Engineering

METHODS USED IN PREVENTING MECHANICAL DAMAGES AT POTATOES

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ABSTRACT:
POTATOES ARE AGRICULTURAL PRODUCTS THAT ARE SENSIBLE TO AMBIENTAL FACTORS AND MANIPULATIONS, THUS TO MECHANICAL DAMAGES. THIS PAPAER HAS THE ROLE OF HIGHLITHING THE MAIN ELEMENTS FROM THE TECHNOLOGICAL FLOW OF HARVESTING, SORTING AND STORING OF POTATOES THAT MAY HAVE AN INFLUENCE ON THE APARITION AND EVOLUTION OF THE PHENOMENON OF MECHANICAL DAMAGE. THERE ARE BEEING STUDIED ANALYTICALLY THE TIPES OF MECHANICAL DAMAGES AT POTATOES, ASPECTS OFTEN SEEN IN THE AGRICULTURAL PRACTICE USED WITH THE ROLE OF AVOIDING DAMAGES OR REDUCING THEIR DEGREE OF EXERCISING, AS BOTH MODERN TECHNIQUES FOR THEIR IDENTIFICATION ON THE TECHNOLOGICAL FLOW AND IN THE LABORATORY.

KEY WORDS: POTATOES, TECHNOLOGICAL FLOW, MECHANICAL DAMAGES, AGRICULTURAL PRACTICE.

1. INTRODUCTION

It is known the fact that potato tubers are agricultural products sensible to ambient factors and manipulations, thus mechanical damages. Potato are harvested and sorted mechanically, thus mechanical damage could be found often.

It is important to differentiate mechanical damages from the harvesting process from the ones at sorting. Although potatoes mechanical damage is an inevitable process, there should be taken all the measures to reduce it as much as possible.

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2. METHODS USED IN RESEARCHING THE TECHNOLOGY OF REDUCING MECHANICAL DAMAGES AT POTATOES

2.1.Types of mechanical damages at potatoes [3]

Internal damages, that are also named black spots or internal black spots are not to be identified by the simple visualization of potatoes surface. These types of damages appear under the potatoes' skin and may be identified only by removing it or by making some sections inside the potatoes, to observe the faded zones.

Internal black spots appear as a consequence of the impact between tubers and a harsh and rigid surface, respectively specific zones of potatoes harvesting and sorting machines. Black spots appear as small, black and oval surfaces, placed under potatoes skin. When potatoes are undertaken to thermal processing, this spots become deep and dark, on the border of the processed products, as for example potatoes chips.

The potatoes discoloration appears as following a specific reaction of multiple breaking of the cell walls and the liberation of a specific compound, named ethylene.

In all cases, the discoloration or the blacking of potatoes are phenomenon that may be explained by the developing of a compound named melamine, a natural pigment that is also present in the human bodies and is responsible for the bruising of the muscular tissues.

Potatoes that have a higher content in dry matter may be more susceptible to mechanical damages; also harvesting potatoes when the soil is not dry may contribute to minimizing the unwanted effect of mechanical damages[3].

2.1.1. Pressure bruises [7]

Pressure bruises (Fig. 1) appear at potato tubers situated beneath the bulk, as a consequence of the force applied by the other potatoes, situated above. Thus, it is very important to establish an adequate size of the potatoes bulk and also to assure a high relative humidity of 90%.

Also, the breeds of potatoes that have a smaller content of dry matter are more susceptible to pressure bruises.

The harming of potatoes through pressure is marked as an unpressured, darkened and swallowed zone that has a circular shape, on the surface of the potatoes and has the approximate dimensions of 0,5 cm…1 cm in the diameter and the deepness of 1..1,2 cm.

These types of bruises have an evolution in time regarding the area of the affected zone and may arrive in time in a cavity. This phenomenon is not favorable upon the commercial aspects and may be decimated before the introduction of the potato production on the market[7].

2.1.2. Cracks [6]

Potatoes cracks (Fig. 2) are manifested by the breaking of the epidermis and periderms, as a cause of harsher impacts, as some falls from heights greater than 10...15 cm, as following kinetics or by the storing in bulks.

Cracks may be observed as small points that evolve from the impact point and may be also caused by some diseases. The tubers that are much hydrated are the most susceptible ones.

Tubers with high specific mass or the ones that have a greater content in dry matter are more sensible to the appearance of cracks. Also, potatoes that have cracks on their surface are more vulnerable to the appearance of different types of diseases[6].

2.1.3. Damages through peeling [5]

The abrasion of potatoes skin is produced by the impacts with blunt, abrupt or irregular surfaces, as also with sides of the technological equipment for harvesting, sorting or storing.

The peeled areas of the potatoes become darkened after a short period of time, that can make the tubers unable to be marketed and may cause pathogen entrance and humidity dissipation.

The main factor that contributes to the appearance of potato peeling is the incomplete maturity of potato tubers at harvesting[5].

2.1.4. Cuts [4]

Cuts result as a result of interaction between potatoes and sharp objects and it manifests both on the surface and on the interior. Depending on the object that gets into contact with potatoes, there may appear continuous cuts, without signs of strokes.

