ANALYTICITY OF SPATIAL REQUIREMENTS FOR MAINTENANCE OF AGRICULTURAL MACHINERY

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Abstract. *The spatial location system of service maintenance of the dealer, the main parameters of its functioning, defining the technical readiness of agricultural machinery, are the direct subject of the study.*

The development of agricultural commodity production, and associated industries, requires certain adjustments in the improvement of organization and technology service activities companies, dealer education system without returning to the forms, developed earlier for production and maintenance of large agricultural companies.

The landowner did not have time and opportunities for surveying intermediaries and bringing services to the solution of production problems due to the lack of the ability to maneuver production assets, ongoing attachment to processes of production, interruption of which is fraught with huge losses and damages.

Agricultural producers are in need of committed partners that are economically motivated and reacting promptly to problems as ensuring

of high efficiency of the machines, the effective implementation of all agricultural production processes are directly dependent on the location and duration of services determine the profitability of the farms.

Research in the field of sales of services technical service through a network of service centers prove a significant increase in production with increasing demand and application.

In the paper, we assume extensive use of methods of probability theory and mathematical statistics, physical and mathematical modeling of the system settings service and technical-operational indicators of machines.

Key words: ***analytic, spatial requirement, maintenance, agricultural machine***

Formulation of problem. In accordance with the modern concept of development of technical service in agroindustrial complex, involving the formation of system of enterprises-providers of services in maintenance and performance of machines throughout their service life provided by the dealers. On the basis of a national system of dealers, it is planned to

reconstruct and improve the effectiveness of the system of support to agriculture machinery and equipment, spare parts and other logistical resources, as well as the efficiency of maintenance of machines and equipment in warranty and post-warranty periods of operation.

Domestic and foreign experience of such companies proves that the dealer engaged in the service of agricultural equipment needs to be closer to producers. This achieves rapid elimination of failures during the warranty and post-warranty periods of operation, the regulatory allowable downtime of machines. The efficiency of dealerships in this is to ensure the smooth implementation of agricultural technologies by rural producers through quality maintenance equipment in the off-season through the complex service delivery institutions – system for maintenance.

The problem of placement and functioning of regional system of service maintenance dealer of the enterprise due to several reasons:

a) theoretical:

- imperfection of the theory of designing, formation and optimization of systems whose purpose is the sale of finished products and services of technical service, taking into account features of development of agriculture,

- lack of range of problems within a field of view of spatial Economics, taking into account the competition between dealer companies on the market,

b) methodological:

- need to adapt our previously developed calculation methods of the specialized service enterprises,

- the need to develop new calculation methods and work organization system of dealerships maintenance,

c) economic:

- significant number of factors and the unpredictable nature of their interaction, have a significant effect on the results of commercial activities of enterprises,

- high degree of confidentiality of information relating to the commercial activities of the enterprises, which does not allow to develop and implement strategies for their development.

With increasing equipment of agriculture with modern technology through a network of dealer points of particular importance was the high use of the machines, defined rational scheme of construction of distribution system maintenance in the regions. Therefore, the research aimed to develop scientifically based recommendations on the substantiation of the system of placing and functioning of the service regional dealer companies is an important and urgent task of agricultural production.

Problems that require further methodological and theoretical research, has identified the main aim and objectives of the present research.

Analysis of recent research results. In the simplest case, we can assume that the requirements for maintenance of machines [1] occur at points uniformly distributed on the plane [2] bounded by a circle of radius $\boldsymbol{R}$. It is obvious that such a hypothesis can be accepted if the location of the machinery park (objects) is not known in advance [3], and known only to the estimated size of service area [4]. In this case, to determine the position of points [5], in which there are requirements, it is convenient to take the polar coordinate system $(\boldsymbol{\alpha}; \boldsymbol{x})$ (Fig. 1).

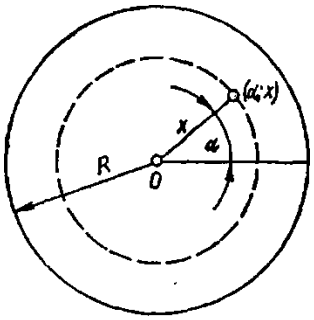

Fig. 1. Polar coordinates requirements.

