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DEVELOPMENT OF COMPLEX INTELLECTUAL SYSTEM FOR EFFICIENSY GROWING TEE PLANT

***Abstract**: Modern development of national economy status requires the new methods of application of information technologies and computer technique. In this connection, in the article the problem of development of the intellectual system on the effective growing tea plant with the use of computer technology is conciedered. The basic methods of realization of agrotechnical works, growing tea-plant and collection of tea folias are analysed. On the basis of certain defects on growing tea plantations, experience of application of computer technologies new architecture of the intellectual system of growing tea plant with realization of complex works is proffered.*

***Key words**: tea plant, intellectual automation system, control, watering devise, tea growing, meteorological and geophysical conditions.*

***Language**: English*

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Introduction.

Growing and maintenance of tea plant is a difficult and long process. In the tea plantations during 60-70 years, realization of effective agro-technical works and timely watering of these earth are required. To and in the period of collection of tea, with the purpose of upgrading of the grown tea, it is necessary to take into account external meteorological, geophysical descriptions of region and apply them in the process of watering and implementation of agrotechnical works [6, 7].

One of the area of application of information technology is agriculture. Insufficient application of innovative and informative technologies in area of growing of tea plant, careful research in this direction is required. In this connection, the considered problem is dedicated a development of intellectual control and management system which would be provided rising productivity and quality at growing and collection of tea plants.

As known, tea plant has green ellipse or round form of leaf (2-3, 35-40 sm), and tea bush has some white flowers (about 5 flowers in one bush, diameter is 40-50 mm), fruit (10-20 mm, can prepare 30-35% tea oil, it ripens in middle of november) and root of plant (it comes back to life at a 7-9^{0}C) [8].

Experience of work in the tea plants shown that when root of tea bush was long time in water of earth of the tea plant, it led to insufficiency of oxygen. In that case, the active root parts of tea bush slowly rise to the upper part of the land, and it prevents growing bush, becomes reason of extinction of rootage of tea plant accordingly (figure 1). In this connection, providing effective growing of tea plantations with the use innovation technology of watering and implementation of agrotechnical works by means of universal complex computer system is one of the important scientifically-actual problem, which are required application of new methods.

Coming from actuality of this problem the following problems were certain in the article:

- development of architecture of subsystems of providing agrotechnical works, watering and collection of tea plantation;

- creation of subsystem of database for providing agrotechnical works at growing of tea plantation;
- creation of subsystem of database of the meteorological and geophysical descriptions of the prospected region of tea plantations;
- development of management algorithm by expert knowledge from meteorological and geophysical descriptions of the prospected region of tea plantations by means of theory of fuzzy logic;
- creation of management subsystem by the databases at collection on tea plantations;
- development of programmatic interface for the complex functioning architecture of subsystems of providing agrotechnical works, watering and collection of tea plantation.

Figure 1 - Extinction of rootage of tea plant.

Analysis of the present technology of growing tea plants and practical experiment methods.

By decision of the problem of creation of architecture of subsystems for realization of complex works at growing of tea plantations, the similar literary sources for the last 10 years were analysed [1], [2] and [3]. From the analysis of literary sources in area of application of the intellectual systems of simulation at growing plants primarily important for peoples, it was certain that functioning of these systems is provided not enough by external meteorological descriptions, biological properties of plants and changes of geophysical properties of the earth.

In this connection, it was solved to use the above marked characteristics for creation of complex intelligence system having the subsystems: meteorology, geophysical parameters which would be influenced on quality growing tea plants.

At first stage there were defined the necessary meteorology characteristics for normal growing tea bush and its vital functions. For growing tea plant it is need to provide optimal temperature regime, which is 20-30^{0}C. Middle relative humidity must be 73-80%. Amount of falling out rain is 800-900 mm.

On second stage there were defined the necessary geophysical characteristics for normal growing tea bush and its vital functions. Determination of norm of humidity of soil for the roots of tea-plant. Mass of test of moist soil (M_{ms}) in grammas is calculated by means of the following formula [8]:

$$M_{ms} = 1{,}65W - 165,$$

where W - humidity of soil, %.

Values of acidity of soil:

so much sour ($p_H < 4{,}0$);
very sour ($p_H = 4{,}1\text{-}4{,}5$);
sour ($p_H = 4{,}5\text{-}5{,}0$);
small sour ($p_H = 5{,}0\text{-}5{,}5$);
near to neutral ($p_H = 5{,}5\text{-}6{,}0$);
neutral ($p_H = 6\text{-}7$).

