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ECONOMICAL CRITERION FOR SELECTING CONTROL STRATEGY OF BIOTECHNICAL OBJECTS

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The strategy of choice electro technical complex control systems terms of keeping chickens hens in industrial poultry houses based on the use a criterion factor in the efficiency of fixed assets proposed. It is shown that for a number of industrial poultry houses for keeping chickens hens no more than 5, is more effective system, which uses the method of undetermined Lagrange multipliers. If the number of poultry houses 6 or more, it is advisable to use a control system based on game theory and statistical decision.

Setting of problem. Since the control system living conditions of laying hens in industrial poultry houses using undetermined Lagrange multipliers [1, 2] and game theory and statistical decision making [3, 4, 5] were better compared to traditional stability, important is the development of criteria for choosing the best of these management strategies.

Research. To assess the impact of control algorithms for energy performance and effectiveness of the biotech facility should compare performance to the same technical object. For technical object take aviary for keeping 30,000 chickens hens size 72×18×3,1 m, equipped with 22 fume extraction plants with air exchange (5300-228000) m^3 / h, two heat generators with combined capacity of fans to warm up to 754,200 kJ / h in air – 14000 m^3 / h each. Subsystem heat distribution and provides warm air temperature in the poultry house during the cold period via a distributed system of air speed (Figure 1).

Streams of warm air heaters are formed located inside the ventilation chamber and through two high-pressure direct heated air fans in the output collector continue in uniform distribution of air speed.

Air placed directly under the adjustable dampers and vents mines, providing a mechanism for the air curtain inflow of cold air and the formation of a mixture of cold and blowing heated air.

Performance indicators retention of biological objects are:

the cost of energy in manufacturing processes;

profit from the sale of the control algorithm.

Compared the quality of the system based on game theory and statistical decision and undetermined Lagrange multipliers. For input used observations (Fig. 2). As the simulation models used the software, which implement the theory of indefinite Lagrange multipliers and game theory and statistical decision.

The analysis of the statistical data of the experiment allowed to build graphical differences depending on quality indicators above operation control systems and to

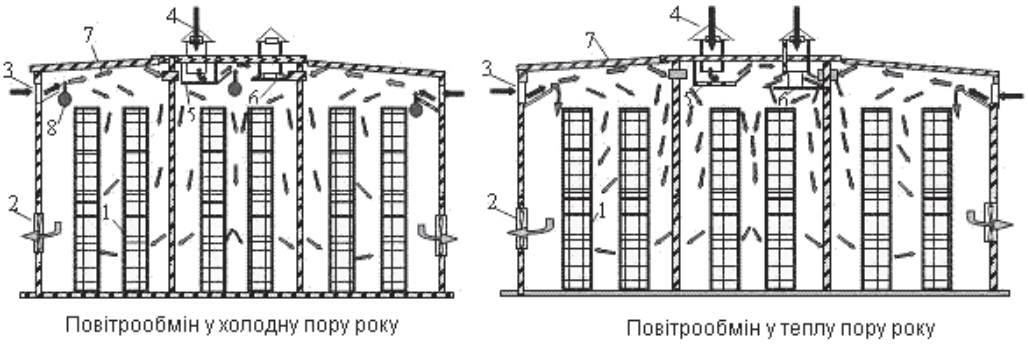

Fig.1. Image forced air movement in different seasons

make such findings (Figure 3):

1) winter (1 month (January), 2 (February), 12 (December) the effectiveness of systems based on game theory and statistical decision much better than a system based on undetermined Lagrange multipliers (10–80%);

2) in the summer systems operate almost at the same level of profitability and energy input;

3) in the spring and autumn system based on game theory and statistical decision is 5–15% more energy efficient.

For economic justification for choosing the best management strategy for different numbers of industrial poultry houses use the results of the implementation of production on poultry egg direction of optimal enterprise resource planning (theory undetermined Lagrange multipliers) and computer-integrated system for effective management of energy resources (game theory and statistical decision).

The results are shown in Table 1 operation, whereby both design showed the best effect compared to traditional systems of stabilization.

