

Don't Fight the Fibers



Online **Extra**

For a lesson on reading grain from Fine Woodworking's Mike Pekovich, go to [FineWoodworking.com/275](https://www.finewoodworking.com/275).

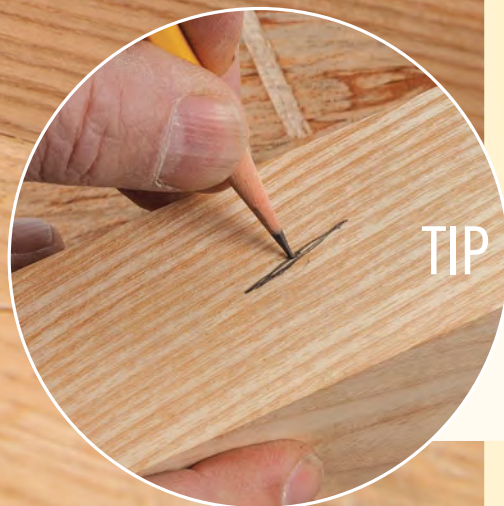
Better ways to read grain and make the most of your lumber

BY JASON ROBERTS

Like most woodworkers, I've learned about grain direction the hard way. I still remember the sound a beautiful piece of spiderwebbed Brazilian rosewood made when I sent it through a planer with dull knives, nor will I forget seeing it emerge with terrible tearout. I was making a jewelry box for my girlfriend, and I nearly wasted that pricey piece of wood. In the end I had to make the sides much thinner than I wanted.

I've now been cutting, drying, and selling high-end lumber for furniture and instruments for more than a decade, and I've been making furniture for much longer than that. Along the way I've learned a number of reliable ways to read grain and avoid tearout, whether I'm surfacing the wood using power tools or by hand. I'll help you make the most of your materials and avoid mistakes reading grain.

In this article, I'll refer collectively to the various longitudinal cells in wood—the ones that grow vertically in the tree—as fiber. Learn how to read the fiber and you'll head off tearout before it happens. Even when you can't prevent it completely, you'll know how to minimize it, making it faster and easier to produce the flat, flawless surfaces that characterize high-end work.

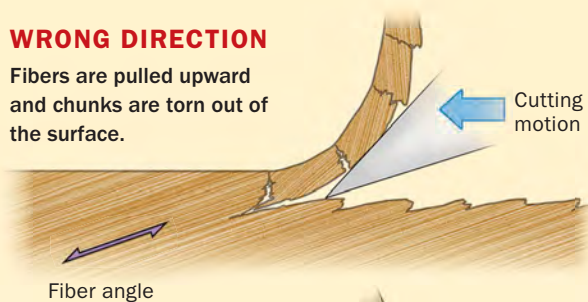


Work in the right direction

Whether you're surfacing boards by hand or machine, the orientation of the wood fibers makes all the difference.

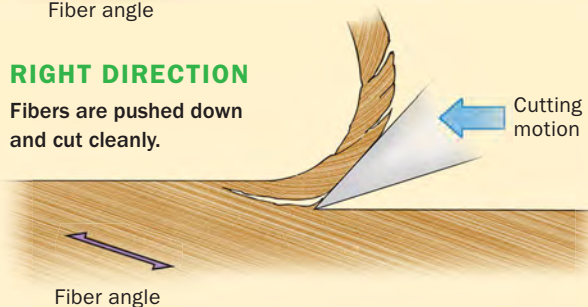
WRONG DIRECTION

Fibers are pulled upward and chunks are torn out of the surface.



RIGHT DIRECTION

Fibers are pushed down and cut cleanly.



