

## CONSIDERATION ON THE TECHNOLOGIES FOR PRUNING COMMON GRAPE VINE - REVIEW

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### ABSTRACT

*Viticulture is a basic branch, has a high coefficient of land recovery while ensuring a significant amount of raw material for the industry producing agricultural products. Grape vine is a liana type plant with strong annual growth. Therefore, annual cutting interventions are needed as well as vine vegetation support. This paper presents an overview of the current state of the dry mechanized cutting of common grape vine.*

### INTRODUCTION

In countries with advanced viticulture, the mechanization of dry pruning held the attention of researchers since 1972 and currently registers significant progress in this area, to which have contributed the international seminars held on the issue [1].

Unlike the above mentioned, in our country dry grape vine pruning is performed manually using traditional grape vine scissors.

So far, the concerns of Romanian viticulturist researchers followed the biological response of grape vine during mechanized pruning, but simulated with manual scissors in the absence of cutting machines.

Currently, ploughing, weeding, maintaining soil around the vine, plant protection, green pruning and raising the vegetation on the support systems during summer are performed easily by using machines. Also, the mechanization of harvesting grapes using mechanical detaching systems register good progress and is widespread [2].

Currently, great acuity is put on the problem of mechanized pruning. If until the mechanization of harvesting grapes it was possible to keep seasonal farm labour to ensure a consecutive harvest and dry pruning, today, during the winter months, cutting requires a big consumption of qualified manual labour, whose presence is not longer justified during the rest of the year and is therefore increasingly difficult and also affects the prices.

During the expansion of researches in the field of mechanized cutting and development of the construction of dry pruning machines, cutting tests were made to track the behaviour of grape vine at different manners of machine intervention. From the execution manner, we have the non-selective and the selective mechanized cutting.

*Non-selective mechanized pruning* is performed using cutting machines that are also called pre-cutters working in plantations tied on monoplane trellis or G.D.C. After the machine passes, the cutting worker removes all surplus wood from the stocks, leaving only the number of strings to the optimum length required.

*Selective mechanized cutting* in crenel is applied in vineyards on bilateral cordon by leaving 20 cm strings with 3-4 eyes and very short strings that are 2-3 cm tall. The following year, the crenels are offset. After 4 years of successive mechanical cutting, hubs acquire a uniform vigour throughout the entire length of the cord. This type of cutting has yielded good results in France and Italy.

The mechanization of dry cutting grape vines currently has two aspects: to ease the labour of the manual cutter while increasing work efficiency and using grape vine pruning machines.

## MATERIAL AND METHOD

### **Dry grape vine pruning (necessity, purpose, classification)**

Dry cuts are intervention on the air formations of the grape vine, removing some of the woody parts, resulting in new elements that ensure the harvest for this year and next year [3].

The main purposes aimed by viticulturists by applying cuttings are:

- Bringing and maintaining grape vine (from the liana growing shape) to an adequate crop shape that makes it an efficient and intensive exploitation;
- Creating optimum conditions for performing other maintenance works;
- Obtaining qualitatively and quantitatively increased productions that are constant throughout the exploiting of plantations. [4]

As a result of those mentioned above, dry pruning is the basic work in vineyards, serving to regulate the growth and fruition of vines by selecting the elements left on the vine and by adjusting their position and length. When carrying out the work, it is aimed to choose a leading shape, a system for cutting and a number of eyes on strings, having as effect the longevity of the plantation and also its increased profitability. [3, 5]

The cutting system is determined by the length of fructification elements remaining on the vine after cutting and can be: short, long or mixed. They have a number of advantages and disadvantages.

*The short cutting system* has as fructification element the fructification pin.

Advantages:

- Maintains fructification element at a relatively constant height from the soil;
- Favours the mechanization of works, especially mechanized pruning and harvesting;
- Reduces the cost price of production.

Through the introduction of tall and semi-tall crop shapes, this system has begun to be generalized especially for wine grapes.

Disadvantage:

Retaining only 5-10% of the formations bearing fructification and therefore partially decreasing grape production

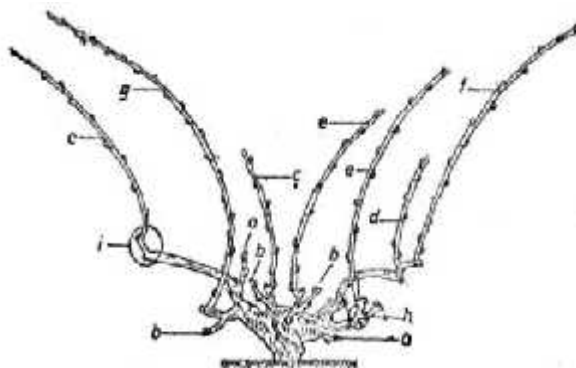
*Long cutting system* uses strings with variable lengths of 8-10 eyes (fig.). [6]

Advantages:

- Obtaining higher grape productions;
- Increasing the life duration of plantations.

