You Must Choose Your Flour, but Choose Wisely

Light, fluffy foods like bread need two things: air and something to trap that air. This might seem obvious, but without some way of holding on to air while cooking, croissants would be as flat as pie crust. This is where your choice of flour comes in.

Flour is, most generically speaking, ground-up "stuff": usually grain, usually wheat. Flours made from other grains—rice, buckwheat, corn/maize—are also commonly used, and flours made from seeds and nuts give us even more choices, like almond flour, chickpea flour, and amaranth flour.

Wheat flour, as an ingredient, has many properties that professional and industrial bakers need to consider, but the selection of flours available to the home baker is generally limited to a handful based on commodity crops, with the main differences being how much gluten can be formed. Hopefully soon we'll see a renaissance in wheat flour, just as we have with other ingredients such as apples and coffee beans. (Although, seriously, how many varieties of apples do we need?) Until then, most of us are stuck with just a handful of choices, so here is some wisdom that can aid you in choosing and working with flour, lest your breads turn to dust and blow away ("he chose…poorly," as the line goes).

Most wheat flour sold in the United States is AP (short for *all-purpose*) flour, named such because it's generally suited for most baking tasks. AP flour is made from the endosperm of the wheat grain and creates about 10–12% gluten (by weight) when worked. When you read "flour" in a recipe, this is what you should use. In parts of Europe, flour is classified by ash content, a measure of mineral content. Ash content is determined by which parts and ratios of the kernel are used. Using only the endosperm yields a lower ash content and whiter flour—e.g. Italian "00" ("doppio zero")—and being more refined is generally ground finer. While there's no guarantee that a "00" flour will be lower in protein or more finely ground than a higher ash one, most "00" flours are similar to finely ground AP flour.

> Wheat allergies and gluten sensitivity are different things—someone can be allergic to proteins in wheat but have no issue with gluten in other flours, and vice versa. If you're cooking for someone with a *wheat* allergy, see page 450. For gluten sensitivities, use ingredients that don't form gluten, such as rice, buckwheat, corn, or quinoa.

You'll sometimes see recipes call for whole wheat flour or cake or pastry flour instead. With whole wheat flour, the wheat grain's bran and germ are milled along with the endosperm, so the flour has more fiber (bran!) and creates less gluten (the proteins for gluten come

primarily from the endosperm). Cake and pastry flours are similar to AP flour but form less gluten, either because they use softer wheats that have less protein or because of chemical processing (bleaching) that changes the flour.

Gluten gets a lot of attention in baking because it's what creates structure in baked goods. Gluten is created when two proteins—glutenin and gliadin in the case of wheat—come into contact with each other to form what chemists call *crosslinks*: bonds between molecules that hold them together. In the kitchen, bakers create this crosslinking by adding water and then mixing, but instead of talking about crosslinks, they speak of "developing the gluten." During mixing, the two proteins bind together with water, and the resulting gluten molecules in turn stick together to form an elastic, stretchy membrane. That membrane traps air bubbles from ingredients like yeast, baking soda, and even water to give baked goods their height and springy texture.

Understanding how to control gluten formation will vastly improve your baked goods. Do you want a chewy texture? Do you want something with lift and rebound when it's pressed? Then you'll need to develop enough gluten to provide the necessary texture and elasticity. If you're trying to create a fluffy pancake, crumbly cake, or crispy cookie, you'll want to decrease the amount of gluten, either by reducing the amount of gluten-forming proteins or by adding ingredients that disrupt that gluten, such as butter, egg yolks, and sugar.

