Examination of the variation of mta power when working with oil anamegators

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Abstract. **One of the main indicators of internal combustion engines, tractors and the machine-tractor unit as a whole it's the power. It can change in the process of operation and there comes a time when subsequent use is inadmissible or inexpedient. In such a state, it is appropriate to apply technology to improve this indicator and reduce the fuel or lubricant consumption.**

The power parameter of an agricultural power machine is essential to achieve high productivity with low operating costs with minimal environmental pollution. The monitoring of changing the power is generally carried out by equipment unbearable and unnecessary for the farmer. The possibility for determining the power of the tractor fitted with the working machine by means of a standard brake performance device is a suitable option for monitoring the technical condition of the machinery. In this way, timely detection of defects and prevention of serious consequences for the engine.

Worldwide, various technological options have been developed to improve the power of engines without the need for their disassembly. One of these technological options is the fitting of anamegators (additives) in very small quantities to the engine lubricant oil.

In this article is made the experiments to evaluating of the variation of the power performance of a diesel tractor engine treated with anamegators as part of a machine-tractor unit. The acceleration and speed of the machine-tractor unit is recorded through a specialized device ENERGOTEST SM4. On this basis of the experimental results obtained, the driving force and power of the tractor from the machine-tractor unit has been determined by theoretical relationships.

Keywords: anamegators, additives, power, engines, energotest

I. INTRODUCTION

The tractors are the main energy machines in agriculture. Together with various additional working machines, they make up the machine-tractor unit - MTA. The most energy-intensive operation is soil cultivation. Optimal selection of MTA parameters improves the economic efficiency of their use and reduces exhaust pollution. Increased consumption of plant products is forces more output to be produced. The stringent legislative measures worldwide is require optimization of the power characteristics and parameters of the engine of the MTA [1,2,3,4,5]. Apart from this, the poor technical condition of the engine will increase the farmer's expenditure on consumables.

The power of the machine-tractor unit can serve as an assessment of the efficiency of its operation. Models can be set up to estimate the aggregate tractive power requirement [6].

There are methods for the measurement of engine power from a single machine-tractor unit by means of a chassis dynamometer [7,8]. There are various dynamometer stands, which can be stationary and mobile [8,9]. However, the use of such stands is associated with a high cost for farmers in their purchase or transport of MTA to the place of measurement. In many cases, this cost is unacceptable and inappropriate.

For power measurement a methodology has been developed by measuring the GPS coordinates of the machine [10]. The method is successful, but in farmers without GPS it is not practical for using.

One of the ways to increase the performance of engines and reduce their maintenance costs is the application of oil additives [11,12].

Anamegator is a patent name class of substance (additive) added to the fuel in quantities less than 0.01% by mass and comprehensively improving the combustion process. The use of anamegators in the combustion process leads to a decrease in the increase in entropy due to the

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composition of the additive as a result of which the useful work is increased and the specific fuel consumption and toxicity of combustion products are reduced [12,13].

In this article, an attempt is made to evaluating the influence of anamegators to engine lubricant oils on the variation of MTA power indicators.

II. MATERIALS AND METHODS

The object of this experiments is an additive Gold Ozirol MP-8 oil. The amount of anamegator added is 7 ml/l oil [13]. The anamegator was added to the lubricant oil 5W40 to the New Holland T6/175 tractor (Figure 1) with a rated output of 129 kW [14,15].

The working machine mounted to the tractor is a deepener.

Fig. 1. General appearance of a machine-tractor unit

Fig. 2. General appearance of the measuring bench

The additive is filled into the tractor and it has started operation after 5 min work on idle speed. During a period of 10 motohours, the readings of a specialized device ENERGOTEST SM4 are reported (Figure 2) [16]. It is mounted on the windscreen of the tractor by vacuum, without the need for any other additional connection. One intermediate acceleration reading after 5 hours of operation was also made.

