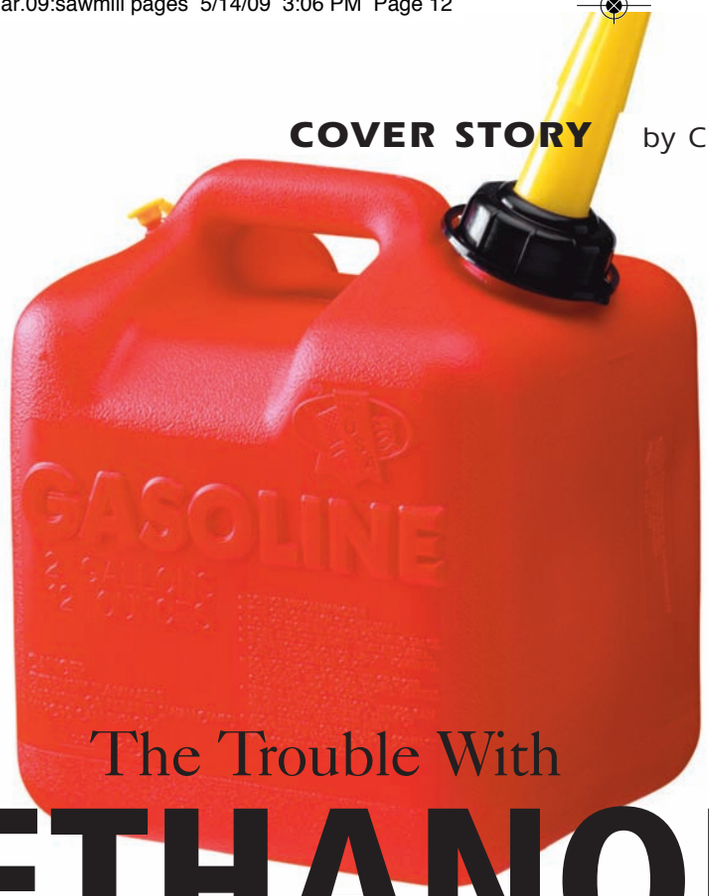
 by Craig Blake



The Trouble With ETHANOL

In recent years, there have been many changes in the gasoline available to consumers. Most of these changes have been driven by the Environmental Protection Agency's (EPA) quest for cleaner air.

The EPA requires gasoline sold as on-road motor fuel to be "oxygenated." That means the fuel is enhanced with some sort of chemical compound that carries oxygen. For many years, that chemical in most of the country was methyl tertiary butyl ether (MTBE). MTBE was heavily used and prized as an oxygen enhancer AND as an octane enhancer. In recent years, MTBE has fallen out of favor due to its long-term effects on aquifers and its questionable carcinogenic characteristics.

The replacement of choice in most of North America, particularly in the United States, is ethanol. Ethanol is a blend of ethyl alcohol and gasoline and is authorized in quantities of up to 10% in fuel sold as gasoline motor fuel in the country today. Oxygenated fuels work by promoting a more complete combustion process. By the very nature of the fuel carrying more oxygen, the resulting emissions (especially carbon monoxide, a by-product of incomplete combustion) are reduced. This reduction is arguably of little consequence in today's modern, computer-controlled, fuel-injected vehicles. However, there are significant emissions gains when ethanol is utilized in carbureted engines such as older vehicles, boats, and motorcycles. These same gains are also realized in the small engines powering our outdoor needs at home, or at work in the mill yard and woodlot.

The Downside

Despite the positives of using ethanol, there are some problems as well. Ethyl alcohol is a very effective solvent. It does a great job of breaking down the years of contaminants within the fuel system of older vehicles and equipment and moves them upstream to the filtration system. This includes fuel tank deposits and any nonalcohol-resistant fuel delivery components. What is not captured by the filtration system is moved to the carburetor and can restrict fuel delivery. This can result in performance issues stemming from lean operation. The solvent action of ethyl alcohol as a gasoline additive introduced to an older, small engine has most of its effect in the carburetor bowl, allowing breakdown of deposits and the subsequent restriction of the fuel delivery jet(s) resulting in additional performance issues. Fuel delivery components such as non-neoprene rubber fuel hoses degrade and begin to leak quickly. This has been particularly noted in the chain saw industry.

