FORMATION ISSUES OF TEA PLANTATIONS

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Abstract: There are described the types of tea bush pruning and working bodies of the pruning devices in the article. Due to the biological condition and agro-technical requirements of the tea bushes, there are carried out five different types of pruning action in the tea plantations. Therefore it is necessary to discuss a different design pruning machines. The variability of the parameters of the cross-section of tea bushes on slope is analyzed, depending on the angle of slope inclination. Also the free line width b_α, as well as the cross-section characteristic parameters of the tea bushes - B_α, h_α and C_α are established.

Different types of surface formation of tea bush are characterized, including flat and semi-cylindrical forms. Their comparative analysis has been conducted. In order to increase their durability and simplifying of the construction of tea pruning and harvesting machines it is recommended to form a flat surface of tea bushes. Accordingly, It is recommended to reconstruct the existing semi-cylindrical shaped tea plantations with flat formation of the bushes surface.

KEYWORDS: TEA, FORMATION, PRUNING, CYLINDRICAL, FLAT, SLOPE

Introduction

The yield of a tea significantly depends on the form of bushes. Trimming of tea bushes at the different height is carried out according to agrotechnical and biological conditions. In order to improve plant sprouting process tea bushes are trimming with a "Superficial pruning" method. During process of the "Superficial pruning", tea bushes are trimmed at 50-100 mm height. As a result of prolonged exploitation of tea plantations, the bushes have been decimated, so it is necessary to carry out a heavy pruning and rejuvenation of its basic body. Pruning should be done with a sharp knife and the cut preferably is made slanted towards the centre of the bush. There are four major styles of pruning, as outlined below viz. clean, rim lung cut-across and rejuvenation pruning. Although rim lung pruning is the most suitable method, other styles also can be adopted under special circumstances as given below [1],[2].

Operating conditions of working bodies of the trimming machines dramatically changes depending on a pruning height. That is why a number of different types of work bodies have been used. Large diameter rods, which size reaches 80-100 mm could be found during the cut-across pruning of a tea bush. Thus, segmental and sectorial type working bodies of the pruning devices were inadequate in these zones. These type working bodies of the pruning devices could be used only trimming zone of the clean and rim lung pruning, after the special strengthening; But it is necessary to use the sawing type working bodies of the pruning devices for rejuvenation pruning, which can cut any thickness tree branches. There are two formation method of the bushes in tea producing countries: Cylindrical and flat. The cylindrical shape of the leaflet surface has some advantages over the flat; In particular, the growth of young leaves on the cylindrical surface is going on even more equally [3],[4].

Basic part

Tea is cultivated on plains as well as on slopes in the subtropical zone of Georgia. The width of the tea bushes and the foliar surface is reduced depending on the tilt angle of a slope. Variability of the tea bushes parameters depending on the angle of slope has been studied by scientists [5],[6],[7].

On the fig. 1 is represented the cross section of tea bushes on slope and plains. According to which we can define the main parameters depending on the angle of slope.

The width of a stripe between the tea bushes: $b_\alpha = L\cos\alpha - B_a\cos\frac{a}{2}$;

Where, $\alpha = \varphi_2 - \varphi_1$ - Average tilt angle of a slope.

The width of a stripe between the tea bushes on the steep slope is going on actually. In this case, value of the slope's tilt angle is equal to zero:
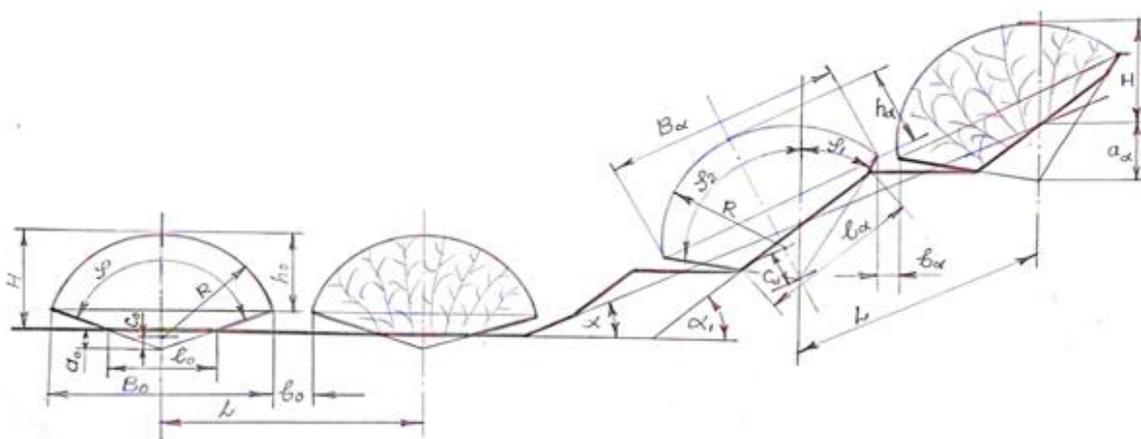