After summarizing the introduction of economic indicators, economic indicators (net profit) for poultry house of 11 thou-

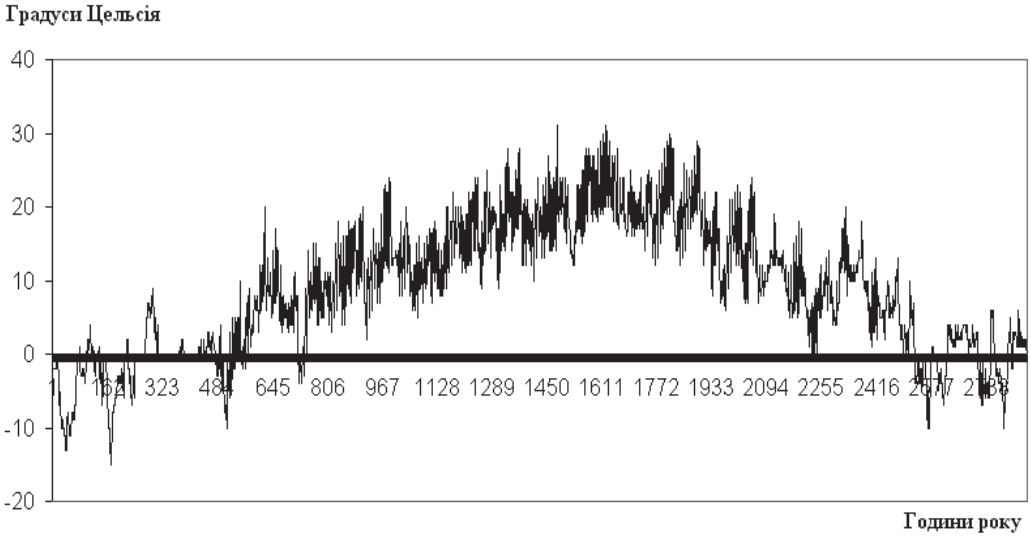

Fig. 2. The value of temperature during the year

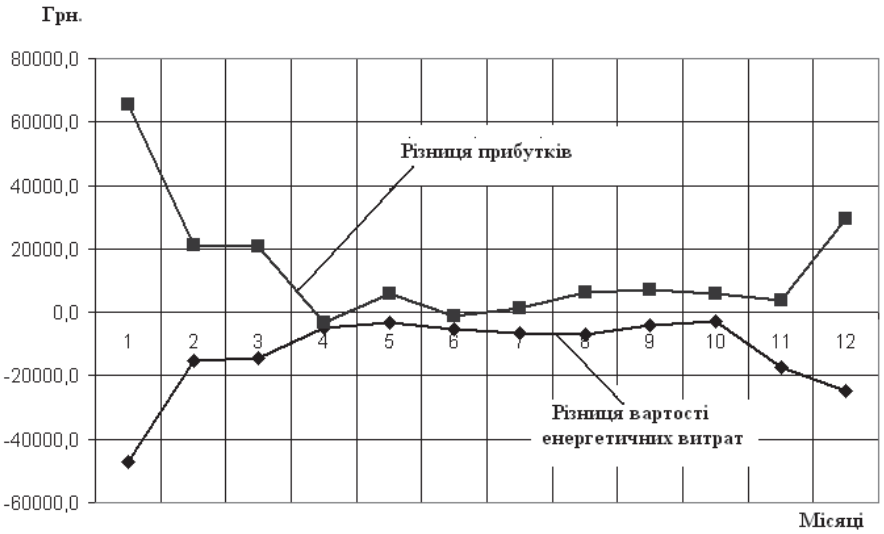

Fig. 3. The difference of quantitative indicators of quality of functioning systems based on game theory and statistical decision theory and theory of uncertain.

sand and financial costs of fixed assets calculated. (Table. 2, Fig. 4).

For further analysis of we start from the assumption that business activity is inextricably linked with the presence and use of fixed assets.

For effective use of assessment criteria fixed assets take rate of return, which in our study and characterize the efficient use of electrical equipment:

$$ROFA = \frac{ЧП}{ВОФ} \cdot 100\%,$$

where:

ЧП – net profit; hrn;

ВОФ – cost of main capital, hrn.

Thus, the system based on the use of indefinite Lagrange multipliers for small businesses is more cost-effective compared with the system, where the adoption of decision applies game theory and statistical decision (see. Fig. 5).

It is advisable to use a system that provides adaptive algorithm based on game theory and statistical decision for companies that hold more than 6 poultry houses with a capacity of 11 thousand poultry.

In view of the foregoing, it is advisable to develop the strategy of choice electrotechnical complex control systems keeping chickens hens in industrial poultry houses, block diagram shown in Figure 6.

