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STUDY ON NEW MECHANIZED HARVESTING TECHNOLOGIES IN VINEYARDS

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Abstract: Based on the needs of a constantly growing industry, researchers have been working on the development of vineyard mechanization in order to maintain the fruit quality and a good efficiency in the aspect of time, economy and productivity in the vineyards. The present paper presents the latest technologies used in vineyard harvesting, aiming to emphasize good practices in order to promote crop quality, reducing environmental impact and raising yield productivity, but also allowing the delay of some procedures that must pe done in vineyards without consequences. Studies have shown that mechanization in vineyards can achieve benefits of cost savings from hand labor, but also time saving and healthy grapes.
Keywords: vineyard machinery, harvesting, new technologies, self–propelled, mechanized harvesting

INTRODUCTION

Traditionally, growers have used manpower in vineyards for many years. In time, after the increasing of labor expenses, the needs of an expanding business and lack of time, but also the increase of local or global competition, the commercial growers had to seek methods of mechanizing vineyards operations. Since 1960, when the first machine was used in vineyards, researchers had conducted their work in developing postharvest handling, adapting harvesters to different trellises, developing machines that mechanize canopy management practices such as dormant and summer pruning, leaf removal, shooting positioning, fruit thinning etc. The main goal is to develop systems that are able to reach every expectation of a complete mechanized process in vineyards without any loss in fruit quality and quantity. (Morris J.R., 2008)

Mechanical harvesters quickly gained popularity in vineyards for wine grapes, but also for juice grapes. During the time of a continuous growing interest, researchers investigated the post harvesting quality of mechanically harvested grapes. Based on the fact that grapes have a rapid fermentation rates with time, the industry have established a maximum six hours interval between mechanical harvesting and processing. (Morris J.R., 2008, Hays P, 2008)

In time, several new generations of harvesters have been developed. Currently there are two types which beat and shake de vine, either by means of staves beating foliage, or the impulse harvester which beats the trunk and cordon. Both aim to detach the berries. The berries are then collected on a conveyor which move past a blower that removes the leaves, where after they are dumped into a bin.

Mechanical harvesters are able to work against slopes and adjustments may be made without stopping. Three basic adjustments may be effective, namely the width between the two sets of staves (pitch), the extent of the beating action (amplitude) and the speed of the beating action (frequency). Different combinations of these three factors may be used for various vineyards. The success of mechanical harvesting is ascribed 35–40% to the harvester, 30% to the operator and 30% to the vineyard. If the canopy is not suited to mechanical harvesting, the process will not be successful. (Morris J.R., 2008, Hays P, 2008, Kaye O. 2008) https://www.wineland.co.za/mechanical–harvesting–of–grapes/)

New generation of harvester offer several new advantages such as: automatic sorting on the harvesters that presents berries without any material other than grapes, sorting of different colour berries, sorting of the grapes according to the condition of ripeness of the grapes, easy cleaning based on the fact that the success of the mechanical harvesting is largely influenced by the maintenance of the harvester. (https://www.mondomacchina.it/)

A great area of interest revolves around the mechanization of harvesting, as testified to by the continuous arrival of new features on the market. What is not new is the idea of the selective collection of the grapes on the basis of their quality, beginning with a specific map of the site. Currently, this is now possible and becoming more and more accessible thanks to the availability of optic sensors capable of detecting in real time the phenolic, or physiologically ripe grapes, that is according to the content of grapes' anthocyanins and flavonoid. The important arrival of sensors and systems for the approach of the machine to the vines is justified by the need for precision provided for work in vineyards in which driving is often made difficult by a number of factors, such as sloping terrain, narrow rows and the length of the worksite. For this reason, assisted driving has taken on more and more interest. Thanks to GNSS (Global Navigation Satellite Systems) with real time corrections (with RTK, Real Time Kinematic systems) the tractor and machine can be positioned with precision of up to a couple of centimeters. This is of importance not only for planting cuttings and setting posts but also for making and using the prescribed maps and assisting and facilitating the work of the driver, especially when driving is complicated by combined operations. In this area, an Enovitis in the Field Technological Innovation Award was given to Spektra–Agri which, in collaboration with Fendt, came up with an AutoCombiGuide drive system which automatically controls operational sequences in the field and provides the possibility of controlling the equipment while running. These features enable work to be performed for carrying out various combined operations to reduce time and labor and entries to the field to lower stress on the operator and the soil.

