# OPTIMIZATION OF THE HARVESTING WORKS IN AGRICULTURE

## OPTIMIZAREA LUCRĂRILOR DE RECOLTARE ÎN AGRICULTURĂ

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**Abstract.** *Harvesting the agricultural products from horticulture is a part which complete and finish the agricultural production process, of all the producers actions, of all the material efforts involved in work process, to create material goods.*

*Harvesting machines are one of the most complex and expensive units and have as a characteristic the fact that in their componence could be found both mechanisms and special working organs to execute some particularly technologic operations of the harvesting process of a certain product, and also many auxiliary technical systems: energy source; moving or auto-moving systems, action system (mechanic, hydrostatic, electric, mix); adjustment control and automatization systems.*

**Rezumat.** *Recoltarea produselor agricole din horticultură, constituie completarea şi închiderea procesului de producţie agricolă, a tuturor acţiunilor producătorului, a tuturor eforturilor materiale investite în procesul muncii, în scopul producerii de bunuri materiale.*

*Maşinile de recoltat sunt printre cele mai complexe şi mai costisitoare şi au caracteristic faptul că, cuprind în componenţă atât mecanisme şi organe de lucru speciale pentru executarea operaţiunilor tehnologice particulare procesului de recoltare a unui anumit produs, cât şi o multitudine de sisteme tehnice auxiliare ca: sursa energetică; sistemul de deplasare sau auto deplasare; sistemul de acţionare (mecanică, hidrostatică, electrică, combinată); şi sistemele de reglare, control şi automatizare.*

## MACHINES FOR GRAPE HARVESTING

There are two different types of technologies:

- semi-mechanized harvesting technology;
- totally mechanized harvesting technology.

**Semi-mechanized harvesting technology.** The detachment of the grapes from vineyard cords is made by hand, and mechanized, is made the transport of the grapes among rows, the transport inside vineyard and the transport to the proceeding and prepacking stations.

**Totally mechanized harvesting technology.** Is applied only to the grapes for wine, the detachment of grapes is done mechanized and also grape collecting and their transport among rows is mechanized.

Function of the done operations, the machines used for grape harvesting are divided in the following groups:

- units for grape harvesting and grapes transport inside vineyard;
- machines for grape harvesting

**Units for grape harvesting and grapes transport inside vineyard:**

- machines with transversal conveyer;
- machines with sided elevators;
- installations with collecting belts;
- collecting and transporting aggregates with semi-carried trailer or with carried containers.

**Machines for grape harvesting. Classification criteria based on function principle:**

- machines for grape harvesting by cutting;
- machines for grape harvesting by aspiration;
- machines for grape harvesting by shaking.

***Machines for grape harvesting by cutting*** are used only at the grape sorts with long peduncle and in plantations settled up in horizontal pergolas, so the bunches to be under the support wires of the cords. The main working organ is a cutting device which has a knife with an alternative-line up movement. The cut bunches, fell down in a stopper collector, and from here are passed by an elevator in a trailer.

***Machines for grape harvesting by aspiration*** are made by 2-4 aspiration fittings carried by hand and connected through flexible hoses to a depression chamber connected to an exhauster. Harvesting the grapes is made after the chemical destroy of leaves was made.

***Machines for grape harvesting by shaking*** are based on two principles:

- pneumatic shaking;
- mechanic shaking.

*Machines for grape harvesting by pneumatic shaking* have as the working organ, ramps with air nozzles placed on the both sides of the row. Nozzles have an alternative movement and send the air jets under pressure to the cords with bunch. The grapes fall into a collector and are conducted to a separation cyclone for leaves and from there in a collecting trailer.

*Machines for grape harvesting by mechanic shaking* have as the working organ metal convertible ramrods (around 5200 pieces) which have an alternative movement in horizontal plan with a frequency of 500 races per minute, or in according with figure 1, with pendulous stems which execute the beating of cords and bunches.

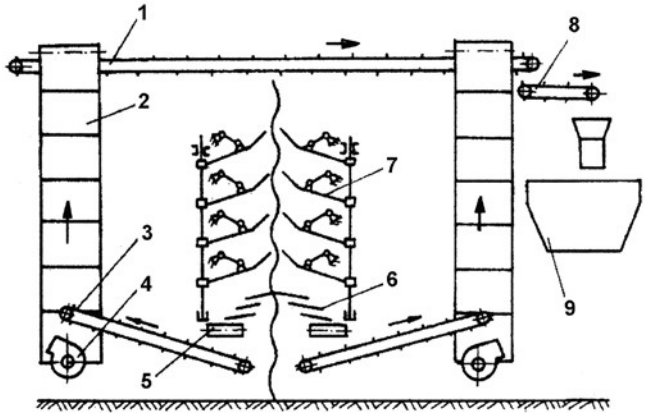

Figure 1. Machine for grape harvesting by mechanic shaking

The figure presents: beating stems (7), grape catching boards (6), longitudinal belt conveyers (5), elevators (3), cleaning fans (4), grape elevators (2), transversal conveyer (1), unloading conveyer (8), collecting trailer (9).