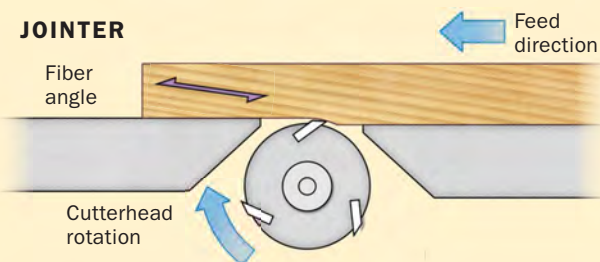
DIFFERENT TOOLS, DIFFERENT DIRECTIONS

Planing with the wood fibers means different things on different tools.

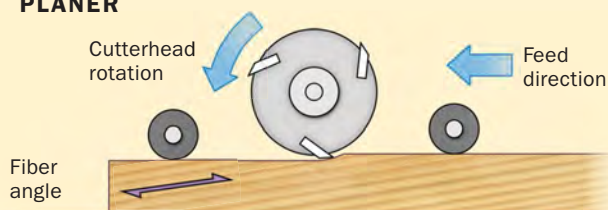
HANDPLANE



JOINTER



PLANER

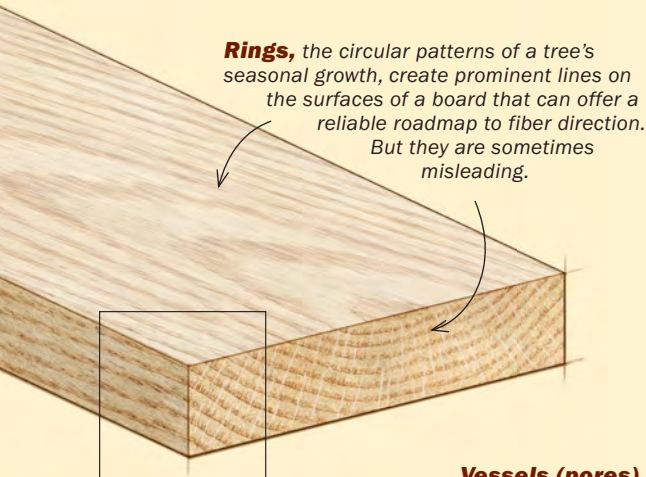


Mark the angle, not the direction

Roberts marks the fiber angle on the edge of the stock with a short dash. An arrow indicating which way to push won't always work, since the right direction depends on which face you are planing and which tool you're using.

It's the fibers that matter

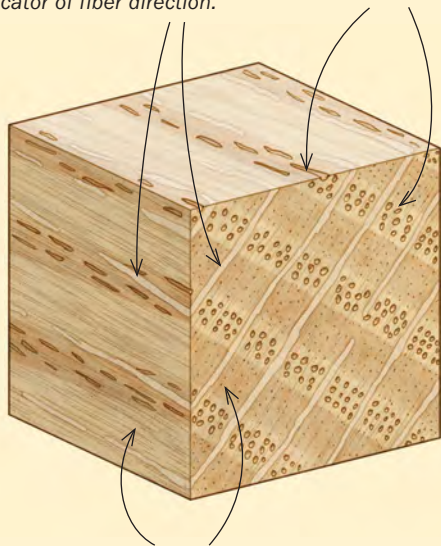
Although growth rings create grain patterns, it's the orientation of the wood fibers—the various cells that grow vertically in a tree—that matters when it comes to cutting. Hardwoods have three types of vertical, or longitudinal, cells: vessels, fiber cells, and tracheids. Softwoods have just one type, tracheids. A closer look at the cellular structure of hardwood reveals a number of reliable indicators of fiber direction. (In softwoods, with no vessels and only microscopic rays, rings are the only guide to fiber direction.)



Rings, the circular patterns of a tree's seasonal growth, create prominent lines on the surfaces of a board that can offer a reliable roadmap to fiber direction. But they are sometimes misleading.

Rays are ribbons of cells that grow horizontally in the tree, radiating out from the center toward the bark, visible in some woods but not others. Because they are sandwiched between the longitudinal cells, rays seen on the face of a board are an excellent indicator of fiber direction.

