OPTIMIZATION OF THE TECHNOLOGICAL SYSTEM (ENERGY MEANS + AGRICULTURAL TOOLS) IN PRODUCTION CROP PRODUCTION

Vasil Mitkov, PhD
(Dmytro Motornyi Tavria State Agrotechnological University)

It is clear that mobile energy means are one of the main sources of negative technogenic influence on the environment by harmful products of combustion of diesel fuel, leakage of operational lubricating and cooling liquids, mechanical sealing and soil destruction, acoustic influence, vibration, etc.

Purpose of the study. Increasing the informativeness of the methodology for evaluating the technological properties of a mobile power tool by taking into account the generalized index of its environmental properties.

Preconditions and means for resolving the problem. In the classical theory of the operation of a machine-tractor park, the index of "environmental compatibility of a complex of machines" is determined by indicators of ecological compatibility: energy content, soil compaction, humus extraction, pollution of the environment [2].

However, in the thesis [3], for example, a more advanced new methodology for defining the generalized "ecological safety factor" (G_{Fes}) is recommended from the influence of the work of the machine-tractor unit on the environment, which is represented in the form of a relative coefficient of deterioration of the sum of the ecological parameters of the work of the latter, attributed to their normative values [4]:

$$G_{Fes} = K_{Ui} \cdot U_{ki}/U_i + K_F \cdot F_{ki}/F_i + SK_{Ti} + K_N \cdot N_{ki}/N_i + K_{CO} \cdot g_{COki}/g_{COi} + \\ + K_{CH} \cdot g_{CHki}/g_{CHi} + K_{NOx} \cdot g_{NOxki}/g_{NOxi} + K_{L1} \cdot L_{1k}/L_1 + K_{L2} \cdot L_{2k}/L_2 + \\ + K_{L3} \cdot L_{3k}/L_3 + K_N \cdot N_{Kx.x}/N_{x.x} + K_{CO} \cdot g_{COKx.x}/g_{COx.x} + K_{CH} \cdot g_{CHKx.x}/g_{CHx.x} + K_{otx}, \quad (1)$$

It is worth to take into account the results of recent scientific studies in the assessment of the environmental properties of the mobile energy means. Dependence on the calculation of the technological level of the mobile power tool, taking into account its environmental properties, will have the form:

$$P_T = S_{Ut} \cdot U_T + S_{AT} \cdot A_T + S_{WT} \cdot W_T + S_{CT} \cdot C_T + S_{ET} \cdot E_T, \quad (2)$$

C_T, E_T – generalized indicators in accordance with technological universality, productivity, agrotechnical properties, cost of performing technological operations, environmental properties;

S_U, S_A, S_W, S_C, S_E - coefficients of weighting of corresponding generalized indicators of technological properties of a mobile power tool.

The structure of the index of environmental properties of E_T depends on the assignment of the estimated energy source and the purpose of the problem to be solved. In our opinion, with a comparative assessment of energy resources as a unit one can adopt the following indicators of their environmental properties: K_{qeg} - quality of exhaust gases; K_{pol} - pollution by operating liquids; K_{mds} - mechanical destruction of soil; K_n - Noise; K_v - vibration; K_{cs} - compaction of soil; K_{so} - is a lay-out scheme of an overburden. Then for the mobile power tool the index of ecological properties of E_T in the generalized form can be expressed in the sum of the products of the coefficients of weighting Si of individual generalized indicators on their relative values:

$$E_T = S_{Kqeg} \cdot K_{qeg} + S_{Kpol} \cdot K_{pol} + S_{Kmds} \cdot K_{mds} + S_{Kn} \cdot K_n + S_{Kv} \cdot K_v + S_{Kcs} \cdot K_{cs\,r} + S_{Kso} \cdot K_{so}, \quad (3)$$

where S_{Kqeg}, S_{Kpol}, S_{Kmds}, S_{Kn}, S_{Kv}, S_{Kso} - coefficients of importance of individual relative indicators of ecological properties.

Summarized unit values according to the equation (3) are not related to each other or to E_T with any analytic or empirical dependence. The task is to find such an addiction. The most appropriate method for solving this problem is the method of ranking individual indicators by interviewing experts [1, 4].

Results and discussion. In our case, 10 experts were selected for the ranking of ecological and technological properties - scientists and specialists in the field of mechanization of agriculture, agronomy, ecology and environment. As a result of their survey on the significance of individual indicators of the environmental and technological properties of the mobile power tool, the ranks of the indicators themselves were determined. Moreover, the highest rank corresponds to the indicators of the highest significance, the lowest, respectively, - the least significant.

The assessment of the consistency of the estimates obtained from experts was carried out using the coefficient of concordation W [1, 4].

The verification of the significance of the coefficient of concordation W was carried out using the $\chi 2$-Pearson criterion [1].

According to the results of the expert survey, the weighting coefficients of the individual indicators of ecological and technological properties for mobile energy products were determined according to the equation [4]:

$$S_i = \frac{1 - \frac{t_k - 1}{n}}{\sum_1^n (1 - \frac{t_k - 1}{n})} \quad (4)$$

where $t_к$ - the final rank of a single indicator of ecological and technological properties;

n - total number of individual indicators.

The poll result shows that the generalized indicator of the environmental properties of a mobile energy facility is most strongly influenced by the K_{cs} soil compaction index, then the mechanical destruction of the soil K_{mds}, the composition of the exhaust gases K_{qeg}, the pollution of the operating liquids, the K_{pol} noise K_n, the vibration of the K_v and the smallest effect - the layout scheme of the energy K_{so}. Analysis of these indicators allows us to determine which structural-technological or regime parameters of the energy resource and to what extent affect the generalized index of its environmental properties. And the more deeply this analysis will be, the most accurate and successful will be proposed constructive-technological or regime measures to improve them.

The indicator of the environmental properties of a mobile power tool by the formula (3) as a result of a survey of experts will take the form:

$$E_т = 0{,}25\ K_{cs} + 0{,}22\ K_{mds} + 0{,}18\ K_{qeg} + 0{,}14\ K_{pol} + 0{,}11\ K_n + 0{,}07\ K_v + 0{,}03\ K_{so}.$$

According to experts, the greatest importance is the index of technological universality of U_T, then the agrotechnical properties of A_T, the productivity of W_T, the environmental integrity of the E_T and the smallest impact is the cost index of the technological process C_T. And the equation for

calculating the technological level of the mobile power tool by the formula (1) as a result of the expert survey will take the form:

$$P_т = 0,33U_T + 0,27A_T + 0,2W_T + 0,13E_T + 0,07\ C_T.$$

The obtained result shows that today it is more relevant to assess the technogenic impact of a mobile energy facility on the environment than the cost of its implementation unit of work. And with this conclusion, one can not disagree, since the neglect of the impact on the environment in the near future can nullify the economic profit from the production of agricultural products.

Conclusions.

1. Taking into account the index of the environmental properties of a mobile power tool allows us to make the most objective decision as to the feasibility of introducing it into production, the efficiency of its use and the technological level of any technological process.

2. The evaluation of the importance of individual indicators for a generalized indicator of the ecological properties of a mobile power tool, according to the results of a survey of experts, showed that the most impact is the index of soil consolidation, then mechanical destruction of soil, composition of exhaust gases, pollution of operating fluids, noise, vibration and least impact is a layout diagram of the power tool.

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