There are now so many technologies and solutions for improving the quality of operations. Though the spread of agricultural mechanization in the vineyard involves in various ways nearly 30% of these vineyards for grape harvesting alone, for a total of some 2,600 machines at work on nearly 15,000 hectares harvested, it is important for manufacturers' research to continue in this direction to provide increasingly competitive and convincing solutions for agriculture. (https://www.winesandvines.com/).

MATERIALS AND METHODS

Various machines are available and technology is advancing rapidly to speed up harvesting of the grapes in the case of almost all kinds of trellis systems, and to harvest more "softly" with less damage to the bunches. Bunches may already be harvested as low as 25 cm from the surface of the soil. Machines are being developed to harvest even bush vines. There are currently two types of harvesters available on the market, such as self–propelled harvesters (Figure1) and towed harvesters (Figure 2) (https://pellenc.com/).

Figure 1 – Self propelled harvester–PELLENC (https://pellenc.com/)

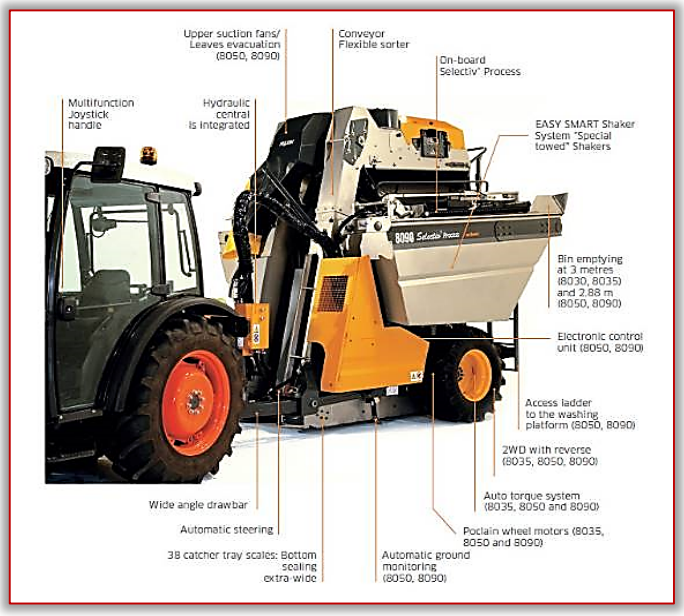


Figure2 – Towed harvester– PELLENC (https://pellenc.com/)

Many winemakers prefer grapes, especially white varieties such as Sauvignon blanc, to be harvested by hand. Much progress has been made, however, in handling berries with a softer touch. An example of this is the used of extended beaters by means of which berries are shaken off with the minimum of skin damage. Furthermore, it is a well–known fact that the quality of many white cultivars is better if the grapes are pressed cool. Therefore, night and early morning pressing by harvesting machines can even result in an improvement in wine quality.

In order to carry out the harvesting process, the vineyardists inspects the samples of grapes whit a refractometer to determinate if the grapes are ready to be picked. If the answer is positive, the process may begin.

For the best results, the harvester may be equipped with several features that ensure a good efficiency of the process, with minimal impact on the grapes.

One of the best features that such harvesters present, is the continuous harvest bin system, which allows a great working efficiency with continuous harvesting bin. The harvest can be redirected directly to gondolas, valley or macro bins by using the side discharge conveyor for long rows. (https://pellenc.com/).