Before landing of tea plant it is required to check soil for acidity. In this connection, it is necessary to use an indicator with special scale of acidity. soil of a 20-30 g is placed in 50 mls distilled water. Further well shaking up soil in glass of water, it is necessary to wait 5-7 minutes. After that water is saved during 50-60 minutes, periodically shaking up the prepared composition. By the got solution will get wet an indicatory paper. Standard color of paper, that does not change, means neutral soil. Decolorized is compared to the special scale, where acidity of soil is set.

High acidity falls down liming.

Important description of the state of soil is its closeness. A closeness can be high and subzero, and also normal, satisfactory. Every closeness affects possibility of growing certain cultures on tea plants. Closeness, g/sм^3 more than 1,5 is bad, and more precisely, unsatisfactory for most of the tea plants. For the decline of closeness it is needed to bring in soil peat about 15-20 kg on every square meter, with periodicity 1 time in 3 years. Closeness 1,2-1,5 is unsuitable or unsatisfactory soil for root crops and many vegetable cultures. A situation is corrected by bringing of the same peat (about 10-15 kg on a square meter, 1 time in 5 years). Closeness 1,0-1,2 is optimal soil for root crops. Organic substance in such soil is brought in standard.

A height and development of plants in earnest depend on humidity of soil, and that is why these characteristics must be carefully researched. Humidity is checked up in three states (liquid, hard and gaseous) and expressed in percent correlation from a general volume or mass of soil. It is important to know primary humidity of soil. For determination of humidity of soil it is necessary to use 20 gram of soil in a glass tableware, rightly measured on the scale (with exactness of measuring about 0,1 gram). The date mass placed in a stove on 5 hours (temperature in the stove is 100^{0}C).

Further, it is necessary to define masses of water in the soil. For this purpose we collate mass of soil before placing it in a stove and after. We take away mass of glass and get mass of the water preliminary contained in soil. Further we set the percentage of moisture in soil. For this purpose mass of water we multiply by 100 and divide by mass of dry soil. It is impossible to assume, that soil was with the parameters of humidity stringing, when plants can not normally develop. For different soil humidity stringing shown in a different percent amount: sandy soils - 1-3%; loams – 3-6%; sandy-loam – 6-15%; clay - 10-15%; peat soils - 50-60%.

It is impossible to assume, that soil was with the parameters of humidity of stringing, when plants can not normally develop. It is considered that optimal humidity on loams and clay soil about 20-45%, and on sandy-loam and sandy soils - 10-20%.

It is very important, that maintenance of organic substances in soil was not below than satisfactory level. Then it is not need with high urgency to top-dress.

As known, all organic substances in soil form from bits and pieces of plants or animals. In deep or superficial layers, decomposition happens and humus appears due to that. Humus, due to the properties, quality of soil improves and also its ability to retain moisture and necessary for development of plants microelements promote.

For investigation of having organic substances in soil we will take metallic glass, fill up in it a 50 g of dry soil from an tea plant and will set on a tile in the ventilated apartment on 3 hours. If there are small organic substances in soil, it will a bit smoke, if it is much - the amount of smoke will grow considerably. After expiration of 3 hours we will weigh glass with soil on precision balance. Further produce a calculation. At once we need to know mass of the soil lost at the warming-up of glass. From general mass of glass with soil to the puncture we will take away mass. We get a result. Let's multiply by 100 and divide by originally high-usage mass of soil, and also take away a static coefficient that designates maintenance in soil of chemically bound-water. For clay soils - 4, for loams - 3, for sandy-loam - 2 and for sandy soils - 1.

Let's estimate maintenance of organic substances and set its level:

- if result less than 2 is this subzero enough maintenance, and, it is necessary to bring in to 5 kg of manure and 10 kg of peat annually on the square meter of tea area of plant;
- if value from 2 to 3 is a level subzero and fertilizing soil is still necessary. It will be enough for 5 kg of manure and peat;
- value from 3 to 6 - satisfactory when the additional fertilizing is needed only by manure, about 3 kg in a year;
- value more than 6 is high maintenance of organic substances. It is possible to bring in a few of manure, only 1-2 kg on a square meter.

The conducted geophysical experiments on realization of necessary agro-technical works allow to systematize these results and form a database and knowledge with biological properties of tea plant, that will provide the quality height of both separate tea-plant and all tea plantations.

Investigation of meteorological, geophysical characteristics and agro-technical works for Lenkaran region of Azerbaijan

Let's investigate meteorological characteristics in the area of growing in the tea plants. It is connected with that, many meteorological characteristics influence positive or negative on quality growing tea bush. For example, very high temperature of weather , high speed of wind, high air humidity, abnormal pressure air or rain value influence negative on growing tea bush and in depend on that, productivity of the tea bush will low.