Disadvantages:

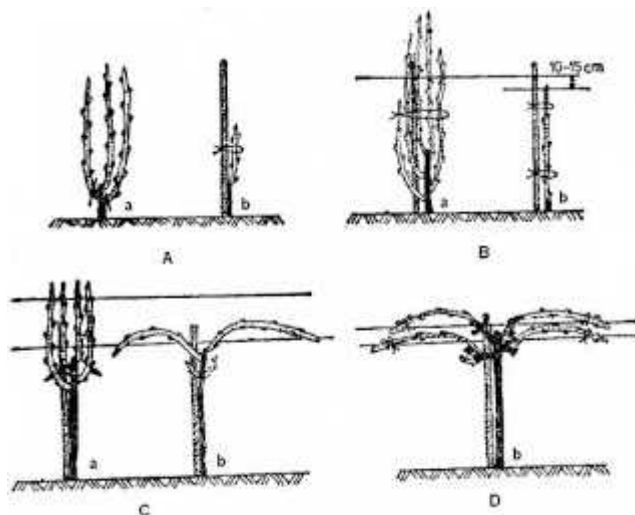
- Uneven grape maturation on strings;
- High necessity for manual work force.



**Fig.1 – Formation and fructification elements resulting from the long cutting system**

- a) Replacement pin; b) fructification pin; c) string; d) riding string
- e) short fructification string; f) average fructification string; g) long fructification string;
- h) fructification link; i) crop.

The mixed cutting system (Guyot) (fig. 2) combines the advantages of the two systems previously mentioned. As disadvantage, it requires better prepared personnel for maintenance and doesn't offer optimum conditions for applying mechanized cutting.



**Fig.2 –Guyot formation cutting [7]**  
**A) 2<sup>nd</sup> year after planting; B) 3<sup>rd</sup> year after planting**  
**C) 4<sup>th</sup> year after planting; D) 5<sup>th</sup> year after planting**  
**a - before spring cutting; b – after cutting**

Easing the labour of the manual cutter by improving the design of the grape vine shears does not solve the high consumption of labour. Thus, in Italy, for dry cutting of a hectare of grape vine with "Capovolto" tall leading shape are necessary 102 man hours / year (26.7%) of the total annual consumption [8]. In France, for this work are spent 60-100 man hours / ha for vineyards with semi-high leading shape, on monoplane trellis. In our country, for the dry pruning of a hectare of grape vine on monoplane trellis (Fig.2) are required 120-182 man hours / year for 3700 - 4800 vines.

Shortages of skilled labour and its price increase, combined with the need to reduce production costs, have led to further research into the application of mechanized cutting while speeding the introduction of various construction types of equipment for cutting grape vine in some vineyard farms in Italy, France, USA, Austria.

**Table 1**

**Classification of dry mechanized grape vine cutting machines**

Depending on the driving manner	carried on tractor	lateral between axles
	carried on bestriding tractors, in front	
	carried on self-propelled chassis	at the lower side between the axles
Depending on the type of the cutting device	with reciprocating knives (mower bars)	
	rotating disks with radial knives and counter-knife	
	circular saw type disks	
Depending on the mobility of	fixed disks cu radial knives, intercalated rotary with radial alveoli	
	with adjustable position manually	

cutting devices during operation	with semi-automated adjustment
	with automated adjustment (with feeler)
Depending on the position of cutting devices during operation	vertical
	horizontal
	inclined
Depending on the position of cutting planes	cutting in two horizontal planes and a vertical plane
	cutting in two vertical planes and a horizontal plane
	contour cutting, in two horizontal planes and in two vertical planes
Depending on the manner of evaluating the cut strings	with device for pulling and shredding the cut strings
	without device, leaving the strings on the field
Depending on adaptability	only for dry cutting
	universal – for dry and green cutting

### Theoretical contributions concerning the determination of constructive forms of rotary knife cutting devices

Dry cutting machines use two types of cutting devices:

- *With knives in reciprocating motion.* Attaching to the device for reciprocating movement of a device for pulling the cut strings, to completely eliminate manual labour after the machine passes, complicates its construction. In order to avoid the inconvenience stated above, cutting devices with radial knives are used on whose axle are fitted the additional bodies for grinding and removing the remaining cut strings;
- *With rotating knives.*

## RESULTS AND DISCUSSIONS

### Constructive types of machinery and their working process for interventions in grape vine plantations:

#### 1. P.I.Emme V. Dry cutting machine:

With the introduction of the GDC support system, double curtain amended in Genoa – Italy was achieved in 1976 **the first generation of dry pruning machine** P.I.Emme V. The machine was carried on the side of a 29.4 kW tractor, had three cutting devices counter-cutting plates, mounted on the mobile support, in vertical plane, driven by the hydraulic cylinder through the command given by the operator to the hydraulic distributor.