Fig.1. The cross section of tea bushes on the plain and slope

$$a_{max} = 2arccos\frac{B_a + \sqrt{B_a^2 + 8L^2}}{4L} ,--$$

The cross section of tea bushes is significantly changed on the slope

$$B_a = C_a \sin\varphi + 2\sqrt{R^2 - C_a^2 sin^2\frac{\varphi}{2}} \, sin\frac{\varphi}{2};$$

$$h_a = R + C_a sin^2\frac{\varphi}{2} - \sqrt{R^2 - C_a^2 sin^2\frac{\varphi}{2}} \, cos\frac{\varphi}{2};$$

$$C_a = (H + a_\alpha)cos\frac{\varphi}{2} - \sqrt{R^2 - (H + a_\alpha)^2 sin^2\frac{\varphi}{2}};$$

$$a_\alpha = \frac{l_a(\cos\varphi_1 \cdot \cos\varphi_2 - \sin\alpha\sin 2\alpha}{\cos 2\alpha\sin\varphi}.$$

On the plain, when $\alpha = 0$, accordingly…

$$a_\alpha = a_0 = \frac{1}{2}l_0 ctg\frac{\varphi}{2};$$
$$c_a = c_0 = H + a_0 - R;$$
$$B_a = B_0;$$
$$h_a = h_0.$$

Marginal value of the slope's tilt angle, where working of mobile machines are allowed, in terms of sustainability, is equal to 0.35 radians. Working on the slope with more tilt are allowed only using technical means of small mechanization [8].

As a result of the theoretical and experimental research, there are certain difficulties for exploitation of the cylindrical bushes, which is mainly conditioned by complexity of the structures of pruning and harvesting machines of tea bushes, due to implementation of these operations is necessary using of arc shaped, immovable and movable knives (fig. 2 a). Centrifugal forces of reaction are formed at the time of working process of the machines, which leads to the growth of the existing gap between the immovable and movable knives, it increases the power of cutting resistance. Accordingly, the wearing out of the cutting knives increases, durability of the device decreases and quality of technological process significantly deteriorates. Working of the tea harvesters on the flat pruned surface is easier, because working bodies of the harvesters operate on the horizontal, flat surface. It also facilitates the creation of differentiated picking machines for tea leaves.
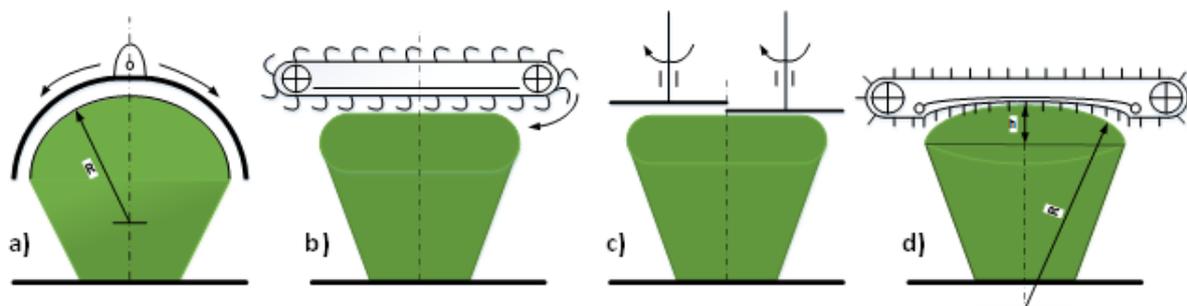

Fig. 2. *Pruning form of tea bushes and working bodies*
a) Cylindrical surface - Arc shaped pruning device; b) Flat surface – lenticular pruning device c) Flat surface - Circular saw device;
d) Oval surface - lenticular oval device.

Thus, the flat formation of a tea bush enhances the simplicity of the construction of the harvesting and pruning machines and increases the durability of their work. Pruning is possible using of the segmental type cutting devices, it is also possible to use the lenticular and circular saws (fig. 2. b, c). In order to increase harvesting surface and protection of equilateral sprout's surface, it is desirable to create an oval harvesting surface, in this case it is necessary to use special harvesting and pruning machines [12], which will be tailored to the curvature of harvesting surface (See fig. 2. d).

At present, tea plantations are mainly formed as a flat shape in tea producing countries (Japan, China, Argentina, India, Turkey and etc.). Accordingly, flat pruning and harvesting machines of the tea bushes are created and successfully used.

Conclusions:
1. In order to revive and further develop tea production in Georgia, it is necessary to restore the patriotic production of the harvesting and pruning machines.
2. For the purpose of introducing modern machinery technologies, it is necessary to reconstruct the existing plantations and cultivate a new, productive plantations;
3. It's advisable to reface of cylindrical-shaped surface to flat-horizontal surface, thus it's recommended the creation of the flat harvesting and pruning machines, or importing and adapt the modern, foreign manufacturing machines in Georgia.

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