

SAVE FUEL – THE MAJOR INTEREST OF FARMERS

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ABSTRACT

The global economic crisis, the alarming increase fuel prices on international markets, accelerated global warming, the spending reduction with the crops, and I could go on with many other arguments, need to find viable solutions to save fuel.

It is known that agriculture generally, self-propelled agricultural machines in particular, are large consumers of fuel. These inputs can vary between very wide limits, from case to case, even though we speak the same work performed with identical machines in similar working conditions.

Regarding the big differences in fuel consumption, in most cases we find weaknesses in the regulation and operation of agricultural machinery by mechanics.

In this paper we present some simple methods to saving fuel based on rational use of agricultural machines without charges, without using expensive equipment.

INTRODUCTION

Generally speaking, from spring until late autumn the fields are full of tractors and agricultural machinery rushing to end as quickly as possible the seeding and harvesting season. Unfortunately the weather does not always contribute to the optimum of these so important works. In cases where weather conditions are not favorable, these field works require much higher fuel consumption compared to the optimum.

Fuel prices in general and diesel in particular to show a rising trend, this follows from the EU statistics.

In 2013, the government decided that the duty on diesel fuel will increase from 374 EUR / ton to 391 EUR / ton and in conjunction with a reference rate (4.5223 RON / EUR) higher than the previous year, it results that we have a higher fuel cost. As is expected, the oil companies will not incur additional costs but they will put you in the final price we will all pay at the pump.



Fig.1 Average price of diesel fuel in EU countries at the beginning of year 2017

The trend increase in the price of diesel at the pump signifies data provided by the European Union and for Romania reported on the time period starting 2011 to 2017.



Fig.2 Variation of the diesel fuel price at the pump (PETROM company, Romania) in the period 2011 - 2017

I want to bring to the attention of farmers and to the vehicle operators some "tricks" that can help save fuel. Whatever the make, model or engine capacity, there are a few simple ways of saving fuel. You do not need anything else than special attention to service and some specialized knowledge.

It seems incredible, but it is true, tractor operation with attention to detail can save up to one-fifth of the fuel consumption.

It is not mandatory that the tractor is equipped with the latest generation engine, when we want to reduce fuel consumption. There are lots of little tricks that can achieve this goal.

The possibility of continuous optimal use of the tractors engine depends on the number of revolutions. High RPM (revolutions per minute) causes increased fuel consumption and energy losses due to friction and evacuation of combustion gases.

The heat generated by burning fuel increases the urgent need for engine cooling. In this operating mode the cooling system is required to work at full capacity, as a result we can be sure that this reduces engine power by at least 10%.

MATERIAL AND METHOD

Saving fuel is in the power of the tractor driver.

A specific consumption that is considered economical is calculated around 80% of the total engine power (80% of its RPM).

Following studies on the exploitation of tractors during the work it was found that most work at 60-70% of their maximum capacity. This is a rational exploitation of the machine.

It is highly indicated to use the engine in the middle rpm range environments. Use higher gears, but do not exaggerate with the accelerator pedal.

The newest engine specific fuel consumption curve shows three peaks called "humps" in the speed range between 1500 - 1600 rev/min. To comply with NOx exhaust emissions established by the manufacturer, engine electronic injection is introducing a timing offsets, what leads to a lower engine power and the engine to operate with a lower efficiency. Compared to the old generation engines, the engine develops its maximum power with lower fuel consumption, if operated at higher rpm. If the tractor has a gearbox with an automated system that allows selection of variants after engine requirements

"power" or "economy", in this case the electronic will try to protect the engine, reducing and maintaining its rpm below 1800 rev/min. This generates increased consumption in a system operating at full power.

It is recommended to know and understand all of the sound signals emitted, submitted by the engine for you to use in determining optimum operating regime, the regime that achieve the minimum fuel consumption.