In Lankaran-Astara and Sheki-Zagatala regions of Azerbaijan during spring-summer months low norm of rains retards the growth of the tea plant, and at temperature of air of 25-27^{0}C the growth of tea plant stops completely. For normal development of tea plant in the subtropical region of Azerbaijan the important factor is relative humidity. In the dry

season the relative humidity is reduced to 25 to 30%. For normal development of the tea plant is necessary not less of 70-73% [10, 9]. The cause of the fall of relative humidity in the winter are cold winds from the north to the south , and in the summer, dry warm winds from the south to the east and from west to east. That becomes a cause of low humidity of soil, what in future also it will be a cause of very low productivity and quality of tea plant.

Thus, of analyze of Azerbaijan regions where grow tea plant, let' s do reduces in commonly meteorological and geophysical characteristics (the data present in the following table 1, 2).

Table 1

Meteorology conditions.

Region	Normal temperature	High temperature	Amount of rain	Middle relative humidity
Lenkaran	14-18°C	25,7-27,6°C	800-900 mm	73-80%
Astara	14-18°C	22,7-25,8°C	750-850 mm	62-73%
Sheki	14-18°C	32,5-37,6°C	900-1200 mm	60-75%
Zagatala	14-18°C	30,8-35,6°C	700-800 mm	65-70%

Geophysical conditions.

Region	Soil type	Soil composition	Relief angle
Lənkəran	red, yellow, podozny	humus, clay	10-50%
Astara	red, yellow,	humus	10-45%
Sheki	podozny	clay	25-64 %
Zagatala	yellow	clay	15-55 %

In depend on the defined meteorological and geophysical data from the experts in regions of tea growing Azerbaijan we can create base of data and knowledge, which will be included into the system of automation of control of growing tea plants and collection of their leafs.

In the subsystem of automation of control of growing tea plants agro-technical works in the tea plantations must plane in accordance to the temperature level, geophysical characteristics of soil in the tea plantations of the region and also the month calendar. As known, the agro-technical works for the tea plantations in Lenkaran are planed from March and finish in October. Depending on a month of the year and position of the moon in constellation the planed agro-technical works include the following: soil preparation for planting; planting new tea bush; tea plantation treatment; plowing the soil; tea bushes spraying; pruning tea bushes; providing the soil with oxygen; favored watering and feeding tea plantations; tea leaf collection.

Dependence of types of agro-technical works and month calendar (for example, April), defined from the astrological data base, can write as follows standard scheme of knowledge base:

If (data of month);
And (changing the moon size in any constellation);
(where the moon sizes changing can be written as: ***increase*** and ***reduction*** of moon);
Then (type of agro-technical works ($A^i t$) in the tea plantation).

Other days of April must check by means of month calendar (through Internet) and on the base of data of increasing or reduction of moon a type agro – technical work is chosen. Algorithmically and program provides of option of the necessary agro-technical works are developed on the base of the created knowledge base.

Development of common system of automation of control of growing tea plants and collection of their leafs

The common system of automation of control of growing tea plants and collection of their leafs functions by means of the following provides:

- the technical provide, which executes speedily processing, saving, operative control of the internal current data during the management procedures of growing tea plants and collection of their leafs;