The stems rotation is 400-500 rot/min. The machine is carried on a 50 kW straddling tractor, working speed is 1.5-2 km/h, and the harvested surface is around 0.3-0.5 ha/hour.

## MACHINES FOR FRUIT HARVESTING

Fruit harvesting is the most expensive operation from the whole production cycle.

**Demands**: harvesting degree must be over 98%;
fruit blight degree to be under 10%;
trees blight degree to be under 2%;
fruit losses to represent less of 0.5%.

The machines used during the process of fruit harvesting are divided, in according with their functions, in:

- auxiliary units;
- supporting and transporting units;
- machines for fruit detachment from trees;
- devices for fruit capturing;
- complex machines for fruit harvesting.

***Auxiliary units*** are used in the case of fruits hand harvesting and are staircases and platforms. Staircases and platforms have a tripod or sledge form, to have good stability and to be easy to carry among trees.

***Supporting and transporting units*** also named harvesting platforms could be: carried, worned and self propelled. Could have one to eight working places. After the position of working places could be: platforms with stable working

places (figure 2A) and platforms with mobile working places (figure 2B). The shaft of working places could be up to 8m on horizontal and 14m on vertical.

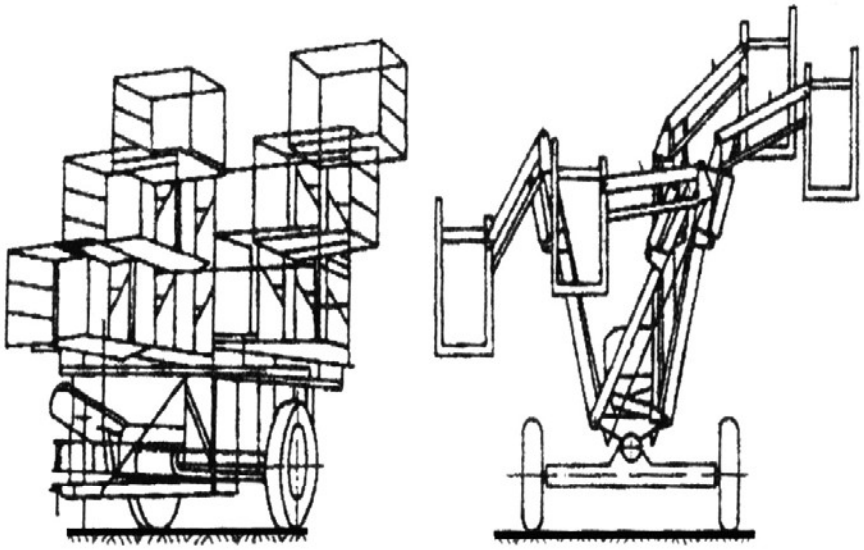

Figure 2 - Supporting and transporting units:
*2A* - platforms with stable working places; *2B* - platforms with mobile working places.

***Machines for fruit detachment from trees.*** After the way in which the oscillations are produced, fruit shakers are divided in:

- mechanic shakers;
- pneumatic (or with shock) shakers.

The most outspreaded are the ***mechanic shakers***, because assures great shaking forces, oscillations with high frequency and low amplitudes, but an disadvantage is that produce a serious damage of the tree bark in the place where it is hanged.

*Pneumatic (with shock) shakers* have a small productivity and could be: light or weight.

The light shakers are made of: oscillations generator, shaker body, shaker arm, supporting handle.

*Weight shakers* are carried on a tractor, self propelled chassis or with a self drive wheels. Pneumatic cylinder have at an end a shock absorber and through it the shock is transmitted to the tree stalk with a frequency of around one beat per second.

***Inertial shakers*** (figure 3) have telescopic arm with an alternative-lined up movement, oscillations frequency is between 3-16.5 Hz.