Vessels (pores) grow vertically in the tree, and they can often be seen emerging from the sides of boards. In large-pored woods, they are another dependable indicator of fiber direction.



Fiber cells, along with tracheids, are the primary structural cells in a tree. However, they are very small in diameter and hard to see on the surface of a board, so you'll need to look elsewhere to determine fiber direction in a board.

Good ways to read fiber direction

Roberts takes different approaches with different woods, depending on which indicators are most visible.



Rings

Growth rings are visible on the edges and faces of many woods, and usually are a good indicator of fiber direction.

READ THE FACE TO PLANE THE EDGE



Adjacent surface tells the tale. Roberts read the ring lines on the face of this ash board to figure out which way to joint the edge, achieving a glassy surface as a result.

How tearout happens

Trees taper as they grow, and tree trunks aren't always straight. So when boards are cut out of a log, the fibers often run at an angle to the surface. Wood always wants to split along the fibers. When you plane in the wrong direction, tiny splits dive forward and down ahead of the blade and little chunks of wood lift up and break off, leaving the jagged divots we call tearout.

Joint, plane, or handplane the board in the right direction, and the fibers will lie down nicely and cut cleanly. Whether the board is riftsawn, quartersawn, or flatsawn, reading the fiber direction and approaching it correctly is the key.

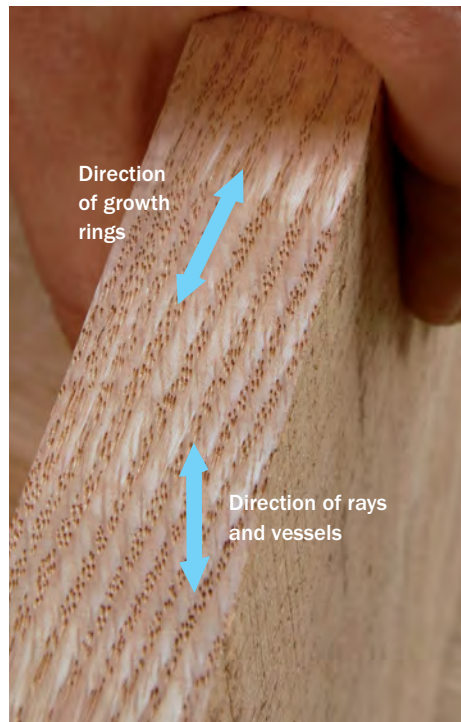
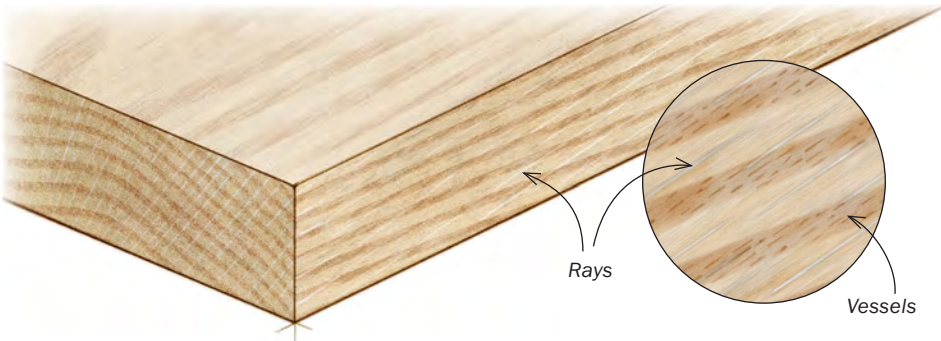


READ THE EDGE TO PLANE THE FACE

Adjacent surface tells the tale. Roberts read the ring lines on the edge of this ash board to figure out which way to plane the face.

Rays and vessels

When visible, rays and vessels are the most reliable indicators of fiber direction.



Sometimes the rings don't tell the story. Using the rings as a guide when jointing this oak board resulted in tearout. A close look at the rays (see photo at right) would have been a better bet.