The most severe form of cuts appears after the technological processes when tubers are moving. While mechanical harvesting takes part, cuts appear because of the processes of elevating from the soil and lifting for transportation.

More than that, it is important to adjust the blades from the equipment of harvesting, so that they won't cut the tubers when are being used. So, the blades of the harvesting machines will be placed beneath the mass of potato tubers that will be undertaken [4].

Fig. 1 Pressure bruises [7]

Fig. 2 Cracks [6]

Fig. 3 Peeling [5]

Fig. 4 Cuts [4]

2.2.A SYNTHESIS OF SOME RECOMANDATIONS FROM THE AGRICULTURAL PRACTICE FOR THE REDUCTION OF MECHANICAL DAMAGES AT POTATOES

There were identified some factors that may influence the process of mechanical damages at potatoes [1].

- **The speed of harvesting potatoes**

The mechanical damages are less expressed when the elevators are full with potatoes. Although the enhancing of the speed for the harvesting process will rise the flow of tubers and will reduce the degree of damages.

- **The reduction of the heights of dropping**

As potatoes drop from a higher altitude, the potatoes will become dark in the place of fall and the damages will evolve to the apparition of some crushes.

It was determined that a layer of rubber that covers the metal parts of the machines that harvest and sort potatoes considerably reduces the degree of mechanical damages. Considerably damages may result when potatoes will drop from heights greater than 40 cm.

- **Types of bodies that potatoes get into contact**

The impact between potatoes is less damaging than the one between tubers and different parts of the agricultural machines.

- **The agro technical conditions**

The humidity of the soil at harvesting may be between 60...80 % and tubers may have between 12...18 ^{o}C at harvesting for as mechanical damages to be lower as possible[1].

Table 1 – Synthesis of the technological factors for the reduction of mechanical damages [1]

No.	The factor useful in the reduction of mechanical damages at potatoes	Means of reducing mechanical damages at potatoes
1.	The speed of harvesting	Enhancing
2.	The drop heights of potatoes	Reducing
3.	The contact surfaces with the tubers	Reduced hardness
4.	The agricultural and ambient factors	Monitoring

2.3.CURRENT METHODS USED IN THE LABORATORY FOR THE IDENTIFICATION OF MECHANICAL DAMAGES AT POTATOES

In the laboratory technique there are especially used two techniques for identifying mechanical damages at potatoes. Their role is to find some means of preventing or reducing the phenomenon of mechanical damages at potatoes, after the identifying and establishing the degree of intensity for the damages[3].

- The *catechol* test

This test is especially used for the identifying and quantifying exterior damages, that are peeling, cuts and cracks.

Catechol is a polyphenol that reacts with the enzymes that produce the damages, transforming these zones is dark red.

Testing procedure:

- it is being sampled a pattern constituted by 10 tubers with the mass of approximately 2 kg and it is washed from soil and other remaining;
- tubers are immersed for 1 to 5 minutes in a catechol solution of 1,5 % concentration, along with a soap solution, that may reduce the superficial tension;
- the liquid of testing is being emptied and samples are left for 1...10 minutes to develop the specific color[3].

- The *tetrazolium* test

This test is specific for the determination of black internal spots or brown spots.

Testing procedure: tubers are softly washed and dried and are introduced in a solution of 2,3,5 – tetrazolium chloride of 1 % concentration, for about 40 minutes.

Damages will appear as dark - red zones in a few minutes[3].

2.4.ELECTRONIC METHODS USED FOR REDUCING OR PREVENTING MECHANICAL DAMAGES AT POTATOES

Taking into account that the main interest for potato producers is the obtaining of a bigger harvest, through the minimizing or reducing of the drops at harvesting, they had been trying to find some practical solutions for reaching that goal.

It is known the fact that loses at harvesting and sorting appear caused to the contact of potatoes with rough, irregular or sharpened objects that are active organs of the agricultural machines. That's why it was very useful to develop a device for as to control this unwanted phenomenon. It was conceptualized, projected and done the *electronic potato* (Fig. 5).

Fig. 5 *Electronic potato* [2]

The *electronic potato* has the following features:
- digital sensors, with a high and adaptable sensibility;
- large depositing memory;
- dedicated software for the quality control at potatoes;
- artificial (electronic) potatoes of different sizes[2].

3. CONCLUSIONS

Taking into account the fact that potatoes are harvested and sorted mainly by using of some active organs of the specialized agricultural machines, the mechanical damage phenomenon may be manifested very often and with relatively high degrees of intensity.

There were identified several types of mechanical damages at potatoes, that are: damages by pressure, the peelings, the cracks and the cuts. For sure, there could be identified other types of damages at potatoes, but on the basis of their study as a means of manifesting, there could be taken the necessary measured for their reduction or the reduction of their associated forms.

The well-known agricultural practices should be well applied and followed, as to ensure a potato harvest that could be sorted afterwards. It should be strictly followed that loses should be reduced to minimal, at harvesting, sorting, inclusively at storing, because it is well known that if these three stages do not go along, it is very probable to obtain loosed on the technological flow.

The control techniques for mechanical damages in the laboratory, along with the electronically instruments of control in the technological flow (the *electronic potato*) are essential instruments in the obtaining of some potato harvests that were sorted and stored with the goal of delivery to the final consumers.

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