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**THE METHODS OF RESEARCH FOR MECHANICAL  
SORTING AND SIZING SYSTEMS**

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**Abstract:** *The potato tuber is vital systems at witch's properties are dependent on the specific structure and technological aspects. After harvesting, as to obtain only whole and healthy potatoes, it is applied the sorting operation. For groups of utilization, potatoes are then sized. All this technological flow from harvesting to sorting and sizing is very important and the critical aspect is weather to avoid or reduce mechanical damages.*

**Keywords:** *potatoes, harvesting, sorting, mechanical damages.*

## **1. INTRODUCTION**

Potato (*Solanum tuberosum*) is an annual ryegrass plant that multiplies by the tubers. The potato tuber is an underground thicken stem. The tuber is formed by the thickening of the final part of stools, at the beginning with the shape of a pear that becomes round, oval – round or long, depending on the variety [3]. The potato shape is an individual characteristic that depends on the variety [2].

The potato tuber has an upper part, that is bellied (the coronary or the apical part), that has the final bud and the inferior part, that is also called the umbilical part. The potatoes' eyes represent the rudiments of the springs [2].

The potatoes' jacket, shallow or thick, even, rough or netlike, may be of white color or yellowish, rose-pink, with yellow blurs, depending on the variety and species. Although, the basic color is white [2].

Anatomically, the tuber is formed by three parts: the epidermis (the shell), the vascular ring and the marrow (the central cylinder) [2].

The forming tuber is coated by a thin membrane (the epidermis), that exfoliates when reaching the maturity and being replaced by the periderm. The thickness of the periderm is different, depending on the potato variety, the number of batches of cells varies between 9 and 17 [2].

The harvesting of potato has the role of eliminating the main foreign bodies from the selected mass that contains potatoes, soil and mineral and vegetal residues [1].

The sorting of potatoes has the role of eliminating, in a great measure, the remaining foreign bodies and separating them from the healthy potatoes [1].

## **2. METHODS FOR THE SCIENTIFIC RESEARCH**

### **2.1. Active organs of the machines for sorting and sizing**

The mechanization of the harvesting involves the following operations:

- the separation of tubers by the stalks and leaves;
- the soil separation;
- the keeping of a predefined deepness for the harvesting process [1].

For the accomplishment of a qualitative sorting, it is necessary that the harvesting of potatoes to be done as the final mass to contain as less foreign bodies as possible. For that reason, there are used active organs for harvesting and separating.

Taking into account that from the total mobilized mass, only at about 1,5% is represented by the potatoes, this active organs have an important role and that is to separate the healthy and qualitative corresponding from the rest of the foreign bodies [1].

The active organs for the separating of potato tubers from the foreign bodies may facilitate the process of sorting, because they carry out the first separation [4]. These may be:

- The carrier with wands (Figure 1): it carries out the decomposing of the material, respective the downsizing of the thickness of the material on the active branch [4].
- The carrier with oscillating sieves (Figure 2): due to the movement of the material in bounces, it is realized the separation of the soil fractions that fall through the sieve [4].
- The sorting tables (Figure 3): the separation of the soil clouds and rocks is done manually. There are used 1...3 separation carriers, that have on each side platforms for the operators [4].

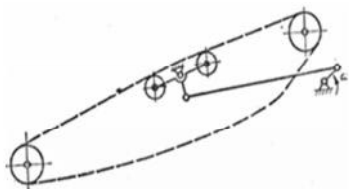


Figure 1: The carrier with wands [4]



Figure 2: Oscillating sieves [4]

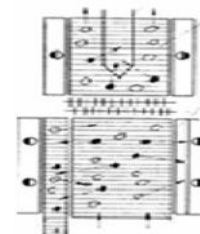


Figure 3: The sorting table [4]

All of these types of transporters are not productive, as their construction is provided for simple construction and easy auctioning, both as facile maintenance.

## 2.2. The potato harvesting and the mechanical damages

The phenomenon of mechanical damage of potato tubers is caused mainly by the brutal manipulation at the harvesting, transportation, but both during the storage process [6].

The most important aspects of potato harvesting, that have an influence upon the sorting process are:

- the gaining of a good degree of separation of potatoes from the rest of the foreign bodies;
- the reducing as possible of the degree of mechanical damage [6].

Table 1: A classification of potatoes mechanical damages [6]

No. crt.	Type of mechanical damage	Manifestations
1.	Exterior, great exterior	<ul style="list-style-type: none"> <li>• impacts;</li> <li>• peel bruising;</li> <li>• cracks of 3 mm;</li> <li>• breaks of the pulp from 5 mm or bigger than 5 mm;</li> <li>• cracks by the length of 20 mm and over 20 mm;</li> <li>• cuts and crushes.</li> </ul>
2.	Interior, great interior	<p>The browning of the pulp:</p> <ul style="list-style-type: none"> <li>• till 3 mm;</li> <li>• from 3 mm to 5 mm;</li> <li>• from 5 mm to 10 mm and over 10 mm.</li> </ul> <p>The damage of the potato jacket on a bigger surface.</p>
3.	Direct	Done by the sorting machines and may be cuts or crushes.
4.	Indirect	Done by the bumping of the tubers by different parts of the sorting machines, but mainly by the soil clods.