It is recommended to set up the transmissions settings professionally, whether it is a automatic transmission or one with no gears. This way the reaction time of the gearbox can be adjusted to the engines rpm, expressed as a percentage.

If you invested money in buying new tractors that can run speeds of 40 km/h, it is recommended to verify the existence of the lever or button "economic". Under these conditions the electronic speed limit of the tractor kicks in, limiting the tractor which may have the opportunity to run up to 50 - 60 km/h because of transmission performance. The advantage of this limitation is that the maximum travel speed is reached full gear at a low rpm.

RESULTS AND DISCUSSION

Increased fuel consumption due to wheel slip.

It is known that there is no traction on wheels with no slip. But it is very important to know how much these wheels are spinning. On the fields is recommended to work with slip below 15%. A higher rate of slippage leads to increased fuel consumption. If we reduce the tire pressure, the result is increased contact area between tire and soil meaning a increased contact surface and that increases traction power by 20%. Modern tires have the ability to hold a large volume of air and allow the safe running at a relatively low pressure of 0.8 bar.

In practice tractor tires are operating at constant pressure, constant pressure control is an extra effort and perform sluggishly.

Use of monitoring and correcting tire pressure can provide extra comfort for the operator. These devices purchased second hand (SH) costs between 500 and 10.000 EUR. You can use simple devices and rapid valve connection valve, the cost does not exceed € 50 EUR and allow pressure control in a short time. On the roads higher tire pressure is required for running higher speed with low resistance so the tire wear decreases. On the fields instead it is required to reduce the pressure to increase adherence and tensile capacity. It's worth the effort!

High tire pressure on the road.

Some of the negative consequences of low pressure in the tires rolling on the road are:

- increases resistance to progressive
- increased operating temperature
- increased tire wear

Therefore, during transportation it is recommended to increase the pressure in the tractors tire with 1.4 - 1.6 bar to those recommended by manufacturers.

Studies have confirmed that the goods transport with trucks is twice cheaper than tractors. Trucks have gearboxes, transmissions and wheels with tires specifically designed for road conditions. Instead at tractors on public roads the tires wear is high and quick, as for a 180 hp tractor, during an hour of transport the lost can reach a value of 2 EUR. Therefore, we conclude that transports on public roads with trucks are more economical compared to shipments made by tractor, calculated on medium and large distances.

PTO speed control.

Shafts, by their nature, are simple construction, robust, efficient and reliable in operation. It is recommended to use efficient rpm. Operating nominal value is reached at

1750 - 1800 rev/min. In most cases, such as fertilization with chemical fertilizers and herbicides, the engine can operate at low speeds, making it successfully to the demands imposed by farm equipment.

In the case of rotary harrows, if the tractor does not have multi-stage adjustments to the rpm of the PTO, is adjusted so working rotating harrow sections so that quality work does not suffer.

In many cases where adjustments are possible force requirements needed to be considered to avoid unnecessary fuel consumption.

Emergency operations on the field.

Speed: exploiting of the machine increases proportional with the speed. If possible it is recommended to increase the width or interfere with working capacity of machines that are attached to the tractor (to plug working width increases, the combination of towed equipment if possible, in line with the thrust available). Studies have established interdependence between the wear of plow coulter blade sharp and speed.

Working depth: with each cm in depth, on the surface of a medium sized parcel represents moving about 150 tons of earth. Proportional to the increased working width fuel consumption rises. If the agronomic conditions permit, you might like to work at shallower depths of penetration in soil - disks does not exceed 5-7 cm. In some cases you can skip a step or more works, but must take into account the fact that the ground worked improperly requires expensive chemical treatment subsequent soil works and in many cases can lead to significant partial loss of crops.

Correct adjustment of agricultural machinery: operators of four-wheel drive tractors can hardly detect improper adjustment of the plow, especially when the tractor is pulling full power. This inevitably may unnecessarily increase fuel consumption by 10-20% and lead to enhanced and premature wear of the coulter. To avoid these inconveniences decoupling the front wheel drive is recommended. With a correct adjustment of the plow, the tractor is not slipping into the furrow and does not have a significant deviation from the forward direction.

