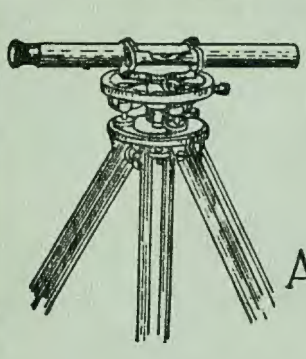
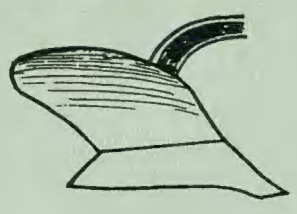
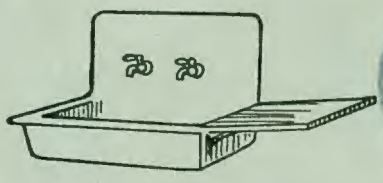
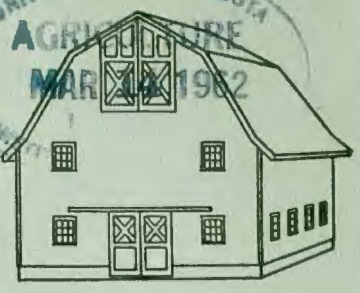

AGRICULTURAL ENGINEERING NEWS LETTER

AGRICULTURAL EXTENSION DIVISION
UNIVERSITY OF MINNESOTA

UNIVERSITY FARM, ST. PAUL—FEBRUARY 15, 1941—No. 107

TRACTOR FUEL

J. B. TORRANCE

One of the principal questions where the operation of tractors is considered is the choice of the fuel to be used. The subject may be considered from any one of several different angles. The object of this article is not to furnish a definite answer but rather to present again some information which may be of value in a consideration of the matter.

All of the fuels used in tractors are obtained from crude oil and are known as hydrocarbons containing around 85 per cent carbon and 15 per cent hydrogen. These two elements are combined in a great many different ways, each combination having characteristics peculiar to itself. We will deal briefly with some fuels common in tractor operation and characteristics which should be considered for best results.

These fuels are extracted from the crude oil by distillation processes. The crude is heated in the still, and the various hydrocarbons are driven off as vapors. The lighter, more volatile compounds are expelled at lower temperatures. The heavier, less volatile compounds require higher temperatures for their distillation. A distillation test of fuel indicates the temperatures at which certain percentages of the fuel are vaporized. Table 1 shows comparative temperatures at which certain percentages of various fuels are recovered through distillation. The "initial point" is the temperature at which the first drop of fuel is recovered from the sample being tested. The "end point" is the temperature at which the last of the sample is recovered. The entire amount of the sample is never recovered, there being slight distillation losses and a small amount of residue which is not distilled.

Table 1. Temperatures, Degrees Fahrenheit

	Initial point	20%	50%	80%	End point
Gasoline—					
premium grade	108	166	235	301	386
regular grade	107	169	243	322	397
third grade	112	185	256	335	403
Kerosene	310	390	429	481	517
Distillate	338	407	459	508	537

Before any fuel can be burned in a carburetor type engine, it must be properly vaporized. If, in the process of distillation, a certain temperature was necessary to vaporize the fuel, that temperature will be required to carburate it for good engine operation. This must be kept in mind especially when using the so-called heavier fuels. A study of Table 1 shows that practically 80 per cent of the gasolines are vaporized by the time the initial point temperature of the kerosene and distillate is reached. This shows the absolute necessity of warming the engine thoroughly before attempting to operate on the heavier fuels. Not only must the engine be warmed properly, but this temperature must be maintained and proper manifold adjustment made completely to vaporize the fuel. The temperature at which the engine will normally run is not sufficiently high for heavy fuel carburetion. Manifold heat is absolutely necessary. Operating conditions have a great effect on operating temperatures. For example, it is not difficult to maintain good operating temperatures when an optimum load is being pulled continually. However, the engine is apt to run much cooler with varying or intermittent loads.

Table 2 shows another picture. Here we see the weights of the different fuels from premium gasoline weighing 6.08 pounds per gallon to the distillates with an average of around 6.87 pounds per gallon. We also see that while the more volatile fuels have more heat units per pound they have less per gallon, which is the unit by which they are purchased. There is, also, another side to this. While there are more heat units per volume of the heavier fuels, more care must be exercised to make those heat units available for use in the engine. If they are not made available for the engine to burn readily, they are not changed to power, hence are wasted. This unburned fuel washes the lubricant from the walls of the cylinders and pistons and dilutes the oil in the crankcase.

Table 2. Some Physical Tests of the Same Fuels Mentioned in Table 1

	Sp.Gr. at 60° F.	Weight pounds per gal.	Heat Value (high) BTU per lb.	Heat Value (high) BTU per gal.
Gasoline—				
premium grade	0.7294	6.080	20,310	123,440
regular grade	0.7335	6.113	20,290	124,500
third grade	0.7345	6.128	20,280	124,785
Kerosene	0.8132	6.778	19,820	133,920
Distillate	0.8251	6.870	19,455	133,700

Greater power may be obtained from an engine by increasing the compression ratio. When this is done, another fuel characteristic is brought to our attention. This is its anti-knock value or "octane" rating. As the compression ratio becomes higher, the tendency toward knocking increases. The anti-knock characteristic of a fuel is changed in one of two ways. Either by adding some anti-knock agent or by changing the method of distillation. This latter method is known as cracking the fuel or distilling it under pressure. Most of our gasolines are obtained in this manner and so have a fair anti-knock rating. This rating is greatly increased in the "premium" grades and in many of the "regular" grades by the addition of "lead." Kerosene being obtained by straight distillation methods has very poor anti-knock qualities. The tractor distillates are obtained both through straight distillation and by cracking. Those obtained by the latter method have a much better "octane" rating and, other characteristics being equal, these are to be preferred as tractor fuels. In fact several of the companies have developed a fuel particularly for tractor use giving it the characteristics necessary for good operation.

It has been mentioned that much, if not most, of the gasoline in use is obtained by the cracking process. The chemical structure of the fuel is changed somewhat in this process. A rather pronounced tendency toward the formation of gummy substances is the result. This substance forms in the tank, sediment bulb, and carburetor particularly when gasoline is left in the fuel system during idle periods. The best remedy is not to allow the gas to remain in the system for any extended period. It is also suggested that the fuel be purchased in such quantities that it will not be kept in storage to exceed 60 days. Any gum which collects in the carburetor or other places such as screens may be removed by a solvent such as alcohol. Some trouble has been experienced with gum forming on and sticking in the inlet valves. Valves of stainless steel and shorter valve guides seem to have remedied this fault.

As yet comparatively few are using tractor engines with compression ratios sufficiently high to require premium grade gasoline. A very small number use kerosene. Perhaps 75 per cent of all operators are using the lower grades of gasoline, and the rest other heavier fuels variously known as distillate, tractor distillate, fuel oil, or tractor fuel.

Published in furtherance of Agricultural Extension Act of May 8, 1914, Paul E. Miller, Director, Agricultural Extension Division, Department of Agriculture, University of Minnesota, cooperating with U. S. Department of Agriculture.