Generalized algorithm this strategy will include:

1) monitoring and analysis of energy production and technological characteristics;

Table 1. Indicators of industrial implementation of energy-efficient biotechnological control objects on poultry farms

Indicator	Theory of undetermined Lagrange multipliers	Game theory and statistical decision
The economic effect	5245,75 hrn/4 months	105338,00 hrn/month
Quantity of birds	11 550	11 000
Cost of the control system (with software)	47 000 hrn	245 000 hrn

Table 2. Generalized energy-efficient performance management systems for poultry

Number of poultry houses	Profit (Game Theory)	Profit (Lagrange)	Fixed assets (Game Theory)	Fixed assets (Lagrange)
1	8778,17	1672,56	245000,00	44956,52
2	17556,34	3345,12	293000,00	54521,74
3	26334,51	5017,68	341000,00	64086,96
4	35112,68	6690,24	389000,00	73652,18
5	43890,85	8362,80	437000,00	83217,40
6	52669,02	10035,36	485000,00	92782,62
7	61447,19	11707,92	533000,00	102347,84
8	70225,36	13380,48	581000,00	111913,06
9	79003,53	15053,04	629000,00	121478,28
10	87781,70	16725,60	677000,00	131043,50
11	96559,87	18398,16	725000,00	140608,72
12	105338,04	20070,72	773000,00	150173,94

2) calculation:

– Cost of developing control systems;

– Energy and economic indicators of effective choice, followed by profit ratio of fixed assets.

Conclusions

1. To assess the efficiency of the developed control systems Electrical complexes of agricultural products should be used profitability ratio of fixed assets.

2. Using the profit ratio of assets allows to state that the control system on the basis of the theory:

a) undetermined Lagrange multipliers is more efficient compared with the system based on the use of game theory and statistical decision-making under conditions that if this system is used to control the number of poultry chicken houses up to 5, where 30 thousand poultry house. Heads trigger hens;

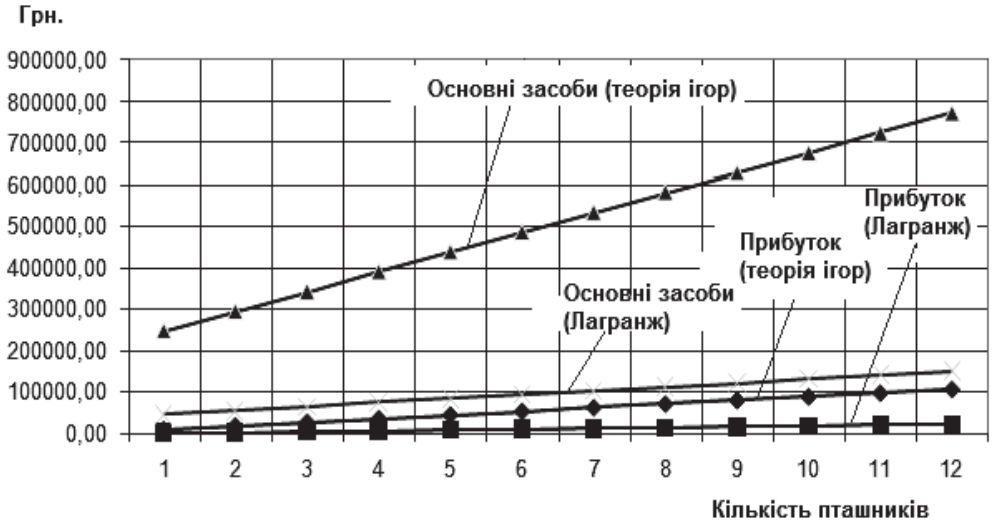

Fig. 4. The economic performance of control systems of electrical complexes

Кількість пташників	R Т. ігор	R Лагранж
1	3,58	3,72
2	5,99	6,14
3	7,72	7,83
4	9,03	9,08
5	**10,04**	**10,05**
6	**10,86**	**10,82**
7	11,53	11,44
8	12,09	11,96
9	12,56	12,39
10	12,97	12,76
11	13,32	13,08
12	13,63	13,36