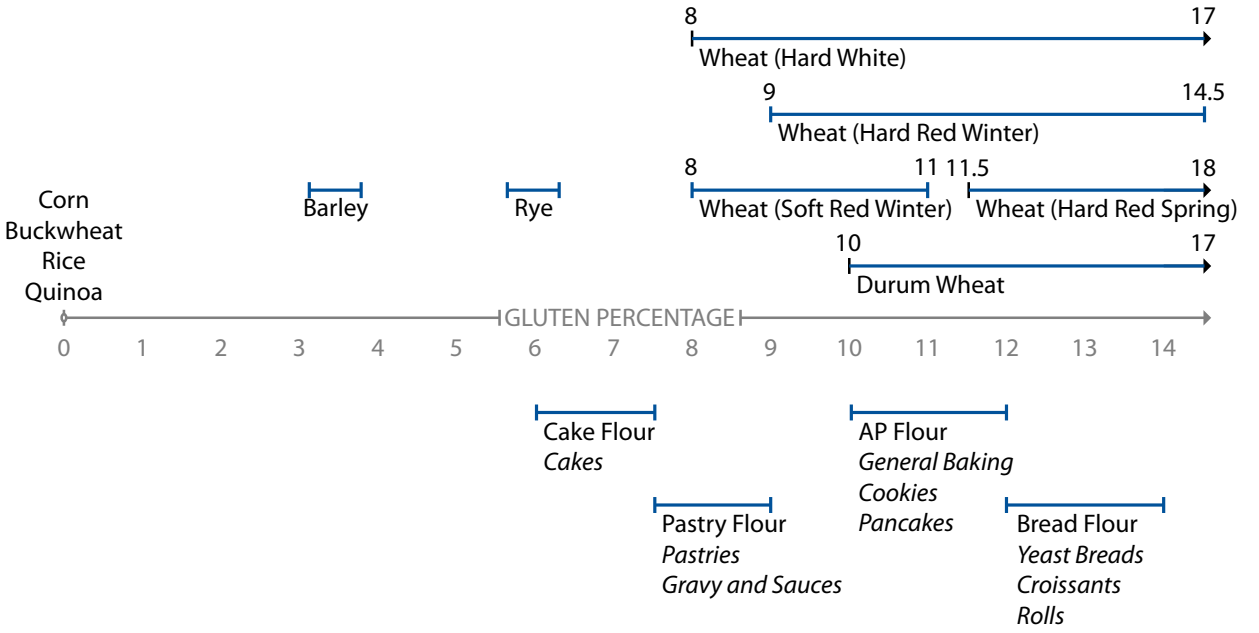
Let's start with the easy part: controlling the amount of gluten by changing the amount of protein. Wheat is the most common source of gluten and creates the highest percentage of it. Different strains of wheat have different concentrations of glutenin and gliadin proteins, based on the growing climate, so varying the source of wheat will vary the amount of protein in its flour. Other grains, like rye and barley, have the necessary proteins but in smaller quantities. Flours made from corn, rice, buckwheat, and quinoa won't form any gluten.

Phyllo dough—also spelled filo dough—is an unleavened dough used in pastries like baklava. It's made by mixing flour and water and repeatedly folding and rolling to develop gluten. It's also paper-thin: the sheets I checked were 0.0065" / 0.175 mm thick. Phyllo dough remains flexible while moist, but becomes brittle when dry. Take care to not let it dry out when working with it and use a spray bottle of water to moisten it if necessary.

Changing the cultivar of wheat, changing the way the flour is milled, or blending in nonwheat flours will change how much gluten exists that will trap air. If you're used to working with AP flour, substituting whole wheat flour or flours from other grains will reduce the amount of gluten and give you a flatter (possibly still tasty!) loaf. Switching to bread flour (start with 50% by weight and add a little more water) will increase the amount of gluten, resulting in a higher loaf.

What if you want the flavor of a certain type of flour (say, whole wheat flour or buckwheat) but need more gluten? You can add *wheat gluten*, wheat flour that has had bran and starch removed, yielding a 70%+ gluten content. If you want to swap out AP flour for whole wheat flour, replace 10% of the flour (by weight) with wheat gluten to add back the right quantity of gluten. (If substituting whole wheat flour for regular flour, you'll also want to use extra water—the bran and germ will absorb it—or decrease the amount of flour; either way, let the dough rest twice as long.)

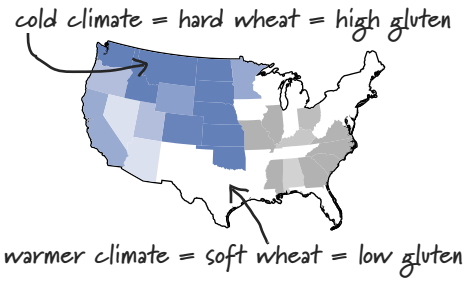
Choosing the right types of flours is the easy way of controlling how much gluten exists in your baked goods. Use wheat flours higher in the necessary proteins to create more; use softer wheat flours or other types to reduce it. The other way is more complicated but sometimes necessary: prevent the glutenin and gliadin from forming crosslinks, or break those crosslinks after they form.