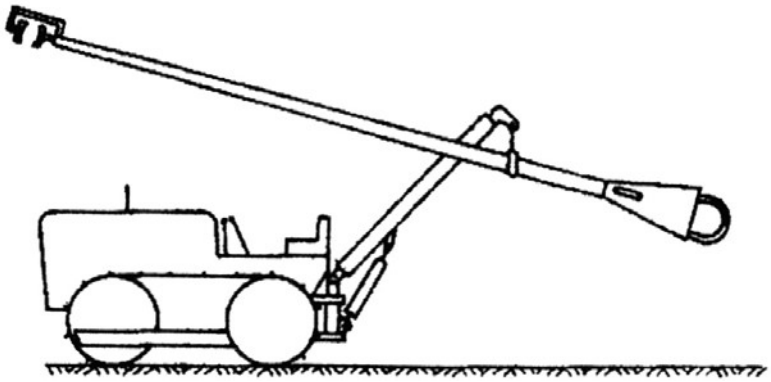

Figure 3 - Inertial shaker

In figure 4 it is presented the scheme of a shaker with a rod connecting-crank mechanism formed by: hydraulic action engine (1), fly wheel (3), bearing crankshaft (4), ball (5), knuckle (6), arm (7), stem (8), arc (9), piston (10), mobile jaw (11), fixed jaw (12).

Pneumatic shakers made fruit oscillation and their detachment by a direct action of the air stream on each fruit.

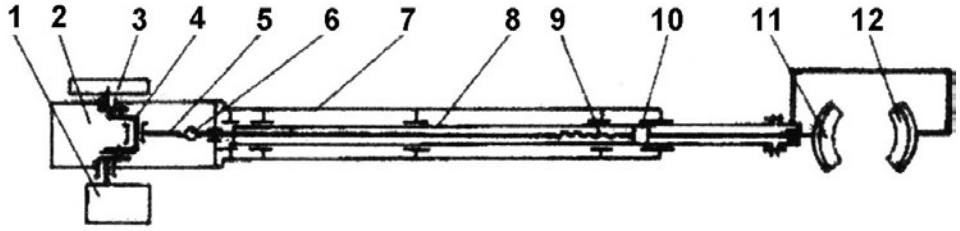


Figure 4 - Scheme of a shaker with a rod connecting-crank mechanism

***Fruit picker by aspiration*** is done by a vacuum generator connected to a fruit collector well closed and provided with 1-4 flexible tubes equipped with nozzles.

***Devices for fruit catching.*** Catching areas used at fruit harvesting are of many types:

- fabric hanging tarpaulin;
- fabric tarpaulin with elastic bands for amortization;
- elastic surface with amortization bands;
- elastic curly surface with amortization bands;
- conveyor belt, conveyor belt with amortization bands;
- elastic surface with blades.

***Catching platforms*** could be fixed type (provided with supporting legs which can be put on soil and with adjustable height) and mobile type (carried or self propelled).

**Devices for fruit catching**

***Combined fruit harvesting machines*** can do the main operations of the harvesting process: fruit detachment, catching, cleaning and fruit collecting.

In figure 5 it is presented the scheme of a machine with inertial shaker and conic collector formed by: catching thumbscrew (1), vibrations generator (2), hydraulic cylinder (3), stem (4), conic collector (5), pipe (6).

For the pneumatic transport, exhauster (7), commanding hydraulic cylinder (8), fruit separation chamber (9), and unloading hole (10).

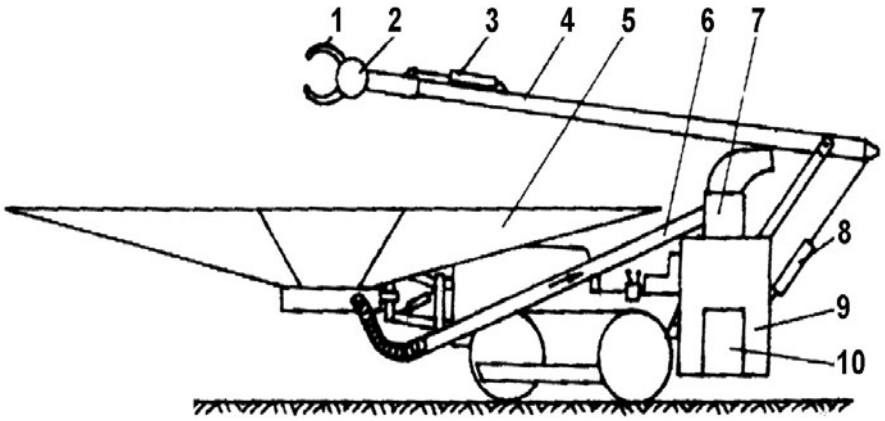


Figure 5 - Machine with inertial shaker and conic collector

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