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Models for formation of optimum strategies of control in structures of glass-covered ground

Aim. To build mathematical models that can be used in the system of the automated management for maximization of income of production in building of the closed soil due to the use as reverse information of data about quality of vegetable products. **Methods.** Mathematically-statistical, experimental. **Results.** Estimation of dependence of quality of vegetable products and income of production of tomatoes in a hothouse conducted neuron networks. The studies of neuron networks took place on results researches that conducted experimentally. The estimation of quality of functioning of networks was carried out after errors on the stages of studies, to control and test (exactness of estimations does not exceed 2,4%). **Conclusions.** Investigational, that in the phase of fruiting a maximal income will present 0,06 hrn.s from one bush on twenty-four hours, if the increase of quality products presents 6 gs/by hours From it swims out, that for twenty-four hours one bush of tomato can make profit in 1,44 hrn.s

Key words: neuron network, multi-layered, quality, income.

By the basic task of any enterprise, in particular and hothouse combines, there is a receipt of maximally possible income. The systems of automation here provide technological requirements are certain. It should be noted that the increase of mass of products not always results in the receipt of maximally possible income, as a substantial role is here played by quality.

Aim — to build mathematical models that can be used in the system of the automated management for maximization of income of production in building of the closed soil due to the use as reverse information of data about quality of vegetable products.

Materials and methods of researches. An income is examined as a difference between a profit from the realized products and charges that accompany producing of products. For realization of products on a profit her quality influences substantially.

Forming is offered of strategies management electrical engineering complexes that is used for providing of technology of growing of tomatoes, to carry out taking into account quality of this products according to the requirements of ДСТУ 3246-95.

As a decision of this task will come true in the conditions of vagueness, that formed by natural indignations and features of biological constituent, expedient is the use of neuron networks. Thus forming of estimation of income of production will be realized on the basis of information about quality of vegetable products, results of monitoring of such technological parameters of production, as a temperature of air and plant, humidity of air, technological indexes of production, results of analysis of influence of natural indignations on a biotechnological object, there is a hothouse that.

Results of researches. Strategies management electrical engineering complexes that accompany the production of tomatoes, will settle accounts with the use of two consistently united neuron networks (rice. 1).

A modern production in building of the closed soil is standardized, and that is why quality of vegetable products $I(t)$ on the certain technological stage must be in certain limits. With the aim of determination in a period fruiting of dependence of quality of tomatoes from the temperatures of air and plant in a hothouse STALEMATE «Combine Hothouse» there were the conducted researches for the

tomatoes of sort Rajyisa F1. Thus the indexes of quality of garden-stuffs differed in accordance with the scale given in a table. 1.

Estimation of quality I	A value of index of quality is on a scale	Index of quality I
Very of kind	0,99-0,80	5
Good less than	0,80-0,64	4
Satisfactory less than	0,63-0,38	3
Bad less than	0,37-0,21	2
Very of bad less than	0,20-0,01	1

As evidently from a table.1, an index of quality is scope from 0,01 to 0,99, and an index is appropriated the appropriate ranges of index of quality from 1 to 5, that it will be used for the constructions of mathematical models and calculations after these models.

It is known that an income is determined as:

$$\Pi = \Delta - B$$

where Δ is a profit; B are charges.

At the choice of architecture of neuron network advantage was given to the structure is «double-layer перцептрон». The estimation of quality of functioning of networks was carried out in the environment of Statistica 6.0 after errors on the stages of studies, to control and test.

For a design the greatest exactness was shown by a network with a structure «multi-layered ». For diminishing of size of errors by means of Designer of networks in the programmatic package of Statistica 6.0 additional studies were conducted, due to what the neuron network of the marked architecture provided the error of studies of 2,4%, and control — 1,9%. Such exactness gives an opportunity to draw conclusion about possibility of the practical use of neuron network of the marked structure.

On rice. 2, and architecture of neuron network of HM1 — double-layer Perceptron is shown.

Rice. 2. Architecture of neuron networks : and — HM1 (for the estimation of quality); би — HM2 (for the estimation of income)

For the stage of studies of neuron network every continuous function is from n of variables, that set in the single cube of n space, can be presented in a kind [5]:

$$f(x) = \sum_{i=1}^n h_i(x) \cdot q_i(x) \quad (3)$$

where $f(x)$ is a function of quality; $h_i(x)$ are continuous functions of change of entry parameters that form the function of quality; $q_i(x)$ — a function that does not depend on the function of $h_i(x)$ is formed from datains.

For the studies of neuron network of HM1 drawn on the results of researches that was conducted in STALEMATE «Combine is »Hothouse« and to the automated chamber фiтотропу of department of automation and systems the name the National university of bioresources and Nature management of Ukraine (table. 2).

2. A selection of measuring is for the studies of neuron network

№ п/п

Temperature of of air, °C

On results the studies of HM1 dependence of quality of vegetable products (tomatoes) is built on the temperatures of air and plants (rice. 3, a).

Rice. 3. Found dependences on results the use of neuron networks : and are internalss of products from the temperatures of air and plant; би — to the income from the amount of products and her quality

As statistical supervisions lasted comparatively not long and proceeded during the season of growing of tomatoes, was made decision about description of surface that is represented on rice. 3, a, with the use of standard methodology a least-squares method is fixed in basis of that [5]. It was thus got in the obvious type of equalization of regression :

(4)

Thus standard deviation of calculations after expression (4) does not exceed 10%. Comparison of results of calculations after expression (4) and on the basis of the use of HM1 is shown on rice.4. Divergences are explained by the features of plant as a biological constituent of biotechnological object and by influence of casual natural indignations on such object.

Rice. 4. Surface of dependence of quality from the temperatures of plant and air : 1 is a surface after expression (4); 2 is a surface after the result of the use of HM1

For the estimation of income productions used the of HM2, the structure of that is shown on rice. 2.

Dependence of income on the amount of products and her quality taking into account charges on providing of requirements of technology, that form a profit from the production of vegetable goods, shown on rice. 3, б. Error here, as marked already, does not exceed 2,4%.

As supervisions were statistically of short duration, description of surface that is represented on rice. 3. би, carried out on standard methodology [4]:

(5)

The analysis of materials (rice. 3, б) gives an opportunity to draw conclusion, that in the phase of fruiting a maximal income will present 0,06 hrn.s from one bush on twenty-four hours, if the increase of quality products presents 6 gs/by hours From it swims out, that for twenty-four hours one bush of томата can make profit in 1,44 hrn.s As in industrial hothouses on 1 m² land 3 plants, then an income from 1 m² for twenty-four hours will present:

$$\Pi=1,443=4,32 \text{ hrn.s}$$

It should be noted that regressive dependences (4) and (5) is adequate for the turn-downs of values of temperature of air, plant, internalss of vegetable products, that over is brought in a table. 1. Except that, calculation of values of index of quality I and sizes of income of Π comes true for the current values of temperatures of air and plants.

Conclusions

Mathematical models that can be used in CAS of forming of strategies of management electrical engineering complexes for maximization of income on condition that as a feed-back is used information about quality of vegetable products are worked out.

For the estimation of dependence of quality of vegetable products and income of production of tomatoes the neuron networks of structure — multi-layered Perceptronare used in building of the closed soil. Thus exactness of estimations does not exceed 2,4%.

Set, that a maximally possible income from 1 m² for hothouses for growing of tomatoes presents 4,32 hrn.s on twenty-four hours on condition that technological parameters answer maintenance of table. 2.

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