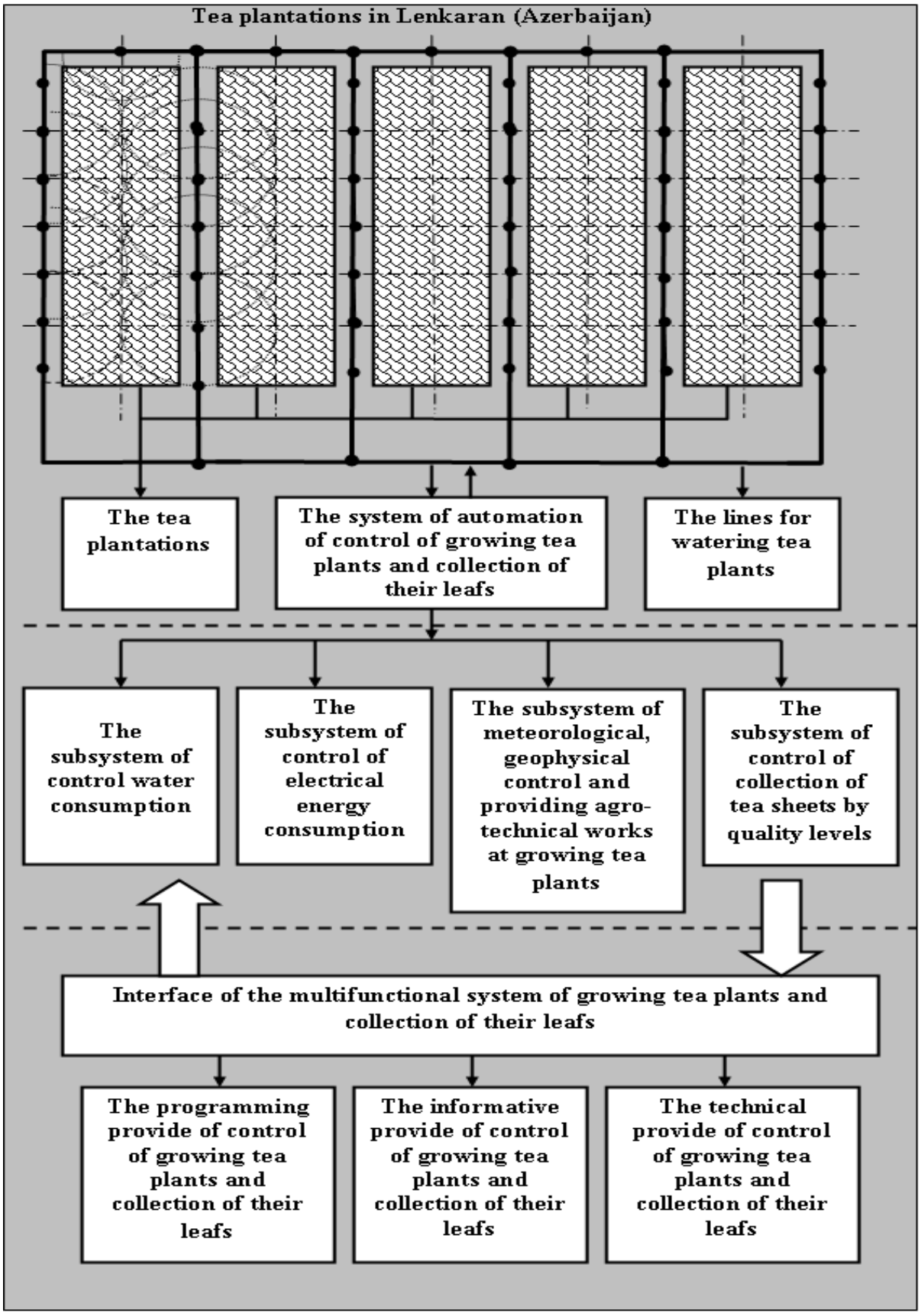

Figure 2 - The architecture of common system of automation of control of growing tea plants.

- the program provide executed operative control, calculation of energetic, watering consumption of growing tea plants and corporative functions of collection of their leafs;

- the informative provide for data saving, knowledge control of growing tea plants and corporative functions of collection of their leafs.

The architecture of common system of automation of control of growing tea plants and collection of their leafs is represented as hierarchical system (figure 2) which works on the following stages:

1. At first stage the number of tea plantation for control of biological status of every tea bush, its sheets is chosen. The system of visual control is fixed a status of its sheets sizes, active root parts of tea bush.

2. On second stage of the system of automation of control of growing tea plants begins to switch the basis elements of the program, informatics and technical subsystems. The lines for watering tea plants are activated.

For definition the data of humidity of soil the sensors of humidity in the places of the tea plantation are given signals about current status of soil. After that water through plumbing by means of the watering devises is given only for that plantation where soil is provided not enough with humidity. Algorithm of given the needed water volume is created by a method of fuzzy logic - sufficient consumption of water for this soil.

3. On the third stage for definition the data of temperature of weather of around area by means of special sensors located on the places of the tea plantation, watering of this part is regulated. So for example at high (25^0C – 35^0C) temperature of weather, watering is not executed, because it perniciously influences on rootage and on the leaves of bush of tea. Water is given only at more subzero temperatures.

4. On the fourth stage the charges of water and electric power are automatically measured. The data are a base for calculation of the out prices for communal consumption.

5. On the fifth stage the system will realize the account of collection of leaves from plantations of tea in obedience to its quality.

The subsystem of control of collection of tea sheets by quality levels is needed for real control of collection different sorts of tea sheets and them distribution by quality to the tea factory in Lenkaran.

For information connection of current data of water and electrical energy consumption with the system of automation of control of growing tea plants, special program interface of functioning with this system is applied. In this case, an important meaning has providing maximal reduction of water and electrical energy consumption. Providing a condition of maximal reduction of water and electrical energy consumption are connected with observance of meteorology and geophysical parameters for growing tea plants in Lenkaran region of Azerbaijan, and also by correct realization of agro-technical works in spring, summer and autumn months.

Conclusion

On the base of the analize and investigation in the article, the following results are got:

1. The basic methods of realization of agrotechnical works, growing tea-plant and collection of tea leafs are analysed.

2. On the basis of certain defects on growing tea plantations, experience of application of computer technologies new architecture of the intellectual system of growing tea plant with realization of complex works is proffered

3. The architecture of common system of automation of control of growing tea plants and collection of tea leafs is represented as hierarchical system with stages of automation function.

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