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# Collection of Azerbaijan Tea (*Camellia sinensis* (L.) *Kuntze*) Varieties Belonged the Lankaran-Astara Region and using their Valuable in Breeding Program

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**Abstract**
Research was focused on selecting newly created tea samples that were high yielding, high quality, and drought-resistant. For this purpose, genetic diversity of tea samples from plantations of Lankaran-Astara region was studied by morphological traits. From the tea plantations in Lankaran-Astara, potential clones were selected based on parameters affecting the industry. A number of morphological traits were studied, including yield, shooting intensity, leaves quality, and other characteristics. As a result of this study, the selection of the best clones for the creation of improved tea populations was ensured using the clone selection method on tea plantations operating in Lankaran-Astara for many years, which were each investigated and studied separately in order to obtain the best results. According to the results of this study, the clones placed in the garden of the collection gene pool have greater shooting intensity, leaf blade, flash weight, mechanical composition, and biochemical qualities than the control variety Azerbaijan-2. This research led to identification of form-clones with valuable economic characteristics.

**Keywords**: tea, clone, collection, morphological traits

## Introduction

Tea plant (*Camellia sinensis* (L.) *Kuntze*) is known as one of the popular non-alcoholic beverages worldwide and is used by about 70% of the world's population due to its refreshing taste, attractive aroma, and medicinal benefits (Karunarathna et.al., 2018). Tea is an economically important product grown in more than 52 countries in Asia, Africa and South America (Wambulwa et.al., 2017). The tea plant of the southern region of the Republic of Azerbaijan is considered one of its important products and plays an important role in the regional economy (Huseynov et al., 2020). The Chinese variety of tea is cultivated in the humid subtropics of

Azerbaijan. The prospective varieties and forms of the tea plant adapted to local soil conditions have been recommended for production purposes (Babayev, 2018).

One of the primary focuses of economic policy carried out in our republic in the modern era is thought to be the development of traditional agricultural sectors, improvement of the social well-being of the nation's population, particularly those engaged in this activity, and decrease in unemployment. In addition to the growth in many economic sectors, this strategic framework's actions contributed to an increase in the non-oil sector's share of the gross domestic product. (Gurbanov et.al., 2016).

A number of significant steps have been taken, and positive outcomes have been obtained, in order to increase state support for the growth of the production of citrus fruits and tea, meet the population's demand for these products, enhance the supply of raw materials for processing enterprises, and increase the variety of finished products. Ensuring sustainable development in this area, meeting demand through local production, as well as increasing cropland and productivity, developing seed and nursery farms, strengthening information and advisory services, human resources, promoting investments and exports, necessary infrastructure and financial resources for the expansion of clone opportunities, improvement of the level of provision requires acceleration of the measure (Guliyev F.A and others, 2012).

In light of this, on February 12, 2018, the President of the Republic of Azerbaijan issued an order approving the "State Program for the Development of Tea Cultivation in the Republic of Azerbaijan for 2018-2027"(Gurbanov et.al., 2016).

In the subtropical Lankaran-Astara region, in the existing tea plantations established since the 1930s - in the Hirkan and Haftoni regions of the Lankaran region, in Kijaba, Lovain of Astara and Kolatansin in the Masalli region discovered tea plantations and determined by long-term observation, and according to about 50 different economic indicators, more than 50 clones of different forms of tea have been cut and rooted and introduced into the harvesting area of the Lankaran tea industry for comparative research (Guliyev et al., 2014).

The main goal is to improve the productivity and product quality of tea plantations in Azerbaijan, create new varieties and strains of tea on the unique soil and climatic conditions of the Lankaran-Astara region and introduce them to the farm.

Research and scientific work was first started in 1948 by M.A. Mammadov at the Lankaran Tea Branch of the Az ETB and SB Institute with the aim of obtaining locally selected Azerbaijani tea varieties (Guliyev et al., 2012; Mammadov, 1965). Using the convetional breeding method, the author obtained 9 Azerbaijani tea varieties (Guliyev et al., 2014; Babayev 1986; Bakhtadze, 1948).