Fuel consumption is significantly influenced by the proper selection of work inclination of the plow. The angle of inclination is determined by the quality of the soil. Plow adjustment is recommended on the beginning of every parcel.

In case of using a subsoiler, if the upper link is too tight, the machine works at depths of proportion. This can lead to increasing length of the anchor. Fuel consumption may even increase by 20%. Correct adjustment requires switching equipment parallel to the ground.

Wear items: use blunt knives on cereal and mowing combine header can increase consumption by 20%. This is valid also in case of small producers, who rarely pointed or sharpen plow coulters, believing that in this way they save money. The conclusion is the following: either sharpen the active elements of farm machinery or change them with new ones, avoiding this way unnecessary fuel expenses.

Avoiding overlapping of worked areas: in some cases, we can save on average up to 10% of fuel consumption on a tractor. This idea holds true also for works like seeding, herbicide and fertilized where we can save significant amounts of money by avoiding scattering materials (seed and chemical fertilizer). To avoid overlap the field works we need precise guidance on the lands, which can be achieved with simple devices for operation based on LED indicator. The cost of these devices start at 1300 euro to sophisticated tools that work with guidance from the satellites that have prices starting at 10,000 euros.

Tractor – equipment unit balancing: can be achieved by using appropriate counterweights. When towing trailers with tandem axles is recommended to eliminate extra weights on the tractor, which in these cases only lead to achieving additional

consumption. Good adherence is ensured by the down force of the trailers. In these cases, the fuel economy is about 1%. With these measures we also contribute to growth of the tractors lifetime.

Cooling radiator should be kept clean at all times. It is known that modern engines do not use permanently the cooling fan and the water pump of the tractor at full capacity, because their electronic systems are equipped with sensors, which do not exist on older tractors.

Modern ventilators have incorporated into their construction a temperature sensor that regulates the flow of oil, thereby adjusting the speed. Maintaining clean radiators ensures good heat exchange with the outside air, which inevitably lead to reduced use of fan operation, so the lower fuel consumption. This reduction may even reach 10%. Do not use pure antifreeze as a coolant. Water has a better coefficient of taking temperature, so it is better to use antifreeze coolant preparation of 25⁰-32⁰ concentration.

Continuously monitor fuel consumption.

If the tractor has a board computer, it can keep track of fuel consumption. In fact, electronics takes data collected by sensors, process and determine the quantity and quality of mixture of diesel and air to the engine operation consumption at the given time.

Companies that are producing tractors are using two different types of fuel consumption determining systems. The first is the classic one which is based on the action of two turbochargers, one inserted in the injection branch and the other branch of the return of the fuel system. This system is used in the case of tractors with engines equipped with mechanical injection pumps.

The second system is based on the "gateway" electronic system through which the computer of the engine control unit receives signals, so that they can monitor the consumption at every moment of operation. Electronic control system CAN, can be connected to the diagnostic data bus of the tractor. With a computer and a data acquisition program we can diagnose faults of the tractor, or you can make adjustments, corrections in the operating mode of the engine.

This way it can be not only reveal the consumption per km traveled but also consumption per hectares worked with the tractor.

The information is read by the sensor within a period of 30 seconds, and in some cases even smaller time intervals. They reach the tractor computer where they are processed and operational measures are taken to optimize the operating conditions of the engine. With only a look on the computers monitor, the operator may intervene at any time to optimize the gear stage or by raising partially the height of the working equipment's and positioning them correctly, PTO speed reduction, and so on. Good visibility is why the computer monitor is mounted on the tractors right front side in a place with higher visibility, on the dashboard.

CONCLUSIONS

We can notice without make any mistake, that a well trained tractor driver is the key of the solution, trained can lead to a large amount of fuel savings. Lower fuel consumption means less air pollution, so cleaner air.

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