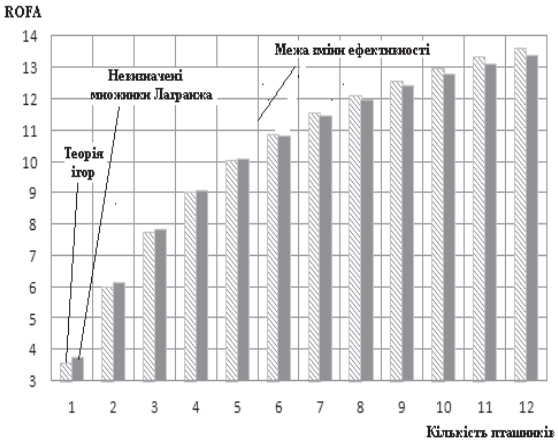

Fig. 5. Dependence of Net profit ratio of fixed assets (ROFA) systems: undetermined Lagrange multipliers and game theory and statistical decision on the number of biotech facilities (chicken houses with birds)

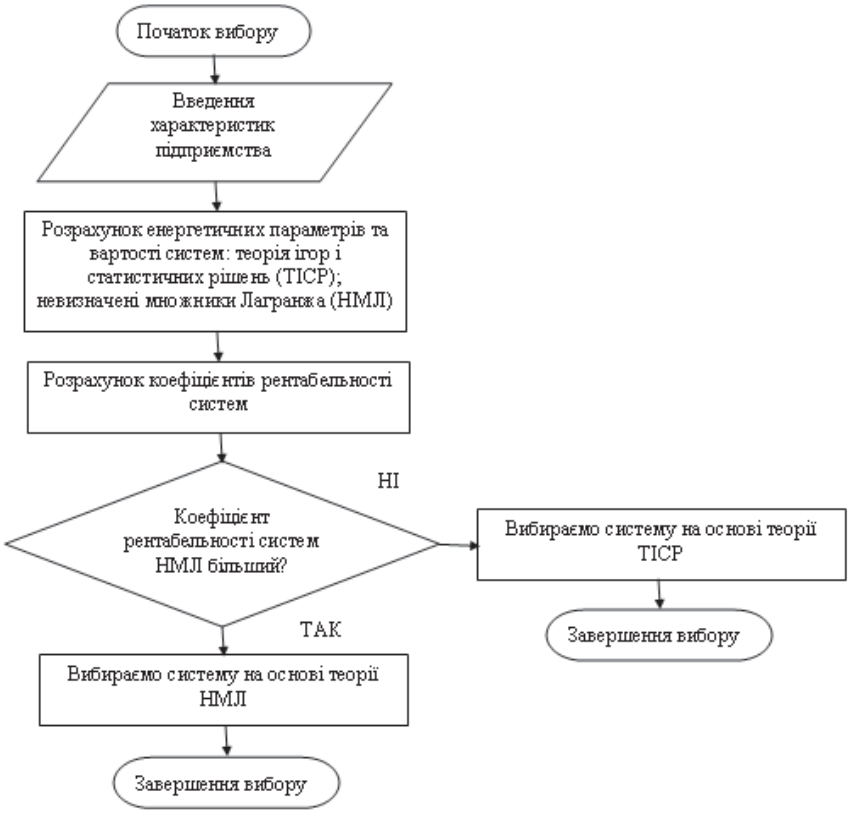

Fig. 6. Block diagram of the algorithm choice of electro technical complex management of agricultural production methods

b) games and making statistical decisions is more effective in comparison with a system based on the theory of undetermined Lagrange multipliers under conditions that if this system is used on poultry farms with the number 6 or more poultry houses where 30 thousand poultry house, heads hens.

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АННОТАЦИЯ

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Предложена стратегия выбора системы руководства электротехническим комплексом условиями содержания курей-несушек в промышленных птичниках на основании использования в качестве критерия коэффициента эффективности основных средств.

Показано, что для птицефабрик с количеством промышленных птичников для содержания курей-несушек не более 5, эффективна система, где используется метод неопределенных множителей Лагранжа. Если же количество таких птичников 6 и более, то целесообразно использовать систему руководства на основании теории игр и статистических решений.

АНОТАЦІЯ

Лисенко В.П. *Економічний критерій вибору стратегії керування біотехнологічними об'єктами// Біоресурси і природокористування. – 2014. – **6**, № 3–4. – С. 173–178.*

Запропоновано стратегію вибору системи керування електротехнічним комплексом умовами утримання курок-несучок у промислових пташниках на основі використання в якості критерію коефіцієнта ефективності основних засобів.

Показано, що для птахофабрик із кількістю промислових пташників для утримання курок-несучок не більше 5, ефективною є система, де використовується метод невизначених множників Лагранжа. Якщо ж кількість таких пташників 6 і більше, то доцільно використовувати систему керування на основі теорії ігор і статистичних рішень.