Fig. 3. General view of measurement area

Measurements are always carried out in the morning at the same time under the following weather conditions – air humidity between 50-60%, air temperature 18-220 C, wind speed 1-3 m/s, dry weather. The tractor has reached normal operating temperature and settles on a flat surface. In our case, this is a site at the base in the area of the village of Kostievo, Plovdiv region, Bulgaria (Fig. 3). One of the major rice producers in Bulgaria is located in the area and we used its technique.

The acceleration of the machine in free measurement mode is investigated. It is carried out in the second transport gear of the tractor. Accelerate to rated speed of the machine and read the acceleration value.

The driving force of the tractor is calculated on the basis of the measured acceleration of the machinery and the mass of the unit.

$$F = m_{MTA} . a_{MTA} \quad (1)$$

where m_{MTA} is the mass of unit;

a_{MTA} – acceleration of unit.

According to the developed methodology, power is defined as the dependence of the driving force of the tractor and the velocity of unit.

$$P = F . v \quad (2)$$

where v is velocity of unit.

III. RESULTS AND DISCUSSION

In defining the parameters, the following conventions have been adopted:

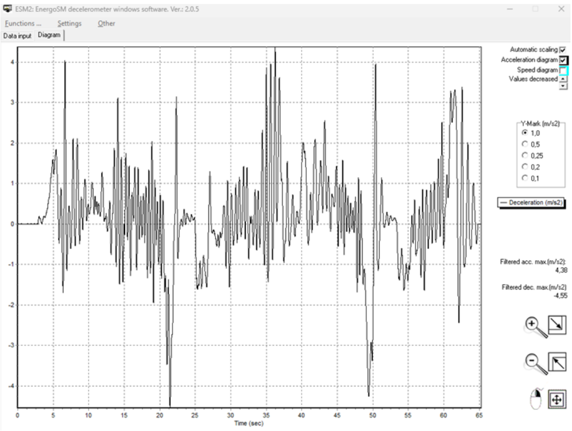

Fig. 4. Acceleration recording after 20 hours of MTA operation with anamegator

- Mass of the machine-tractor unit 7230 kg – measured;
- Gear ratio in second gear 2H (10) – 57,17 [17].

An authentic record of the measured acceleration after 20 hours of MTA operation when anamegator was added is shown in Fig. 4. The recording is illustrated by the ESM2 software of the ENERGOTEST SM4 device.

The results of the post-processing experiments carried out are summarized in Table 1 and graphically interpreted in Fig. 5, 6 and 7.

Observing the table and Fig. 5 it is noticed that the acceleration of the machine increases from 3,89 m/s2 in the initial stage of the experiment to 4,39 m/s2. This increase also shows an increase in the speed of the machine until the nominal speed of 4 km/h to 4,9 km/h is reached.

TABLE 1 VARIATION OF MEASUREMENT PARAMETERS

Work, hours	**Acceleration a_{MTA} m/s^2**	**Velocity v, km/h**	**Driving force F, kN**	**Power, kW**
0	3,89	4	28,12	112,5
5	3,92	4	28,34	113,36
10	3,95	4,4	28,56	128,52
20	4,38	4,7	31,67	148,85
30	4,39	4,9	31,74	155,23
40	4,38	4,8	31,67	152,02
50	4,39	4,9	31,74	155,53

The acceleration changes in the period 0-10 hours of operation of the MTA, because in this period the accumulation of the additive in the bearing and friction units of the engine occurs. As a result of the accumulation, friction in the nodes is reduced and the lubricating environment is improved.

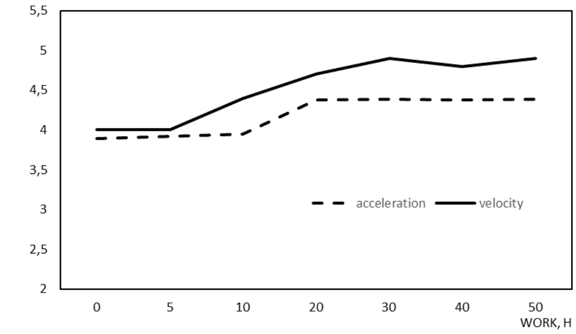

Fig. 5. Variation of MTA acceleration and speed when using oil anamegators

Reduced friction probably leads to an increase in the mechanical efficiency of the engine and hence affects the parameters of the entire unit. During the period 10-20 hours of MTA operation, there is a stabilization of the processes in the engine and an almost constant change in the acceleration of the unit.

