

**THE DRIVING OF APPLE TREES IN THE SHAPE OF A SLENDER
SPINDLE**

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ABSTRACT

The paper relates to fruit growing, namely to a process for formation of apple tree crown in the shape of a slender spindle. The process of training the central axis on the apple was applied to the Granny Smith apple variety, grafted onto the M9 rootstock, with the slender spindle-type crown, the planting distances being 0.8 m per row and 3.2 m between rows. We used vigorous planting material with branches anticipated at the height of 50-80 cm and with well-developed and unshavened shaft, with viable buds along the entire length of the shaft, well-developed root system, excellent graft and root growth without traces of necrosis. Before planting, the trellis was installed and fixed 5 wires spaced 50, 80, 160, 240, 320 cm from the ground. The results of invention allow to form conical and narrow canopies, with a vertical central axis, weakly curved and well garnished with a single level of semi-skeletal and fruit bearing branches, which decrease in length from the base to the top of the tree.

INTRODUCTION

Modern fruit growing is based on the results obtained in the last decades in the theoretical and practical research carried out in the big cultivating countries (Germany, Holland, Poland, Switzerland, France, Italy) and in our country. The high-volume crown shapes are progressively replaced by the flattened or palm-shaped shapes. The varied variety of forms has biological origins (varieties, rootstocks, etc.), climate (luminosity, heat, precipitation, etc.) and soil, but it also certainly responds to factors such as tradition and maximum productive potential and economic.

Due to the multiple varieties / rootstocks, the numerous planting distances, as well as the ways of grouping the trees due to the diversity of the existing biological material (crowned trees, knip-baum, etc.), numerous researches have been imposed on systems of management of the trees. Among the driving systems experienced at the apple we mention the flattened shapes (palm with oblique arms, palm with horizontal arms, palm with free flattened, vertical cord, etc.), the free shapes (Slanke spil, Super spindle system, North Dutch axle etc.) and the shapes in two oblique planes (Tatura Trellis, "V-system" or V-Guttingen system) that demonstrate this great diversity (Ghena et al. 2004; Babuc et al. 2015).

The diversity of the seeding material, the methods and the technical possibilities as well as the climatic conditions in the area must be studied in the

formation of the tree crown, which will be the basis of the culture systems in the future. Indifferent of the culture system, for the stimulation of fruiting at planting, preformed trees, from anticipated shoots, of 1 and 2 years are used. In order to increase the productivity of the work, simple driving systems with a high degree of mechanization of the works or crops of the low-sized trees are chosen, which allow to maximize the manual work (the cutting of the trees, the cutting and the harvesting of the fruits). The culture system is oriented towards the continuous improvement of the assortment from the qualitative, quantitative and constant point of view in order to meet the demands of the integrated production. Such a system can be highlighted by the coherence of the relationships existing between the varieties, rootstocks, the crown conductance, the crown shape and the planting distances (Balan, 1996; Balan et al. 2001).

MATERIAL AND METHODS

The experience was organized in the fruit-growing area of the center of the Republic of Moldova, at the "Elit Fruct" in Criuleni district. The process of training the central axis at the apple was applied to the Granny Smith apple variety, grafted onto the M9 rootstock, with the slender spindle-type crown, the planting distances being 0.8 m per row and 3.2 m between rows. Before planting, the trellis was installed and fixed 5 wires spaced 50, 80, 160, 240, 320 cm from the ground. The first wire was fixed to the drip irrigation hose. We used vigorous planting material with branches anticipated at the height of 50-80 cm and with well developed, unobstructed shaft (Balan et al. 2018).

The planting material was of high quality: viable buds along the entire length of the shaft; well-developed root system; excellent breeding between rootstocks and rootstocks without traces of necrosis. Tree planting was done in the pits, early spring and they were tied to the second wire (fig. a), and when the dismantling began, the shaft inclined and tied to the three wire in an arched position (fig. b). When the shoots have reached the length of 20-25 cm, on the axis is chosen a shoot, which tends to the vertical, and the rest of the vertical shoots is suppressed to the ring (fig. c). In July the shaft of the extension of the shaft of the tree is fixed in the vertical position of the fourth wire to consolidate its position (fig. d).