Ethyl alcohol is also hygroscopic, meaning it readily absorbs and disperses water. In New England and other parts of the country where 10% ethanol is standard at the fuel pumps, there is no longer any need for fuel line antifreeze. That product is an isopropyl alcohol base. With 10% alcohol already in your tank, the product becomes obsolete.

The hygroscopic properties of ethanol are probably the leading cause of small engine problems today. Experts in the small engine field agree that between 70% and 80% of the repair work generated in their facility is attributed to ethanol-enhanced gasoline and a phenomenon called "phase separation." Phase separation occurs when moisture is introduced to the fuel. This moisture can be from accidental introduction of straight water, or more commonly from the result of condensation in the fuel system. Condensation is made possible by the normal and necessary

fuel ventilation system on most small equipment.

Unlike your car or truck where the systems are tighter and fuel is typically used at a faster rate, the gasoline in a piece of power equipment that is not used for a period of weeks or months can attract moisture from the atmosphere. The moisture will combine with the ethanol and this mixture will then fall out of suspension with the gasoline and form at the bottom of the tank and/or the fuel bowl in the carburetor. The suspension often has a characteristic white milky substance between the phases. The moisture at the bottom of the mix has corrosive properties in a steel fuel tank or carburetor bowl. The resulting fuel leftovers will not operate in the engine, and will not recombine into a combustible mixture once separated. The only alternative is to drain and clean the fuel tank and lines, and additionally remove, disassemble, and clean the carburetor. This operation is becoming commonplace in the small engine world where gasoline can often sit in both equipment fuel tanks and vented gasoline containers for extended periods of time.

The third problem with ethanol has to do with its characteristics as a fuel: Fact one, ethanol has 30% less energy per unit volume than gasoline. Fact two, standard gasoline burns with an ideal ratio of 14.7 parts air to 1 part fuel, while ethanol's preferred ratio is 9:1. Translation, ethanol requires less air to burn per unit volume than gasoline AND will not provide the same amount of power in an engine designed for gasoline. These characteristics alone are enough reason for the federal government to limit ethanol as an additive to gasoline to 10%. Add any more than that, and the engine burning it will be operating too "lean," that is, too much air and not enough fuel. Lean operation is not desirable because it can cause too much heat in the combustion chamber. This additional heat can be problematic…especially when there is aluminum around the combustion chamber. A common small engine failure nowadays is in designs with "overhead" valves and pushrods. Typically, the valve pushrods are made of aluminum, and designed to bend or break in the event of any valve train problems—and bending or breaking they are! Many cylinder heads on small engines are aluminum, and the additional heat around the combustion chamber is causing valves to stick in the cylinder head. The aluminum pushrod is the component that fails. This same lean operating failure can be caused by a restriction in the fuel delivery from the carburetor as mentioned previously.

This carburetor is one-year old, but was stored with untreated fuel for eight months. The engine started but ran poorly. The choke was used to keep it running until it ultimately stopped. The body of the carburetor and the bowl are aluminum. The only steel component in the bowl area corroded and the resulting corrosion made its way into the fuel metering system. When in doubt, consult a professional on long-term storage practices. Some carburetors, like this one, benefit from a complete removal of fuel from the carburetor before storage. Others such as two-stroke engines are better left "wet" with fuel that is properly treated for phase separation.