The same can be applied to the MTA speed. The difference, however, is that here the increase in speed until the nominal engine power is reached increases smoothly to about 4,7 km/h or again 20 hours of operation of the unit. This modification starts from the fifth hour of operation of the MTA with the entry of the anamegator into the engine lubrication system and the reduction of friction in the units. As a result, the speed of the aggregate increases. This change in speed is more violent than in the change in acceleration due to the specifics of these parameters.

Looking at Fig. 6 the variation of the driving force of the tractor changes marginally in the period 0-10 hours of MTA operation. After the entry of the anamegator into the friction elements of the engine and improvement of the lubricating medium, stabilization of the driving force of the unit after 20 hours of operation is observed. The period of dynamic increase in driving force is 10-20 hours of MTA operation. The variation of this force is within 3,62 kN. The variation in driving force throughout the test period was within 11,4 %.

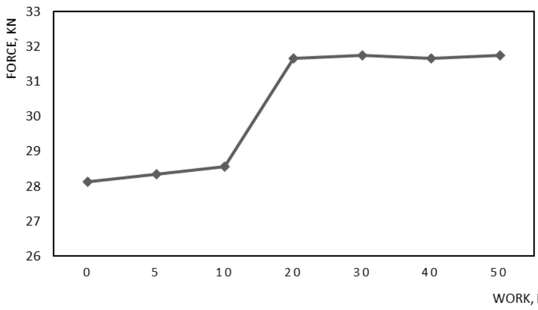

Fig. 6. Variation of MTA driving force when using oil anamegators

The variation in MTA power when operating with anamegators varies within 27,7% for a running engine with a range of approximately 9000 hours of operation. The increase in power based on a new catalogue data engine is within 20%.

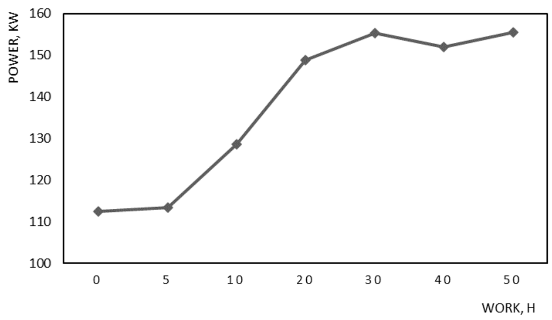

Fig. 7. Variation of MTA power when working with oil anamegators

Reduced friction probably leads to an increase in the mechanical efficiency of the engine and hence affects the parameters of the entire unit. During the period 10-20 hours of MTA operation, there is a stabilization of the processes in the engine and an almost constant change in the acceleration of the unit.

The power variation starts after a period of five hours MTA operation and ends after 20 hours of MTA operation. The actual power variation is from 113,36 kW to 155,53 kW.

IV. Conclusions

The variation of MTA power when working with oil anamegators is determined. The increase in power is within 20% of a new MTA. This increase takes place in the period of 10-20 hours of MTA work with the anamegator and is maintained during subsequent operation of the MTA. The increase in acceleration is within 11.4%, which at equal mass of MTA leads to an increase in driving force. The increase in the speed of MTA is 22.5% until the nominal engine speed is reached or from 4 km/h to 4.9 km/h.

The anamegators added to the oils can be used to preserve or increase the tractive properties of the MTA without the need for additional adjustment. They can significantly reduce the cost of farmers to obtain production.

The ease of use of ENERGOTEST SM4 makes it suitable for determining the current state of the machine and can be used in the assembly of MTA.

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