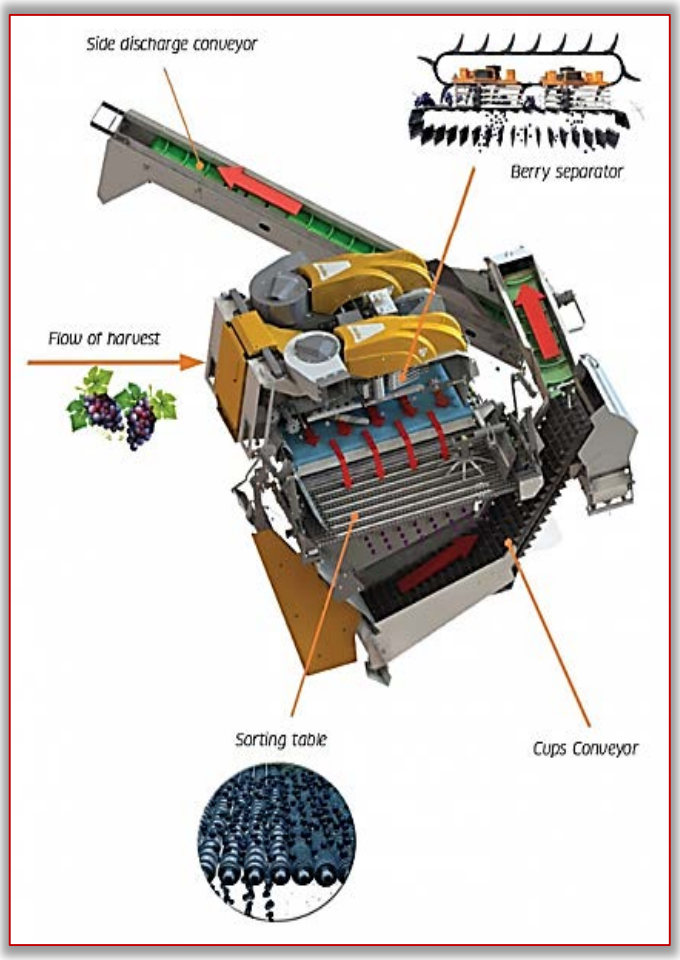


Figure3 – Continuous harvest bin system (https://pellenc.com/)

The cab is equipped with a console that allows frequency, pinch, amplitude, destemming and other settings adjustment instantly and continuous, while working, without stopping. Also, self–propelled harvesters, are equipped with position sensors that automatically align the harvesting head in the row, while an active system optimises the efficiency of shaking, without damaging the trellising and plants. The movement of the harvesting head is proportional to the working speed.

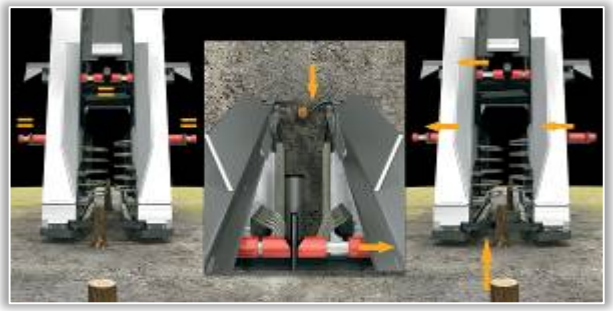
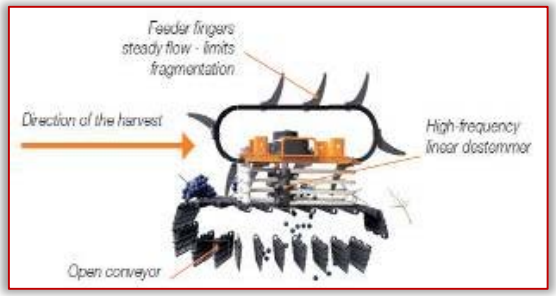


Figure 4 – Console and sensors systems (https://pellenc.com/)



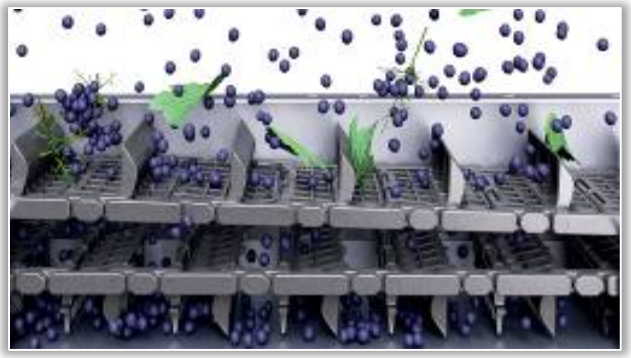


Figure 5 – Linear berry separator– Destemmer (https://pellenc.com/)

Figure 6 – Screen rollers (https://pellenc.com/)

Harvesters are equipped with selective destemming systems, with high–frequency linear berry separator, that gently removes the berries and the stems remain intact. The linear berry separator (Figure 5) has an anti–jam feature with five long fingers, while the adjustable sorting rollers can adapt to all grape varieties.