Gluten levels of various grains and common flours. Besides wheat, both barley and rye form noticeable amounts of gluten, although rye also contains substances that interfere with its ability to form gluten.

Why biscuits are Southern food and Wonder Bread came from the Midwest

Colder climates favor flour cultivars with more glutenin and gliadin proteins. Flour in, say, France won't be identical to that grown in the US, and different regions will differ, too. Where your flour comes from will change its properties. Since different mills use different flours, try baking with a couple of different brands.



Consider the following tips for managing gluten levels:

Use fats and sugar to reduce gluten formation.

Cookies crumble and cakes are tender because of fat and sugar, both of which prevent gluten from forming. Oil, butter, and egg yolks all add fat to doughs, preventing crosslinking, while sugar is hygroscopic and snaps up the water before gluten does. If your baked goods aren't coming out with a desirable crumbly texture, one possible fix is to increase the fats (hence "one egg plus one egg yolk") or sugar (if not too sweet).

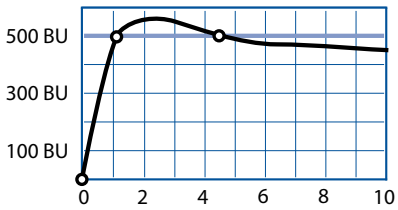
Use mechanical agitation and rest time to develop gluten.

Mechanical agitation (a.k.a. kneading) physically rams proteins together, increasing the odds that they'll form gluten. Letting dough sit also develops gluten by giving wheat's glutenin and gliadin proteins time to combine as the dough subtly moves. This is why the no-knead bread recipe on page 261 works.

Don't overmix.

Too much kneading weakens gluten. Mixing a batter or dough initially develops gluten by bringing the necessary proteins together, but after a few minutes, enzymes in the flour will cause the gluten to break down.

Ever wonder why some recipes tell you to mix "just until incorporated" (muffins) and others say "mix for a few minutes" (breads and dinner rolls)? Researchers use Farinograph charts to check dough viscosity over time as it's mixed, and one look at such a chart explains it all. It takes about a minute of mixing for a flour-and-water dough to have formed enough gluten to give a chewy, breadlike texture. Mixing less than that will avoid that texture—good in muffins, not so good in breads. On the other extreme, mixing for more than a few minutes will cause enzymes in the flour to break down the gluten, deteriorating below the magic "500 Brabender Unit" threshold. (Brabender Units are an arbitrary measure of viscosity.) These one-minute and five-minute rules will vary depending upon your dough and ingredients, but they're good rules of thumb.



Brabender Units versus time (in minutes) shows the viscosity of a dough as it's mixed.

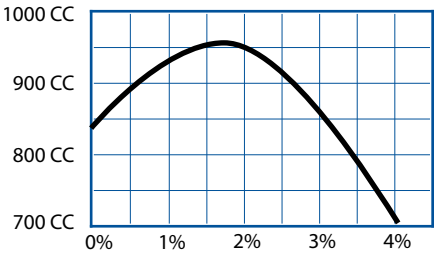
Pay attention to water.

Quantity matters: you need enough water for gluten to form, but add too much and the proteins won't bump into each other. In bread dough, aim for about a 0.60:0.65 ratio of water to flour (about 30–35% water by weight); more than that, and you'll get large, irregular holes, which can be nice in rustic bread, but not sandwich bread. Flours with more gluten will absorb a little more water, so adjust the amount of water accordingly. Due to evaporative cooling, batters with too much water will end up with surface issues and stall out, leading to cakes that fall after baking; if you see that, cut back on wet ingredients. You'll face similar issues if the humidity is too high, so reduce wet ingredients in this case too.

Ingredients like sugar, flour, and salt all absorb atmospheric moisture, so changes in humidity will change the amount of water they bring to the recipe. Ideally, buy and store them in airtight containers; otherwise, on humid days, reserve a fifth or so of your liquid ingredients and add in what's necessary to achieve consistency.

Pay attention to minerals and salt.

Gluten also needs some amount of calcium or magnesium from dissolved minerals in water; you can counterbalance too much or too little by adjusting the amount of salt in your dough. As for salt, there's some wiggle room, but in breads, try to keep salt at between 1% and 2% of the total weight for optimal lift. Finally, be mindful of high pH levels: if your water is alkaline, add an acid (vitamin C, lemon juice, vinegar). (See page 240 for more on how water impacts your baking.)



Loaf volume (cc) by percent salt (NaCl).