The soil is maintained by artificial grass, the orchard is irrigated by drip, and Watermark translators are used to monitor soil moisture. The water is distributed by buses with droplets fixed 40 cm from the ground in the direction of the line. The strips, 2.5 m wide, with weeds are mowing as needed and remain as mulch. The experiences are presented linearly and include 4 repetitions of 8 trees each. The evidence and appreciation of the important characters and properties of trees from a biological and technological point of view or carried out under field and laboratory conditions according to the method of stationary and biological research (Moiseicenko, 1994).

RESULTS AND DISCUSSIONS

The research concerns a process for forming the slender spindle-shaped crown of the apple tree (Balan et al. 2018). The main role in the formation of the slender spindle, at the apple, is the directing of the central axis and the preservation of the pyramidal shape, with the width of the crown at the base of 1-1,5 m, and at the top of 0,5-0,6 m. The shafts driven by the slender spindle have a height of 3-3,5 m, and the side branches are perfectly subordinated to the shaft.

Spring cutting of the central axis. When used for planting, crowned trees, one or two years old with normal or anticipated branches, the spring at the time of dismantling, choose 3-4 branches (snakes) evenly distributed in space at a distance of 10-15 cm between them, for the first floor and an extension branch of the central axis that shortens if it exceeds the length of 60 cm and is subordinated to the axis.

When in the crown design area we have well-developed branches to choose 3-4 branches to form the floor, but the extension of the central axis is vigorously developed and unpaved with anticipated branches, it shortens to 20-25 cm above the plane cutting the branches from the floor. Depending on the growth force, the central axis is cut in half or one third of the length (Babuc et al. 2015).

The disadvantages of this powerful shortening are the formation of vigorous shoots at the top, those below will be shorter, and the lower part usually remains unobstructed. Next, the vertical help branches from the shaft or by transfer cuts to a lateral branch with the required position are suppressed. Thus, the accumulated organic mass in the photosynthesis process is eliminated, the entry of the trees on the fruit is delayed, which denotes the insufficient efficiency of shortening the branch of the central axis extension.

Central shaft imitated during spring. If the shaft of the tree is too vigorous without branches, the extension of the shaft is suppressed to a lower branch, which tends vertically, above the last branch of the group chosen for the formation of the first floor (Ghena et al. 2004).

Shortening the vigorous shaft to a lower branch presents difficulties in steering the trees upright, it delays reaching the optimum height for the designed crown and as a result the productivity of the trees decreases.

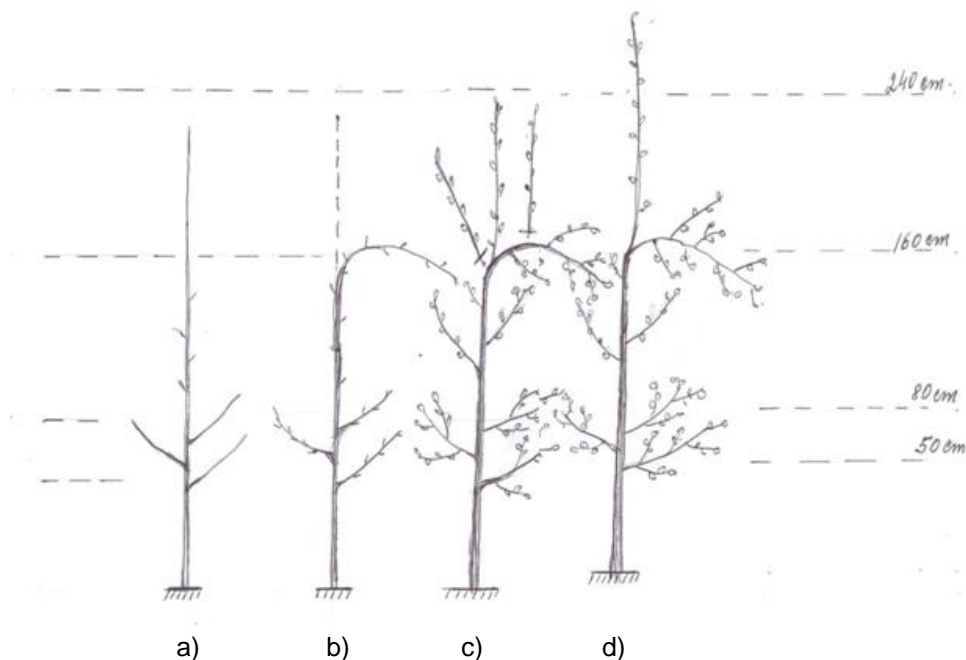
The essence of the process of forming the slender spindle-shaped crown of the apple tree. The driven trees according to the invention have a small trunk of 0.5-0.6 m and a well developed shaft, high of 3-3.5 m, uniformly lined with semi-skeletal branches and fruit branches, predominantly with an oblique position to the horizontal, decreasing their force from the base of the crown to its tip.