The screen rollers (1) allow the sorted berries to pass through and remove petioles and green waste. The solid notched roller feeders (2) separate small waste and route petioles to the screen rollers (Figure 6).

Another optional sorter can be added to the mechanized harvester, that allows optimal sorting of berries, whole bunches and leaves at the conveyor output. The grid belt of the sorter catches the harvest at the output of the Flexible Sorter Conveyor. Juice and berries pass directly into the bins.

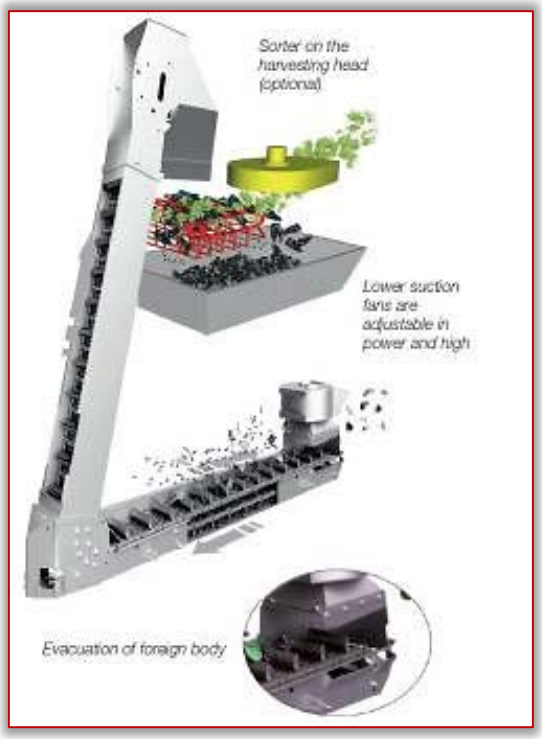


Figure 7 – Sorting and cleaning system (https://pellenc.com/)

RESULTS

Most of the harvesters, have a great efficiency, with 99.82% of cleanliness rate in the bin, and 82% of good berries, 100% of leaves are removed as well as 95% of whole stalks, the sorting table consists of a series of feeder rollers that distribute the berries on the sorting table, and aligns waste to evacuate it, thanks to the selective process. Only grape clusters and leaves pass under the lower suction fans, less than 30 % of the harvest. (https://pellenc.com/)

Figure 8 – Vineyard after harvesting (https://pellenc.com/)

CONCLUSIONS

With all the features available in the latest generations of mechanical harvesters, the whole system of harvesting and vinery crush pad, is basically operating on wheels. Most of the machines are equipped with on–board destemming and sorting. Some machines, are now standardized with destemmers and sorting systems, while others offer optional add–on equipment Harvesters can be towed by a tractor, or self–propelled. With an efficiency of 99.82%, the ability to pick any date for the harvesting process, but also with the advantage of working during night, the cost of the harvesters is worthy. Time saving, less human power, good efficiency represent the key factor in implementing mechanized equipment and good practices in vineyards, especially for mass production and large surfaces of vineyards.

Acknowledgement

This work was funded by the Romanian Ministry of Research and Innovation, "SECTORIAL Program", (Contract no.3PS/02.11.2017 "Research to support the development of the capacity to assess and mitigate the impact of climate change and other stress factors on the state of forest ecosystems and wine–growing").

Note:

This paper is based on the paper presented at ISB-INMA TEH' 2018 International Symposium (Agricultural and Mechanical Engineering), organized by Politehnica University of Bucharest – Faculty of Biotechnical Systems Engineering (ISB), National Institute of Research-Development for Machines and Installations Designed to Agriculture and Food Industry (INMA) Bucharest, The European Society of Agricultural Engineers (EurAgEng), Society of Agricultural Mechanical Engineers from Romania (SIMAR), National Research & Development Institute For Food Bioresources (IBA), University of Agronomic Sciences and Veterinary Medicine Of Bucharest (UASVMB), Research-Development Institute for Plant Protection (ICDPP), Hydraulics and Pneumatics Research Institute (INOE 2000 IHP), National Institute for Research and Development in Environmental Protection (INCDPM), in Bucharest, ROMANIA, between 01–03 November, 2018.

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ISSN: 2067-3809