The selection of tea in Azerbaijan is aimed at obtaining the following local varieties. Azerbaijan №1 - a hybrid of large-leaved Chinese tea; Azerbaijan № 2 - half-leaf Chinese tea; Azerbaijan №3 - mid-leaved tea of the southern group intersort hybrid; Azerbaijan №4 - intersort hybrid of broad-leaved tea and Azerbaijan №6 - "Kimin" hybrid, etc (Guliyev F.A and others, 2012).

When testing the obtained tea varieties, special attention was paid to their productivity, product quality and resistance to the unfavorable climate of the Lankaran-Astara region.

Thus, 7 of the 9 selection varieties of tea obtained in the Lankaran-Astara region of Azerbaijan (Azerbaijan №1, №2, №3, №4, №5, №6, and №9) were submitted to the State Variety Trial, and 2 selection varieties from them - Azerbaijan №2 was regionalized in 1977 and Azerbaijan №4 (Talish) in 1979 (Guliyev et al., 2014; Mammadov, 1965).

The productivity, longevity, and quality of the tea plantations are highly dependent on the variety composition of the tea plant. Tea populations and varieties vary significantly in yield, harvest time and leaf quality indicators. At the same time, the characteristics of the tea plant and its response to the growing conditions play an important role. Each variety is adapted to certain natural climatic conditions and differs in giving the highest quality products in those conditions. Tea plants respond best to soil conditions. The variety with the same name differs in productivity and quality of the product in one massif, but in different soil conditions (Guliyev et al., 2014; Babayev and d., 1986; Bakhtadze, 1948; Dzhakeli, 1988).

In 1980, research work on clone selection of tea at Lankaran Chay branch of Az.ETB and SB Institute was carried out. For this purpose, the method of propagation of tea by vegetative method under the conditions of Lankaran-Astara region under polyethylene cork curtains was developed (F.A. Guliyev and M.M. Babayev, 1986).

**Materials and methods**

The research were carried out in 2022-2023 on different varieties and forms of the tea plant (*Camellia sinensis* (L.) *Kuntze*) cultivated in the experimental area of the Lankaran tea branch of the Scientific Research Institute of Fruit and Tea Cultivation.

The biomorphological description of tea varieties and forms is given based on the instructions of M.I. Dashkevich (1963) and the method of P.J. Lapin (1986).

Phenological observations cover the period from March to October during the active vegetation period of the plant. At this time, the beginning of height and development

of the variety, form or clone, depending on the external environmental conditions of the phenophases, depending on the external harsh environmental conditions of the plant, the reaction of the plant to external harsh environmental conditions was studied. Phenological observations were carried out every 5 days from the beginning of "Painting" to the end of vegetation. Phenological observations are recorded according to the scheme given in the journal. Tea variety, form and clone weight were studied according to the specified procedure. The morphological characteristics of the flashes are determined according to the order shown in the relevant table (Table 1). Productivity indicators of tea bushes are shown in table1.

The plant height and plant width are measured at the beginning of vegetation and also at the end of vegetation.

The yielding biology and intensity of tea bushes are studied separately for each sample in 0.0625 $m^2$ area (0.25m x 0.25m= 0.0625$m^2$) in four replicates.

For this purpose, in the spring, after pruning the wallpaper, certain stumps are separated and labeled.

Observations on the growth of crows are made every 5 days. To find the volume of the tea bush, the formula presented by O.A. Kovalyov (Guliyev et al., 2014) was used:

$$V=\frac{3,14*D^2*H}{4}$$

Here,

H- bush height

D- bush diameter (cm)

V- bush volume ($cm^3$)

The leaf blade of the tea plant was studied by the method of D.A. Vardikadze, A.S. Sanikidze (1973). At this time, 25 leaf blades characteristic for each variant were determined.

The obtained numbers are mathematically calculated by the dispersion method (Dospexov V.A. 1973).