The rays are always right (if you can see them). In woods with visible rays, like red oak, white oak, and sycamore, their brown lines are a foolproof indicator of fiber direction. Note how the oval-shaped pores (vessels) agree with the rays here, while the growth rings do not.

Visible vessels are excellent too. If you can't see rays, look for vessels (pores). In some woods, like the butternut shown here, vessels appear as long, dark dashes. Other woods with readable pores include birch, walnut, and mahogany.

Milling difficult woods

No matter how great a grain-reader you are, you can't always avoid tearout. Here's how to prevent or minimize it on the toughest woods.



RAYS

Rays are a weak point in some woods—such as quartersawn oak—and are prone to tearout no matter which direction you plane or cut.



CURL

Woods like tiger maple get their luster from the tight undulations of the grain, which can change direction every $\frac{1}{4}$ in. or less.



INTERLOCKED

It's common for some tropical hardwoods to have interlocked grain where adjacent stripes of wood have fibers running in opposite directions.

SKEW WHEN JOINTING



No good way to go. Figured woods have constantly changing grain, which can result in really nasty tearout.



Use sharp blades and skew the board. Roberts installed sharp knives on his jointer, skewed the slab of quilted maple as far as possible to create a shearing cut (top), and got amazing results this time.

Of course, wood is an organic material, and not all boards can be planed cleanly in one direction. Trees crook and twist, branches and knots intervene, and grain sometimes changes direction along the length of a board. Some tearout is inevitable.

In fact, some boards are hard to plane cleanly in any direction. Figured woods are especially tricky, with curly figure, burls, and bird's-eyes. Exotic woods with interlocking grain are also tough. And in some woods the rays are prone to tearout no matter which direction you plane or cut. There are boards with straight grain, mostly parallel to the surface, that won't tear out no matter what you do. Air-dried wood is also forgiving, even when it's figured.

There are ways to prevent tearout in even the trickiest woods, and I'll cover a few of those. But first, let's focus on the vast majority of boards you'll encounter.

A step-by-step approach to reading grain

Where to read the grain direction depends on which part of the board you're working on. When planing the face of a board, look at an adjacent edge. Before planing or jointing an edge, look at an adjacent face.

Most woodworkers start with the rings—Growth rings are prominent in many species, and usually are a reliable indicator of fiber direction. But because of the way they emerge on certain boards, these rings are sometimes misleading. To determine the fiber direction from growth rings, it helps to look at the lines on three adjacent surfaces: an edge, a face, and the end grain. In softwoods, which have no visible rays or vessels, the rings are the only guide to fiber direction. But with some hardwoods, there are alternatives.

Rays can be a better option—Ray cells radiate out from the center, or pith, of a tree to the bark, carrying nutrients horizontally and storing starches and sugars. Because ray cells are stacked in bands that grow between the vertical cells, they are a guaranteed indicator of fiber direction. They are visible in sycamore, red oak, and white oak, among other woods that display ray fleck when quartersawn. Unfortunately, not all woods have visible rays. The ray cells in walnut, mahogany, ash, and all softwoods, for example, are too tiny to see.

No rays? Look for vessels—If you are working hardwood and it doesn't have visible rays, it might have visible vessels (pores), another indicator of fiber direction.

Along the edges and faces of open-pored hardwoods like butternut, birch, walnut, mahogany, and the oaks, vessels emerge as oval-shaped holes or long, thin dashes with a distinct orientation. Follow their lead:



TRICKS FOR PLANING

Try wetting the surface. This works well on the planer, where the wet surface faces up, as opposed to the jointer, where it would ride the cast-iron tables—a recipe for rust.



Consider a helical head. Spiral cutterheads, with segmented carbide blades, are available for an increasing number of new jointers and planers, and can be retrofitted to many old ones. These cutterheads give amazing results on the toughest woods.



Hand tools for difficult surfaces

You can get handplanes sharper than jointer and planer knives, and scrapers are tearout-free in any direction.

