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Indicators of Average Resource of Pneumatic Tires

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ABSTRACT: The article discusses the basic data on the resource of pneumatic tires during operation in the conditions of technological processes in cotton growing. The service life and the shelf life of tires, tire durability is estimated by the resource (operating time) and service life (operating time), if the resource gives a direct idea of the operating time in various conditions, then the service life is convenient when planning the terms for putting tires into repair, replacing them with new ones.

KEYWORDS: tire, operation, service life, workable failure rate, probability of failure-free operation, cotton modification, row-crop tractors, resource, durability, machine persistence, tractor, aggregate, wheel, pneumatic, load.

I. INTRODUCTION

At present, there are methodological mathematical and experimental developments of tractors that can significantly reduce the cost of laboratory and production experiments based on the use of expensive prototypes of tested tractors and significant investments in completing the technical support of experiments [1,3].

II. LITERATURE SURVEY

Estimating the level during the implementation of exploratory research of one of the existing methods for analyzing the influence of the resource of pneumatic wheeled tires on the resource of cotton modifications of row-crop tractors. The purpose of the study is the formation of a method for the comprehensive study of the influence of the average resource of wheels in universally tilled tractors on tire durability. Material and research methods. Theoretical and experimental studies of the process of performance indicators with a pneumatic tire are described in the works of both domestic and foreign scientists [4,5]. The tractor tire resource theory is described in the works of academician Sh.U. Yuldashev, prof. M. Toshboltaeva, prof. T.S. Khudaiberdieva, B. Schlippe, W. Bergman, R. Dietrich et al. [5,6,7,8,9]. However, scientific research did not focus attention in terms of influence and was described by M. Rustamov.

III. MATERIAL AND METHODS

As a result of his research, an empirical relationship was obtained that determines the resource of tires of pneumatic wheels of tractors interacting when processing cotton [11,12,13,14].

According to the attached formulas (1), we determine the average resource of each brand of tractor tires [15,16,17,18]. When calculating the service life and shelf life of tires. The norm of the generators is the operating time of the tire and its calendar period of being on the machine or storage until decommissioning.

IV. SIMULATION & RESULTS

The reasons for removing the tire are indicated and suitable for use are excluded from the sample for calculating the service life and retention of tires. Then the probability of occurrence of a failure to the operating time x_0, when the N^1 bus failed and kept working $N^{11}=N-N^1=14+86=100$ will make tires.

$$Q(x_o)=N^1/N=14/100=0,14 \quad (1)$$

Hereinafter, approximate estimates will be denoted by the same letters, but with dashes on top. Uptime probability

$$P(x_o)=N^{11}/N=86/100=0,86 \quad (2)$$

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Mean time to failure will be

$x_{cp}=\sum x_i /N^1$ (3)

where: $\sum x_i$ – total operating hours of the tested tires to failure; n is the number of tires tested. if r tires failed out of n observed tires during time t, then the mean time between failures will be equal to

$x_{cp}=\sum x_i + T(N- r)/r = 446500/14 = 31*10^3$ (4)

failure r at e corresponding to a sufficiently small time interval δt (small mtbfδx)

$\lambda(x) = \Delta r / \Delta xN = \Delta N / \Delta xN$ (5)

where: Δr is the number of failures for the time between Δx; ΔN is the number of tire failures per operating time Δx; N-number of working tires to the beginning of the considered operating time. From expressions (1) and (5) we write

$f(x)=dP(x) / dx$

Substituting this relation into expression (6) and separating the variables, we obtain

$\lambda(x)dx= dP(x) / P(x) = d [Ln P(x)]$ (6)

Integrating this equation and taking into account that P (0) = 1, we find the probability of failure-free operation

$P(x) = exp[- \int \lambda(\xi) d(\xi)]$.

We define the failure-free operation indicators of a batch of tires in an amount of $N =100$ pcs., Which should have an operating time of $x_{80} = 5000$ hours (they must maintain working capacity of at least *80 %* (according to academician Sh. U. Yuldashev [4,5]. It is known that within *5000* hours their work failed: one tire after *3000* hours, two tires after *4000* hours and one tire after *4500* hours.

V. EXPERIMENTAL RESULTS

In accordance with the accepted designations $x_{80}= 5000$ ч, $N^1= 14$и$N^{11}=86$ total operating time $\sum x_i=3000 + 2\cdot4000+4500+86\cdot5000 = 44{,}55\cdot10^4$h

Using approximate formulas (3), (4) and (6) we find $Q(x_1) = 0{,}04$; $P(x_1)= 0{,}86$; and $x_{cp}= 31\cdot10^3$h. Thus, the probability of tire failure was 86%, i.e. above the specified equal to 80% (Fig. 1).

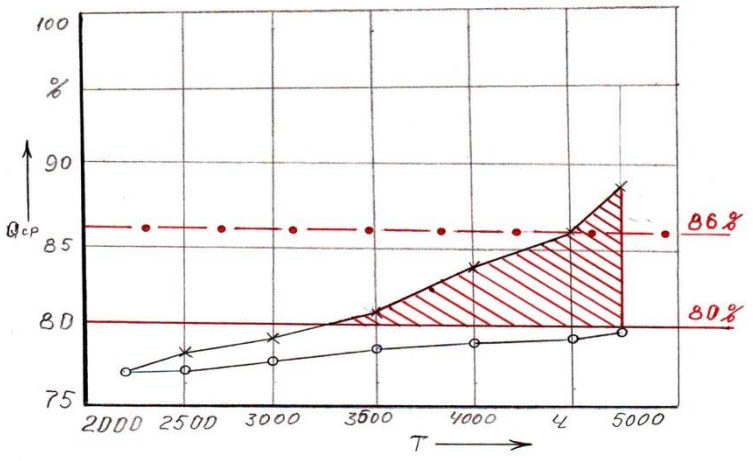

Fig. 1. Changes in the intensity of the average resource depending on the operating time: 1-existing option; 2 proposed option. Using formulas (6), one can also determine the magnitude of the failure rate for all batches of tires on average for the operating time x_{80}. Assuming $\Delta x = x_{80}$,$\Delta N = N^1$, we get$\lambda (x_{80}) = 0{,}8\cdot10^{-5}$.

For an approximate determination of reliability, you need to know their operating time to failure or until the end of the test: $x_1, x_2 ..., x_n$

Our analysis shows that the bus options offered (I, II, III, IV options) are average values of 86,2 % of the total operating time (Fig. 1)

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VI.CONCLUSION

1. An analytical calculation of the service life and the shelf life of the tires shows that the operating time of the tire and its calendar period of being on the machine or storage prior to decommissioning are normative, the reasons for removing the tire suitable for use are indicated, are excluded from the sample to calculate the service life and retention of tires;

2. Average resources 15,5-38 I-166 and 18,4 / 15-30 R-319 tractor tires, the probability of tire failure was 86%, ie above the specified equal to 80%.

3. The performance calculation shows that the tires (front 12-16 and rear 18,4 / 15-30 R-319 tires) are 82,4%.

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