#### 2. Universal cutting machine:

The modifications brought to the universal grape vine cutting machines have led to the emergence of the more perfected **second generation**. On the frame of the first generation machine were fitted the three cutting bars. The fourth vertical mobile bar was provided with a palpation device and was articulated the side of the attachment support.

In the case of vines carried on counter-trellis, the vegetation forms along the row a curtain in vertical plane, also called “simple curtain”, this carrying system being very widespread in all wine-growing countries, occupying the largest part of grape vine surfaces.

The counter-trellis system presents through its structure a series of inconvenient related to the presence of fixed obstacles, tutor trellis and support wires, in the way of the machines’ cutting devices.

The working process of dry grape vine cutting machines that operate in monoplane trellis comprises the following operations:

- Performing a smooth cut without harming the string section;
- Extracting the cut strings, intercalated and naturally attached on wires through their tendrils, from the trellising system and leaving them on the ground.

Another category of machines for pruning the grape vine supported on monoplane trellis is represented by cutters with rotating blades. The actual cutting is carried out by the rotating knives. The cut strings are shredded by vertical rotors with knives mounted on folding frames, driven by the hydraulic cylinder. On the frame of the machine fixed laterally on the tractor is mounted the parallelogram frame. The cutting assembly works with two vertical rotors, on each side of the row of grape vines and is mounted through a tilting head on the articulated parallelogram. [9]

### **3. “Trimmer” simplified universal machine**

In the Department of Viticulture at the University of Bologna was designed and built the **“Trimmer” simplified universal machine** at the end of 1993. It was carried in front of the 30 kW tractor, it had three cutting devices and operated in vineyards sustained on monoplane trellis as well as on the double GDC curtain. The machine frame with vertical sliding holders support the vertical cutting bar and the horizontal bars. The position of cutting bars in relation to the horizontal vine cordon, respectively the length of cut strings remaining on the cordon is adjusted by modifying the position of supports and cutting bars. Adjustment of the assembly with cutting bars position related to the cordon is done during operation by the means of the hydraulic cylinder through the command given by the operator [10].

### **4. “Pellenc” dry cutting machine supported on monoplane trellis**

In France, Pellenc Company, which has an importance place in the construction of machines for viticulture produced a dry cutting machine supported on monoplane trellis, from an original design, both by the manner of construction but also by the type of cuttings performed. At a single passing are performed: dry cutting, fragmenting strings remaining on the trellis and leaving them on the ground, in tall vineyards, on bilateral cordon. [11]

### **5. „Binger PR-33”: dry cutting machine on monoplane trellis**

PR-33 dry cutting machine on monoplane trellis built by Binger Company is carried on the tractor. The machine is comprised of a support on which are mounted two vertical rotors driven by hydraulic motors. [12]

### **6. Dry cutting machine for plantations with “free cordon” support system**

Ever since the 80s, Italian researchers have initiated research to achieve a new system for supporting and leading grape vine, which offers advantages in terms of simplification. For these cuts were built two types of machines, Pruner model, mounted on a Trinova self-propelled straddling chassis and the Trimmer universal machine with multiple bars, carried in the front part on a series tractor.

### **7. Dry cutting machine for plantations without support system**

In some wine-growing countries, especially in France there are vineyards in exploitation that have low leading, in the shape of shrubs or bushes, without support or trellis, type gobelet. In these plantations, dry cutting is performed using SCEMAP – France type machines, carried on the hydraulic linker of a straddling vineyard tractor and driven from its PTO.

## **CONCLUSIONS**

In order to give Romanian viticulture the important role back that it has occupied through its tradition, is imperative that through a legal system to be supported as rapid and effectively as possible the small viticulturists to purchase tractors and the necessary equipment, at an affordable price cost. Also, for companies that have large areas of vineyards it is primarily necessary to modernize the system of machinery used for

viticulture. This way, Romanian grape vine growers will be able to produce grapes and wines in competitive conditions.

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