PLANING AT A HIGH ANGLE

High blade angles. Woods such as tiger maple cut best with the blade at about 55° (below left), while cocobolo (below right) should be worked with the blade cutting at 60° to 65°.



Their angle is the other telltale sign of fiber direction.

If all else fails, there's always trial and error—If you can't determine the best planing direction with a close look, make your best guess, and take a light pass with your planer, jointer, or handplane. You'll have a 50-50 chance of getting the direction right. Even if you guessed wrong, if the blades are sharp and the pass is light, the tearout will be shallow and you'll have plenty of thickness left to try again.

When you figure out the best direction for planing any board, mark it on one edge for subsequent passes.

Techniques for tricky woods

Some tearout is inevitable. If you experience it in both directions, choose the one that works best. Or try one of these approaches.

Tips for machine work—Whether you're using a planer or jointer, one of the simplest ways to avoid tearout is to install sharp knives. If you can afford one, converting to a helical cutterhead in your jointer or planer will greatly reduce tearout in all woods. These cutterheads are especially amazing on figured woods. If you don't have a helical head, one way to achieve a shear cut on a straight-knife jointer or planer is to skew the board as much as the machine will let you.

Another trick for woods with wild figure is to soften the fibers with a wet cloth before feeding the board through the planer. This often reduces tearout. I avoid this on the jointer, where the wet surface could rust the cast-iron tables.

Handplane has its advantages—A handplane has a few advantages over planers and jointers. One is that you can adapt quickly as you work, planing different parts of the board in different directions. This is helpful any time the fibers switch directions, such as around knots. As always, make sure your handplane blades

TRY A SCRAPER

Scrapers work well in any direction. A card scraper is a great tool for targeting tricky areas (right), but it can leave an obvious hollow if you work one spot too much. A scraper plane is a better option for tabletops (far right), helping you remove an even amount of material from the entire surface.



SANDING IS THE GREAT EQUALIZER

Although it's not always the fastest way to smooth wood, sandpaper is a relatively foolproof method for producing flawless surfaces on the toughest woods.



Smooth tabletops start with careful glue-ups. By keeping the boards level to start with, Roberts makes it much easier to sand them flat. He applies pressure with parallel-jaw clamps, uses a rubber mallet to tap joints level, and then clamps the ends of the panel to level the joints there, too.

are super sharp. On tricky woods, try closing up the mouth tight and taking very thin shavings. Using a higher blade angle should reduce tearout as well.

Sanding or scraping always works—If you continue to have trouble with tearout, try sanding or scraping. You'll get zero tearout on the wildest woods. You'll need to know how to turn a sharp burr on a scraper, and both methods can leave hollows in the surface with improper technique. This often happens when people focus on a small area of deep tearout.

The key to even scraping or sanding is to work the entire surface in a uniform way. That's why a scraper plane works better than a card scraper at keeping the surface flat and avoiding hollows. If you have to go deeper in one spot, "feather out" the small hollow to create a larger, less noticeable, depression.

Sandpaper requires no setup, has a short learning curve, and will surface the wildest wood with no tearout. This is why so many pros own a drum sander or wide-belt sander. With random-orbit sanders, I use harder pads to help avoid digging hollows on large surfaces like tabletops. These firm pads are available for many sanders. They stay flatter in use, especially when a board is harder in some areas than others.

Wood is expensive and mistakes can be hard to fix. Learn to read fiber direction, and you'll be paid back many times over. □

Jason Roberts is a furniture maker and wood dealer in Olympia, Wash.



Try a firmer pad. Firm sanding pads are available for many sanders. They stay flatter in use, a big plus on large surfaces and those with figure or defects.



Sand in a uniform pattern. To avoid creating hollows and leaving behind scratches from previous grits, work the panel in a uniform pattern with each new disk. Be sure to attach a vacuum to the sander, keep it level, and don't add any pressure beyond the weight of your hand and the sander itself.