According to its signs, the delicacy, shine, color and curl of the leaf are recorded, and an assessment is made for all three types (strong, medium, weak).

During the vegetation period, the symptoms of the leaves are observed twice in spring and summer.

Winter damage, percentage of shoots, leaves, annual shoots, perennial branch, whole aboveground part and whole plant are recorded as a percentage of the whole bush from the beginning of spring growth. Damages in the summer, damages observed in the plant until May-August due to drought are recorded.

A number of additional indicators for the selection of the tea bush according to its productivity: the nature of the tea bush development, the size of the leaf blade, buds, the buds ripening at the same time for harvesting, strong dyeing energy and good development of the buds, the plant during the season - more than 4-5 during the leaf collection period the formation of graded ridges has been taken into account.

To obtain tea variety-clones, the following scheme was used: selection of mother plants, analysis of their morphological and biological characteristics, yield rate and product quality, their selection based on the obtained data, and then creation of varieties by multiplying the best clones.

**Results and discussion**

In addition to the tea bush's yield, other morphological characteristics like leaf blade's high shooting intensity, seasonally high shooting intensity, flash weight, growing intensity, and shoot development were examined in our investigation.

**Table 1. Volume measurements and yield of studied tea samples**

| Samples | 1 clone | | | Node distance (cm) | Total leaves Per bush (gr) | Yied kg/ha | Comparison among varities ( %) |
|---|---|---|---|---|---|---|---|
| | Height (cm) | Diameter (cm) | Volume, ($cm^{3)}$ | | | | |
| FAQ-12 | 70,0 | 110,0 | 664,89 | 3,0 | 232,0 | 5104 | 163 |
| FAQ-13 | 50,0 | 110,0 | 474,92 | 4,5 | 249,0 | 5346 | 171 |
| FAQ-15 | 70,0 | 125,0 | 858,69 | 4,5 | 389,0 | 7238 | 232 |
| FAQ-16 | 50,0 | 110,0 | 474,92 | 4,0 | 202,0 | 4444 | 142 |
| FAQ-17 | - | - | - | - | - | - | - |
| FAQ-18 | 65,0 | 95,0 | 460,50 | 3,0 | 173,0 | 3806 | 122 |
| FAQ-19 | 50,0 | 115,0 | 519,08 | 4,0 | 503,0 | 1106 | 354 |
| FAQ-20 | 80,0 | 135,0 | 1.144,53 | 5,0 | 268,0 | 5896 | 188 |
| FAQ-21 | 75,0 | 100,0 | 588,75 | 5,0 | 295,0 | 6490 | 207 |
| FAQ-22 | 80,0 | 130,0 | 1.061,32 | 4,0 | 550,0 | 12100 | 387 |
| Control | 45,0 | 95,0 | 318,80 | 2,5 | 142,0 | 3124 | 100 |

More than 50 forms were gathered, and some clones were taken for comparative analysis. In addition to several of their morphological and biological traits that give

them farm values, the quality indicators of the green leaf product (flashes) are also carefully examined in parallel.

Using the collection garden established at the Lankaran Tea Branch, form-clones of the tea plant were compared with the "Azerbaijan 2" tea variety as a control.

As shown in tables, research was conducted on a collection of form-clones. Table 1 shows the volume size and node distances of the compared form-clones.

It is evident from the table that the form-clones differ as much as possible from the control variety (Azerbaijan 2). Therefore, the comparable clones had an average bush volume of 460.5-1144.5 cm3, compared to 318.8 cm3 for the control variant. That is, the volume size was relatively large in form-clones compared to the control, and FAQ-20 and 22 had the largest volume size.