Purpose of research is an analytical research of the spatial requirements for maintenance of agricultural machines, which occur at points uniformly distributed on the territory.

Results of research. Assuming a uniform distribution of the accepted elements in the plane bounded by a circle of radius $\boldsymbol{R}$, the value of $\boldsymbol{\alpha}$ will be distributed according to the law of probability density distribution in the range $\boldsymbol{0 \leq \alpha \leq 2\pi}$, is equal to: $\varphi(\alpha) = \frac{1}{2\pi}$.

The distribution function of the variable $\boldsymbol{x}$ within $\boldsymbol{0} \leq x \leq R$ can be determined as follows: $F_x = \frac{\pi x^2}{\pi R^2} = \frac{x^2}{R^2}$, where the probability density: $f(x) = \frac{2x}{R^2}$. This is determined by the probability density of the random coordinates of requirements for their uniform distribution in the plane. However, almost often, it can meet uneven distribution on the ground of the accepted elements, and, consequently, the flow requirements that is uneven in space.

This flow is in some cases described as a discrete scheme in which the requirement can arise at an arbitrary point in a known region, but only in one of a finite number of fixed points with predetermined coordinates. Such a description, for example, with the known approaches can be used

in relation to Park construction vehicles, dispersed on construction sites, the size of which compared to the distances separating them are small. Let $\boldsymbol{z = 50}$ of the same cars are scattered in five fixed points on the ground (Fig. 2).

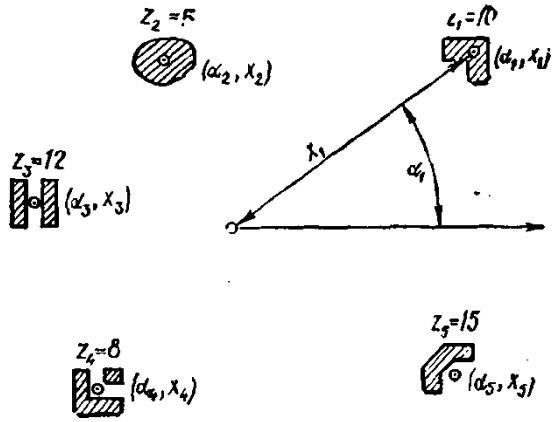

Fig. 2. Placement of machines on the ground at fixed points.

At some point in time there is a requirement to service one of the cars park. We assume that the probability $P(\boldsymbol{\alpha}; \boldsymbol{x})$ that this requirement originated in the point with coordinates $(\boldsymbol{\alpha}; \boldsymbol{x})$, is proportional to the number of cars centered on the corresponding object.

Then for the sample random coordinates of the requirements can be defined according to:

Coordinates of point	Probability that claim arose at point
$(\alpha; x)$	$P(\alpha; x)$
$(\alpha_1; x_1)$	**0,20**
$(\alpha_2; x_2)$	**0,10**
$(\alpha_3; x_3)$	**0,24**
$(\alpha_4; x_4)$	**0,16**
$(\alpha_5; x_5)$	**0,30**

In general, the distribution of the accepted items on the ground can be set by the plan, which elements are depicted as separate points (Fig. 3). This plan is overlaid with a rectangular grid of coordinates is dense enough for a given degree of accuracy can be considered that all the elements in the me or square have the coordinates of the geometric centre of the square $(x'; y')$.