Central axis driving through by arching is used when the shaft is strong, unobstructed, and the branches on it are poorly developed. In this case, the shaft does not shorten, but is driven by arching. In the spring, at break-up, the tree binds in an arched position, either by wire or the other tree. The place of the bending remains ascending, and the inclined branch becomes descending. The buds from the curved area emit vigorous shoots, and the buds from the descending area form fruit branches, which differentiate floral buds.

From the shoots appearing on the shaft, a central shaft extension shaft is selected, which tends to the vertical and is allowed to grow freely, with the cutting of the vertical shoots at the ring reaching their length of 20-25 cm, fixing the extension shaft in an upright position, in July. The arched shaft, garnished with fruit-bearing branches 2-3 years, is then cut to the stem.

The purpose is to trim the shaft with vigorous annual growths and fruit branches in the descending area.

The result of the invention allows the formation of conical and narrow crowns, with a vertical central axis, weakly curved and well trimmed with a single level of semi-skeletal branches and fruit branches, which decrease in length from the base to the top of the tree using rational photosynthesis products and early entry of the trees on the fruit.



The present invention is explained by the following figure:
 Figure. Process for training the central shaft at the apple. a) Tree planted in autumn or spring; b) The spring at the dismantling of the shaft is connected in arched form; c) When the shoots have reached the length of 20-25 cm, on the axis is chosen a shoot, which tends to the vertical, and the rest of the vertical shoots is suppressed to the ring; d) In July, the shaft of the extension of the shaft of the tree is fixed upright.

CONCLUSIONS

The central shaft drilling procedure was applied to the Granny Smith apple variety, grafted onto the M9 rootstock, and planted at a distance of 3.2 x 0.8 m.

The central axis is driven by arching when the axis is strong and unobtrusive, and the branches on it are poorly developed. In this case, the shaft does not shorten, but is driven by arching in order to trim the shaft with vigorous annual growths and fruit branches in the descending area.

In the spring, at the break, the shaft of the tree is tied in an arched position, either by the wire or the other tree. The place of the bending remains ascending, and the inclined branch becomes descending. The buds from the curved area emit vigorous shoots, and the buds from the descending area form fruit branches, which differentiate floral buds.

From the shoots sprouted on the shaft one is chosen, which tends to the vertical and is allowed to grow freely, to replace the shaft, and the rest of the vertical shoots is suppressed in the ring. The arched shaft, garnished with fruit-bearing branches 2-3 years, is then cut to the stem.

The driven trees according to the invention have a small trunk of 0.5-0.6 m and a well developed shaft, high of 3-3.5 m, uniformly lined with semi-skeletal

branches and fruit branches, predominantly with an oblique position to the horizontal, decreasing their force from the base of the crown to its tip.

ACKNOWLEDGMENT

The paper relates to fruit growing, namely to a process for shaping the slender spindle crown of the apple tree. The process, according to the invention, comprises arcuation of the highly developed trunk without branches with its fixation in horizontal position in spring in the first year after planting at the onset of the awakening of buds, selection of an extension shoot of the central axis with arched-cane pruning of vertical shoots when they reach a length of 20- 25 cm, fixation of the extension shoot in vertical position, in July

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