| Forms № | Start of the Spring vegetation | End | Start of the Summer vegetation | End | Start of the Fall vegetation. | End | Start of the buttons | End | Start of the flowering |
|---|---|---|---|---|---|---|---|---|---|
| FAQ-12 | 1/IV | 4/VI | 14/VI | 3/IX | 10/IX | | 17/VII | | 14/IX |
| FAQ-13 | 31/III | 4/VI | 13/VI | 2/IX | 12/IX | | 15VII | | 13/IX |
| FAQ-15 | 31/III | 4/VI | 13/VI | 3/IX | 11/IX | | 17/VII | | 11/IX |
| FAQ-16 | 1/IV | 4/VI | 14/VI | 2/IX | 12/IX | | 16/VII | | 12/IX |
| FAQ-17 | - | heavy | pruning | - | - | - | - | - | - |
| FAQ-18 | 31/III | 4/VI | 13/VI | 3/IX | 10/IX | | 15/VII | | 11/IX |
| FAQ-19 | 1/IV | 4/VI | 14/VI | 5/IX | 8/IX | | 18/VII | | 13/IX |
| FAQ-20 | 30/III | 4/VI | 14/VI | 1/IX | 10/IX | | 17/VII | | 12/IX |
| FAQ-21 | 1/IV | 4/VI | 13/VI | 2/IX | 12/IX | | 16/VII | | 11/IX |
| FAQ-22 | 29/III | 4/VI | 14/VI | 3/IX | 11/IX | | 18/VI | | 14/IX |
| Control | 2/IV | 4/VI | 17/VI | 1/IX | 13/IX | | 14/VII | | 8/IX |

The result of observations on vegetative and generative organs in Table2 show that the beginning of spring vegetation in the control option 2.IV, in some of the comparatively studied FAQs (FAQ-12,16,19,21) 1 day earlier, the remaining form - clones started earlier, which had its effect on the start of summer and autumn vegetation.

Regarding the development of generative organs, it has been known that compared to the control variant, form-clones are different to one degree or another.

The study of the leaf surface is of particular importance in tea bushes. Thus, the surface area of the leaves has an important effect on the synthesis of organic substances. From this point of view, the study of the surface of the leaf blade in tea bushes shows its effect on the growth and development of the plant, the realization of its photosynthesis process and the formation of organic substances. The study of the leaf surface was carried out in 3 stages of the leaf harvesting season. While the largest leaf area vegetation is observed in spring (May) and relatively small in summer (July), it appears to be larger in autumn (September) than in summer. So, in the control option, this number is 24.4 in May, July, and September, respectively; In case of 22.0 and 23.1 $cm^2$ involved forms-clones this comparative degree in spring (May) -27.5-36.0; in summer (July)-24.6-27.2; in autumn (September) it was 25.6-29 $cm^2$.

It was determined that the tea form-clones included in the comparison are superior in comparison with the control variant in terms of leaf surface. This situation was observed in green tea leaf harvested seasonally.

As the flash intensity of tea bushes is the basis of high productivity, the application of complex agrotechnical measures to plants for this purpose plays an important role.

The correct mode of cultivation, cultivation, fertilizing, pruning, harvesting, etc. by applying it has a positive effect on the flash intensity due to the collection of tea bushes during the season. It was determined that in this case, the difference between tea flash ripening in the studied tea form-clones and control variants is almost the same, that is, the intensity of flash ripening during the season occurs almost 7-9 times. Here, the main difference is observed in the size and development of the flashes, mainly in the mass and quality indicators of the collected flashes.

The scientific-research works conducted on the various tea forms-clones collected in this way show that they differ with positive signs according to economic and quality indicators.

As a result of the research, form-clones with valuable economic characteristics were identified.

In the scientific investigation, it was determined that FAQ-20, FAQ-22, FAQ-18 are superior to regionalized "Azerbaijan-2" tea variety (control) and at the same time compared to clones with selection number studied in terms of both sizes of tea bushes. Observations made on vegetative and generative organs show that the form-clones with the selection number FAQ-22, FAQ-20 start vegetation earlier than the control and mature relatively late. At the same time, in the comparison of yield and

variants from Hk, form-clones show higher results than "Azerbaijan-2" tea variety (control). Similar differences were also found in other biometric measures.

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