СОВЕРШЕНСТВОВАНИЕ МЕТОДОВ ОПТИМИЗАЦИИ ТОПЛИВНОЙ МОЩНОСТИ ТРАКТОРОВ

Турсунов Шавкат Серабович
Доцент, кафедры «общетехнических дисциплин»
Каршинского инженерно-экономического института. Узбекистан

Аннотация

Показано эмпирическое и теоретическое распределение количества заявок на заправку тракторов нефтепродуктами в сутки. При организации заправки тракторов нефтепродуктами в условиях сельского хозяйства основным определяющим фактором является поток сервисных заявок, поступающих от тракторов и комбайнов. Особое внимание было уделено изучению и определению этого потока.

Ключевые слова: тракторы, комбайны, расход, АЗС, оптимизация.

IMPROVING THE METHODS OF OPTIMIZING THE FUEL POWER OF TRACTORS

Tursunov Shavkat Serabovich
Associate Professor, Department of "general technical disciplines"
of Karshi Engineering and Economic Institute, Uzbekistan

Annotation

The empirical and theoretical distribution of the number of applications for refueling tractors with petroleum products per day is shown. In organizing the refueling of tractors with petroleum products in agricultural conditions, the main determining factor is the flow of service requirements coming from tractors and combines. Special attention was paid to the study and definition of this flow.

Keywords: tractors, combines, consumption, gas station, optimization.

Introduction. Refueling tractors with petroleum products is an integral element of the maintenance system for the machine and tractor fleet of collective and state farms. In agriculture, the annual cost of refueling each tractor is 100...220 dollars, the cost of maintaining one mechanized refueling unit (MAZ) is 1...1.5 thousand.dollars. The efficiency of their operation significantly depends on the quality of functioning of the channel for refueling tractors with petroleum products.

In organizing the refueling of tractors with petroleum products in agricultural conditions, the main determining factor is the flow of service requirements coming from tractors and combines. Special attention was paid to the study and definition of this flow.

As a result of timing observations, a statistical set of discrete random variable X was obtained, which represents the flow of requests for servicing tractors requiring refueling throughout the entire period under study.

The empirical and theoretical distribution of the number of applications for refueling tractors with petroleum products per day is shown in Fig. 1. The hypothesis that the distribution of the number of gas stations per day obeys Poisson's law was tested using Pearson's goodness-of-fit test 2. It is accepted that the empirical curve agrees with the theoretical one if the probability of agreement is more than 0.01. If this probability turns out to be less than 0.01, then the discrepancy is considered significant and it is necessary to select a different distribution law.

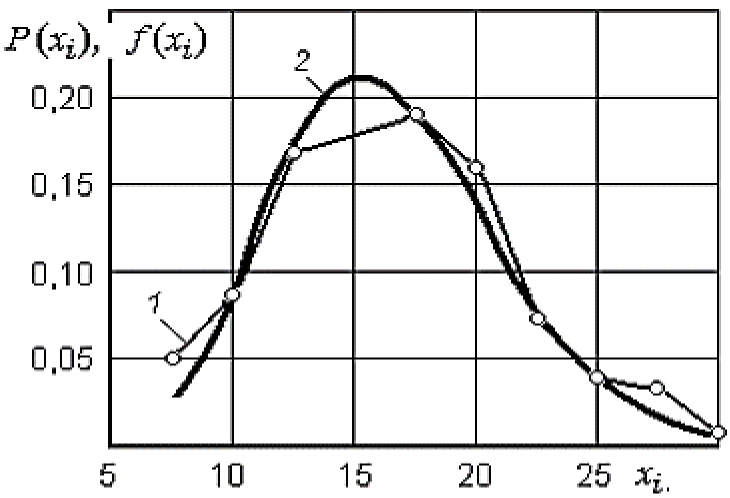

Fig. 1. Histogram 1 and density 2 of the distribution of the daily flow of applications for refueling tractors with petroleum products during the field work season

In agricultural production, tractors and combines arriving for refueling, firstly, as a rule, have very different needs for petroleum products (both in terms of volume and types of petroleum products) and, secondly, service facilities have different throughput capacities. Maintenance time includes the time required to prepare the refueling unit and the tractor for refueling, the net time of filling the petroleum product into the container of the tractor or combine, and the time required for operations performed after refueling.

The service time values form a statistical aggregate, the minimum value of which is min = 2 minutes, and the maximum value is max = 11 minutes.

The mathematical expectation of the duration of servicing one request by a mechanized filling unit is 4.3 minutes.

The tractor servicing time at a stationary refueling station is also described by an exponential distribution law (Fig.2) with density.

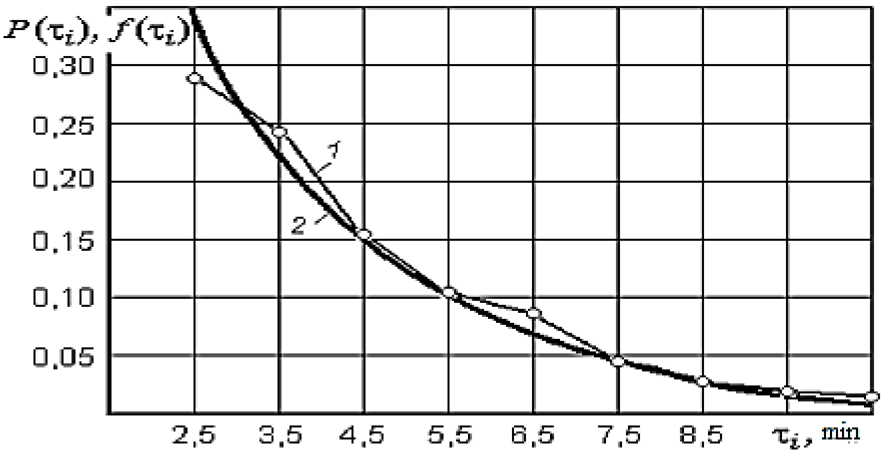

Fig. 2. Distribution of time for refueling tractors with a mechanized refueling unit.

Figure 3 shows the empirical and theoretical distribution curves of the speed of movement of the MPA. The approximation of the curves was checked using the Pearson test. The obtained values 0.3423 < P (2) < 0.4335 indicate fairly good agreement between the empirical and theoretical distribution curves of the MPA movement speed.

Analysis of the density distribution of the filling size of tractors of the 30 kN class allowed us to conclude that it is described by a normal distribution law with a density function of the form.

$$f(q_i) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(q_i - q)^2}{2\sigma^2}},$$

here, q_i - value of the size of one filling;

q- mathematical expectation of the size of one filling equal to 96 l;

$\sigma -$¿standard deviation equal to 32.

Conclusion. Analysis of the simulation results allows us to draw the following conclusions and proposals:

1. The lowest total machine downtime when refueling with petroleum products is achieved with option I (using only a mechanized refueling unit for refueling).

2. The total downtime of machines increases significantly when refueling machines according to option II (SPZ + MZA) due to the long wait by some of the P1 tractors for refueling at the SPZ - at the beginning of the working day and the small value of kme.

3. When refueling tractors according to option III (at the SPZ), there is a minimum of machine downtime at P2 = 0.4.

4. Due to the fact that the MZA reduces its performance in the cold season, for the simulated farm it is recommended to organize refueling according to option II (SPZ + MZA). At the same time, the number of serviced tractors should be increased to 32...35, which will ensure rational loading of the MPA.

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