There are some aspects of the potato harvesting process that may influence the second operation, the sorting and both the sizing. It is well known that potatoes are very sensible at the environmental factors and both manipulations all over the technological flow of processing [6].

Taking into account the fact that potatoes are harvested using mechanical systems, mainly active organs of the harvesting machines, the mechanical damage is very susceptible to appear in this case [6].

Although the potato mechanical damages during the harvesting and also the sorting, is an inevitable phenomenon, there should be taken all the measures as to reduce them [6].

The potato harvesting machines have to be arranged and maintained on all the period of harvesting and sorting, in the limit of the parameters for which they have been constructed [6].

There are three types of damages that may be produced, mainly at the harvesting:

- Potato's peeling (Figure 4): caused mainly by the manipulation of immature potatoes. The thin jacket is being grazed or burnished and that areas became darkened, as both being exposed to the wind, sun or the hot air [6].
- Black-spot bruising (Figure 5): it is produced under conditions of excessive heat and arid soil [6].
- Shatter bruising (Figure 6): it is represented by rare cracks at the level of the potatoes' jacket [6].



**Figure 4:** Potato's peeling [6]



**Figure 5:** Black-spot bruising [6]



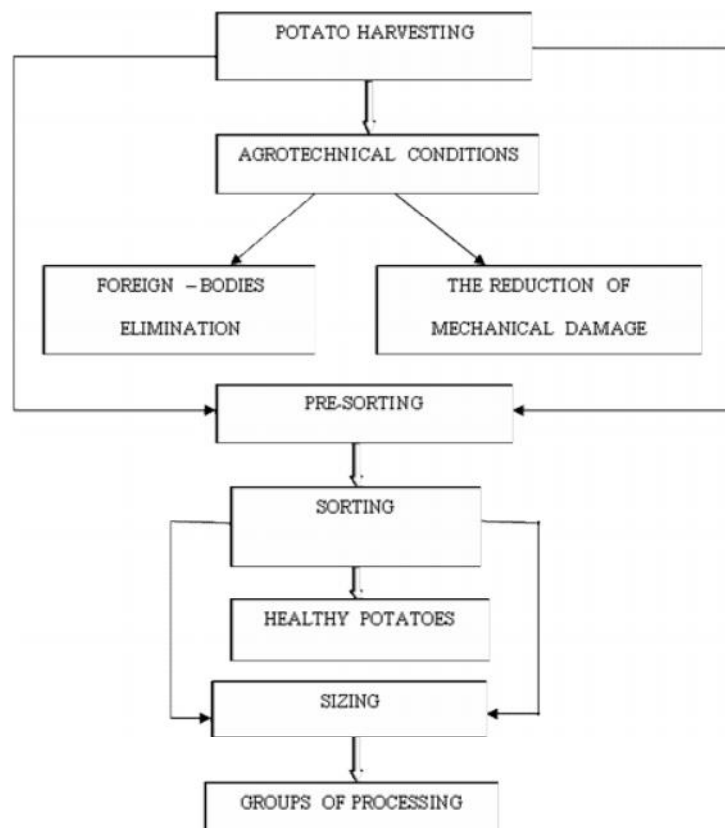
**Figure 6:** Shatter bruising [6]

Methods for reducing mechanical damages:

- cultivating potatoes on light soils;
- the optimization of the soil preparation technology;
- the use of vibratory dislocation active organs;
- the coating of the machine's sieves in rubber;
- the movement of the tubers without rolling them;
- the reducing of the height from which potatoes fall;
- the harvesting at adequate temperatures and humidity of soils;
- the situating of some parameters like the volume of potatoes and the capacity of processing them;
- the keeping of the carriers full with potatoes [6].

### 2.3. The bond between the harvesting, sorting and sizing

It is presented an original logical scheme for the processes of harvesting, sorting and sizing (Figure 7).



**Figure 7:** The technological flow harvesting – sorting – sizing

The sorting and sizing have as main goal the separation of the products. Both of these operations take part from the conditioning process. Taking in to account their common goal, in the literature of specialty, these are presented sometimes as synonyms.

The difference between sorting and sizing consist mainly in the criteria by which products are separated, so sorting is done mainly after the exterior aspect and the sizing is done after the sizes and the mass of the products.

#### **2.4. Sorting and sizing machines**

The sorting and sizing machines execute the processes in case after the linear dimensions of the potatoes (length, largeness and thickness), on active organs with appropriate shapes with the ones of the sizing calibers [5].

The sorting machines are composed by some devices that execute the following operations:

- potato sorting;
- the eliminating of the foreign bodies;
- the selecting of the altered and damaged potatoes [2].

There are also other machines or devices that do auxiliary operations, like:

- the employing of potatoes on the active organ for sorting;
- the transport of the fractions of sorted potatoes;
- the packaging of the sorted potatoes [2].

There are machines that do sorting and sizing and others that do only sorting or sizing, after the case.

### **3. CONCLUSION**

The active organs for separating are used at the harvesting, with the role of eliminating the foreign bodies and also do a pre-sorting.

The potatoes have to be extracted from the soil, with less as possible fragments of soil and unharmed.

The most important aspects in the technological flow of harvesting, sorting and sizing are the degree of separation and the reduction of mechanical damages.

The maintaining of the qualities and the reducing of the loosed at storing depend on the reducing of the mechanical damages at harvesting – transport – conditioning.

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