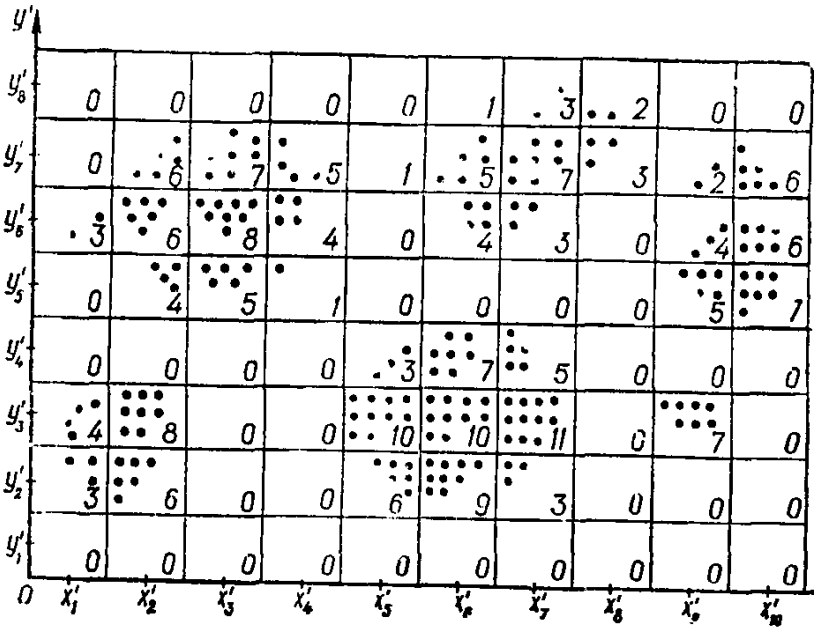

Fig. 3. Plan the placement of accepted elements in general.

The number of items in each square is recorded in the lower-right corner squares. We assume that the absolute probability $P(y')$ the ordinates of the center of each square will be equal to the ratio of the number of elements that are concentrated in all the squares of the plan, having the corresponding ordinate to the total number of elements. Conditional probability $P\{x'|y'\}$ will be equal to the ratio of the number of elements, centered in the square with coordinates $(x';y')$, to the number of elements that are concentrated in all the squares of the plan with the ordinate of the geometric center of y'.

Thus, the random ordinate the maintenance requirements of the elements arranged as shown in Fig. 3, can be set in accordance with the following data:

Ordinate of the point	Probability
y'	0,00
y'_1	0.14
y'_2	0,25
y'_3	0,07
y'_4	0,11
y'_5	0,19
y'_6	0,10
y'_7	0,03

When modeling the spatial coordinates of the requirements initially given probabilities is generated realization of a random ordinates of the point at which there is a requirement that y', and then with the probabilities given in Table. 1 for this implementation of the ordinate is formed by the

realization of the random abscissa x'. If to solve this problem is better to use rectangular and polar coordinates requirements, latter are determined by known formulas: $\alpha = \tan^{-1}\frac{y'}{x'}$; $x = \sqrt{x'^2 + y'^2}$.

1. Conditional probability of random abscissa of point at which there is another requirement

x'	$P\{x'\|y'\}$							
	y'_1	y'_2	y'_3	y'_4	y'_5	y'_6	y'_7	y'_8
x'_1	0,00	0,11	0,08	0,00	0,00	0,08	0,00	0,00
x'_2	0,00	0,22	0,16	0,00	0,18	0,16	0,14	0,00
x'_3	0,00	0,00	0,00	0,00	0,23	0,22	0,17	0,00
x'_4	0,00	0,00	0,00	0,00	0,04	0,10	0,12	0,00
x'_5	0,00	0,22	0,20	0,20	0.00	0,00	0,02	0,00
x'_6	0,00	0,34	0,20	0,47	0,00	0,10	0,12	0,17
x'_7	0,00	0,11	0,22	0,33	0,00	0,08	0,17	0,50
x'_8	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,33
x'_9	0,00	0,00	0,14	0,00	0,23	0,10	0,05	0,00
x'_{10}	0,00	0.00	0,00	0,00	0,32	0,16	0,14	0,00

If within the time during which planned maintenance, the deployment of the machines on the ground does not change, for each i-ro requirements in accordance with constant probability $\boldsymbol{P_0(y')}$ and $P_0\{x'|y'\}$ may be obtained the coordinates of the point $\boldsymbol{\alpha_i}$ and $\boldsymbol{x_i}$ where this requirement originated. If you change in a time of deployment of machines, for example upon completion of one object and move on with the construction of the other, must, from this time, continue building a realization of the random coordinates is accordingly changed to the probabilities $P_1(\boldsymbol{y'})$, $P_1\{x'|y'\}$, etc.

Conclusions. Found $\boldsymbol{\alpha_i}$ random variable and define $\boldsymbol{x_i}$ to given spatial stream, the moments of occurrence of claims in the reference system of machine time, the requirements and the coordinates of the points in which they arise. However, at the decision of tasks of technical operation it is necessary that the moments of occurrence of the requirements recorded in the frame of reference of the working time servicing vehicles.