Avoiding the Problems

So now you may be wondering what steps you can take to avoid the problems associated with ethanol. Here are some recommendations I have developed from personal experiences and from interacting with customers:

▪**Fuel Treatment** There have been fuel stabilizers on the market for decades. A fuel stabilizer is designed to protect gasoline from degradation. However, your old standby may not offer enough protection with ethanol-enhanced gasoline. There are some stabilizers fairly new to the market. These were initially intended for the recreational marine consumer and are outstanding choices for ethanol stabilization. They work by essentially inhibiting the ability of ethanol to attract moisture. I suggest reading the label on your old favorite and doing a bit of research on its abilities relating to ethanol. I have switched to a "marine"-based product for all of my small engines, 2- and 4-stroke alike. Also, every tank of gasoline for my small equipment is now treated at time of purchase. It eliminates the question, "Was the fuel in the leaf blower treated before I put it away in November?" This has also eliminated problems I have encountered with intermittently used items like our generator. Another thing to remember is to treat your fuel immediately at time of purchase: Fuel treatment will not return a can of fuel that has already been sitting for several months to new condition!

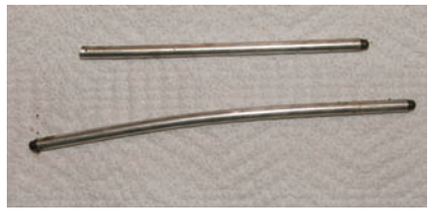
▪**Fuel Storage** In addition to treatment, store fuel in properly sealed containers, not in the old gasoline can that you bought in the 1970s that is now missing the tank vent and spout caps. The ethanol content for fuel stored in a container open to the elements is going to rapidly attract moisture and begin the separation process. All fuel cans should be vented for temperature fluctuations. Most do this through the spout/spout cap.

▪**Inactive or Seasonal Equipment** If you choose not to treat all of your fuel all of the time, at the very least be certain to add a fuel treatment to the tank in the appropriate ratio before storage.

The engine should be operated on this mixture to ensure the entire fuel delivery system is protected. If at all possible, seasonal equipment should be started and run to operating temperature during off season at least every 60 days. Another precaution is to keep fuel tanks near full when possible. This helps prevent atmospheric air intrusion and, therefore, water's potential for entering the gasoline.

▪ **Use Caution** One last recommendation would be to exercise caution if a piece of equipment is not running properly after an extended period of inactivity. When confronted with this situation, most people will try anything to keep the equipment running in an attempt to fix the problem. I have had many customers who have damaged their equipment by doing just this. The problem is usually remedied simply with a fuel exchange and maybe a carburetor cleaning, but if not handled properly, can result in expensive mechanical damage from overheated cylinders and stuck valve trains.

Ethanol is only the latest chapter in the evolution of gasoline as a motor fuel. In warmer climates around the world, 100% ethanol is used as a motor fuel and in our own country it is sometimes used in concentrations of up to 85%. One hundred percent ethanol or E100 does not have good cold weather starting characteristics and, therefore, E85 is used in the United States. According to some studies, it currently takes more energy to produce ethanol than you get back out of it in energy. This varies with the choice of crop to produce it. Traditionally, most of the ethanol in the United States is produced from corn, but alternative crops such as beets, switchgrass, and even general cellulostic wood waste are showing promise. No matter the source, it is likely that we will not be seeing ethanol as anything more than a gasoline additive across the country for some time—until it can be produced more economically on a larger scale. But as a gasoline additive, it appears it will stay. ■



These aluminum pushrods (one bent, one broken) are from a single cylinder on a small aluminum head, "overhead-valve" style small engine. (This means the valves are located in the top of the cylinder head.) This engine suffered from a restriction in the carburetor that lead to a lean fuel:air mix. The resulting abnormally hot temperature in the cylinder caused the valves to stick, and the pushrods are the weakest link.

Along with wife Lorraine, Craig Blake operates a sawmill supply and small equipment business in southern Massachusetts. He is also a part-time sawyer, and a nationally recognized authority on swingmills. www.majestystables.com