½ inches above the butt-line of the next course, it is obvious that the roof boards should be spaced the same distance between centers as the shingles are laid to the weather, if the nails are to be driven into the center of the roof board.

Therefore, in laying shingles 4½ inches to the weather, 4-inch roof boards spaced 4½ inches, center to center, will leave a ½-inch space between them. If 24-inch shingles are laid 6 inches to the weather for maximum exposure, 1-x4-inch roof boards laid 6 inches, center to center, would leave a 2-inch space between (Fig. 12).

The lower insulating value of the slat deck will be partially offset by the increased thickness of shingle covering, if the shingles are sawed to the foregoing recommended dimensions. Where greater insulation is required, it may be desirable to use better quality shingles over a tight deck of matched sheathing.

A shingle roof will last no longer than the deck upon which it is laid, and sound shingles have often had to be replaced because poor-quality

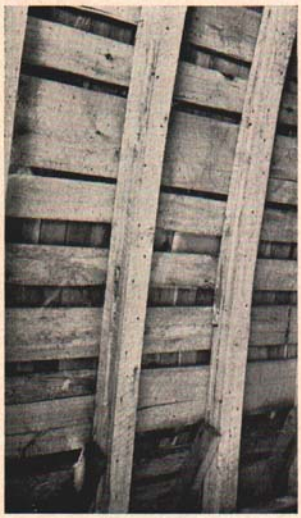

Fig. 14. A mediocre roof deck. The roof boards show numerous defects, and uniform nailing of shingles is difficult because of random widths and uneven spacing of roof boards.

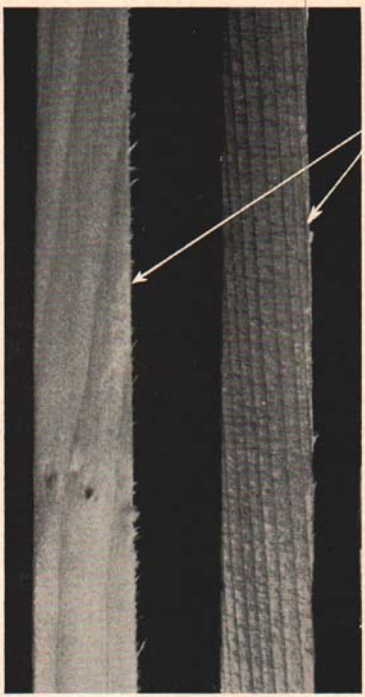

Fig. 15. Sections of two shingles showing slope of grain. Left shingle shows grain acting to retain moisture. Shingle on the right shows grain shedding water. Arrow indicates exposed surface.

roof boards decayed under them. The practice of using poor-quality lumber or slabs and edgings of random width for roof boards should be discouraged (Fig. 14).

All roof boards should be well seasoned before being used. Green or partially seasoned lumber will shrink as it drys and the wood fibers will pull away from the nails, leaving the shingles so loose that wind and rain can get under them. Since the nail-holding power of Jack pine and popple is relatively low, only well-seasoned, sound lumber should be used for roof boards (Fig. 13).

Only the best quality of galvanized shingle nails should be used, and they should be long enough to extend through the roof boards.

In starting to lay the shingles, a double course should be laid at the eaves, and the butt end of the shingles should project over the lower edge of the roof boards about 1½ inches. All shingles over 10 inches wide should be split, otherwise they may split in weathering and leave a crack directly over a joint which would cause a leaky roof. All boxed heart and exceedingly cross-grained shingles should be discarded. As the shingles are laid, caution should be taken to lay them with the grain of the wood sloping so that water will drain off more rapidly (Fig. 15).

The joint at the ridge may be covered with a metal ridge roll or by shingles laid as shown in Fig. 17.

Fig. 16. Edge-grain shingles will not warp or curl even when badly weathered, thus reducing the fire hazard.

It is advisable to avoid hips and valleys as much as possible, but where they are necessary, precaution should be taken to install proper flashing. Metal flashing is advisable when available, but heavy roofing paper may be used if it is properly maintained (Fig. 18).

PRESERVATIVE TREATMENT AND PAINTING

Perhaps some thought should be given to a preservative treatment for popple or Jack pine shingles. A creosote stain is most effective. It should be applied to the seasoned (or dry) shingles by dipping the butt-half of the shingle a few days before the shingles are to be used. After dipping, the shingles are thrown into a stock pile to dry before being laid. Only well-seasoned shingles should be dipped, since the creosote will not penetrate "green" shingles. If the shingles are not dipped, they may be given a brush application of creosote after they are laid—but this is not as effective as dipping. Even though the shingles are treated, they should be given a brush application of creosote at intervals of 4 or 5 years, owing to the fact that the creosote will gradually weather away.

Painting all exposed wood surfaces is usually considered a sound procedure, and it would seem particularly desirable to paint all popple or Jack pine siding. Any good exterior paint should be satisfactory. For further information on painting refer to literature cited.[5]

[5]*When and How to Paint Homes and Farm Buildings*—United States Department of Agriculture, Forest Products Laboratory, Mimeograph R962, Madison, Wis.

Fig. 17. Detail of lapped shingle ridge roll.

Photo courtesy U. S. Forest Service, Forest Products Laboratory.

Fig. 18. House roof, showing metal flashing used in valley. Also, lapped shingle ridge roll.

CONCLUSION

Although Jack pine and popple predominate in the forest growth in northeastern Michigan, there are many other species which are available and may be used for the construction of farm buildings. In this bulletin, an attempt has been made to show that more emphasis should be placed upon *how* and *where* to use lumber, rather than on what species to use. It has been pointed out that even though Jack pine and popple are considered to be non-durable species they will give very satisfactory service if properly sawed, seasoned and protected against decay hazards. Emphasis is placed on the need for high foundation walls, tight joints, steep-pitched roofs, drip caps on doors and windows, and water-tight flashings around chimneys and in valleys.

Preservative treatment is desirable in some cases for sills and roofs. All other exposed parts should be protected with several coats of good paint.

If all of the above-mentioned rules for good construction are observed, satisfactory results will be obtained with the use of native timber in farm building construction.

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