

Maintaining Forage Harvester for High Fuel Efficiency

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Harvesting corn silage requires large quantities of fuel in comparison to other field operations. To ensure near maximum corn silage production profitability, the proper operation and maintenance of forage harvesters (choppers) and engines becomes more important with the recent high fuel prices. Simple maintenance steps can have a significant impact on the fuel usage in harvesting corn silage and the machine's capacity. A well adjusted forage harvester will require an estimated 2.8 gallons of fuel/ac. Using a fuel price of \$3.00/gallon, the fuel cost is \$8.40/ac. The engine should be properly maintained for best fuel efficiency.

Adjustment and maintenance steps that will have a significant impact on fuel consumption include theoretical length of cut, knife sharpness, knife and shearbar clearance, and crop processor clearance. For the forage harvester, the energy and fuel consumption can be divided among corn head and feed rolls (20%), cutterhead (40%), and blowing (40%) for a properly adjusted machine. Three of these adjustment and maintenance steps influence the portion of the energy required by the cutterhead.

As the cutterhead knives wear, the power requirement increases. In one report, worn knives doubled the fuel requirements of the cutterhead. Therefore, the estimated cutterhead fuel requirement goes from 1.12 gallons (2.8 x 0.4)/ac to 2.24 gallons/ac. For \$3.00 per gallon of fuel, the added fuel cost is \$3.36/ac. The added fuel requirement will be greatly affected by the degree of wear.

The power requirement increases as the knife and shearbar clearance increases. When considering a clearance of 0.01" versus 0.02", the power requirement of the cutterhead is doubled when increasing the clearance. This result is similar to the worn knives, an increased fuel cost of \$3.36/ac. If the clearance is 0.03", the fuel cost increase over 0.01" of clearance is \$6.72/ac. If the machine has worn knives and a knife and shearbar clearance of 0.03", the added fuel cost will be estimated at \$10.08/ac. For many machines on the market today, manufacturers have automated the knife sharpening process, making it much easier to maintain sharp knives and shearbar clearance and keep fuel usage down.

For the crop processor, the fuel consumption will increase as the clearance is reduced. A clearance of 0.12" is sufficient enough to break most of the corn kernels. A clearance smaller than 0.12" is unnecessary with respect to feed quality and will require more fuel. If the feed handling and storage system can handle the crop, a 0.75" theoretical length of cut is recommended with the crop processor clearance at 0.12".

For the maximum productivity of the engine, good maintenance steps should be followed which are provided in the Operator's Manual. The primary engine systems to consider are cooling (radiator), intake (air cleaner), and fuel (filter). A dirty radiator will restrict the air flow through the radiator and cause the engine to operate at a higher temperature which is inefficient. A dirty air cleaner element will restrict the air flow into the engine which causes inefficient operation. A fouled fuel filter will restrict fuel flow which will sacrifice performance.

Another hidden cost with higher fuel consumption is the machine driveline wear due to the higher loads on the gears, shafts, and chains. A higher fuel usage leads to a shorter machine life. Furthermore, the increased fuel consumption will reduce the machine capacity with respect to acres per hour and tons per hour.

In summary, these are estimated figures related to increased consumption and rising fuel costs. Nonetheless, properly adjusting the forage harvester cutterhead will lead to lower fuel consumption, higher field capacity and a more profitable forage production system. The machine's Operator's Manual provides further details on adjustment procedures for the most productive and profitable operation of the forage harvester and engine maintenance for efficient operation.