

A New Method for the Low-Stress Harvest of Potatoes

To reduce mechanical stress on potatoes from harvest to storage and to attain improved potato quality in long-time storage, a new method for box filling on the harvester was developed. By using selected criteria, this new method, which is called direct box filling, was compared to two traditional methods.



Fig. 1: Direct box filling on the harvester

Every handling process during harvest, transport and storage causes mechanical stress on potato tubers. To decrease this stress the potatoes have to be filled in pallet boxes already on board of the harvester. This method hereinafter called ‘direct box filling’ was tested within a period of two years.

Method

For practical studies a special device for filling and transfer of pallet boxes was mounted on a potato harvester Grimme SE 150-60 made by the company Schöpstal Maschinenbau GmbH (Fig. 1).

In case of direct box filling a 4-ton-box is filled with potatoes already on board of the harvester, afterwards moved onto a transport vehicle and finally carried into the storage hall [1]. The processing chain (Table 1) includes a single handling process (black spots) only. Using indirect box filling, potatoes are temporarily stored in a 6-ton-hopper of the harvester, afterwards moved into boxes

(4 tons each) on board of a transport vehicle and finally carried into the storage hall. In case of loose storage, potatoes are stored in a hopper of the harvester, afterwards moved on the bed of a transport vehicle, carried to the storage hall and finally stored in a section of the store.

All of the three methods were tested and compared to each other using important criteria such as damages inside the tubers, respiration intensity, level of mechanical stress, loss of mass and costs involved. In 2002 and 2003 six different potato varieties were used for examinations. Totally 384 4-ton-boxes were filled with potatoes and stored in a depot. Additionally, potatoes of all varieties were placed in loose storage in special storage sections.

Results

Damages inside the potatoes were determined by measuring discoloration of cut tubers three weeks after placing in the store. In

Dipl.-Ing. Pavel Malý and Dr. rer. agr. Thomas Hoffmann are scientists and Prof. Dr.-Ing. habil Christan Füll is the head of the department of post harvest technology at the Institute of Agricultural Engineering Bornim, Max-Eyth-Alle 100, 14469 Potsdam-Bornim (scientific director: Prof. Dr.-Ing. Jürgen Zaskel); e-mail: pmaly@atb-potsdam.de

Keywords

Potatoes, harvest methods, box filling

Literature

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- [2] Meinel, G.: Untersuchungen über die Respirationsintensität von Kartoffeln als Indikator für Schädigungen durch Ernte und Aufbereitungsverfahren, Archiv Acker- und Pflanzenbau und Bodenkunde, 16 (1972), H. 1, S. 21- 30

Tab. 1: Process chain scheme of different harvest methods

	Box filling direct	indirect	Loose storage
Harvest	●	●	●
Box filling onboard of the harvester	●		
Hopper filling onboard of the harvester		●	
Box moving onto the transport vehicle	●		
Box filling onboard of the transport vehicle		●	
Potato moving on the bed of transport vehicle			●
Tipping of potatoes			●
Section filling in the store			●
Storage	●	●	●

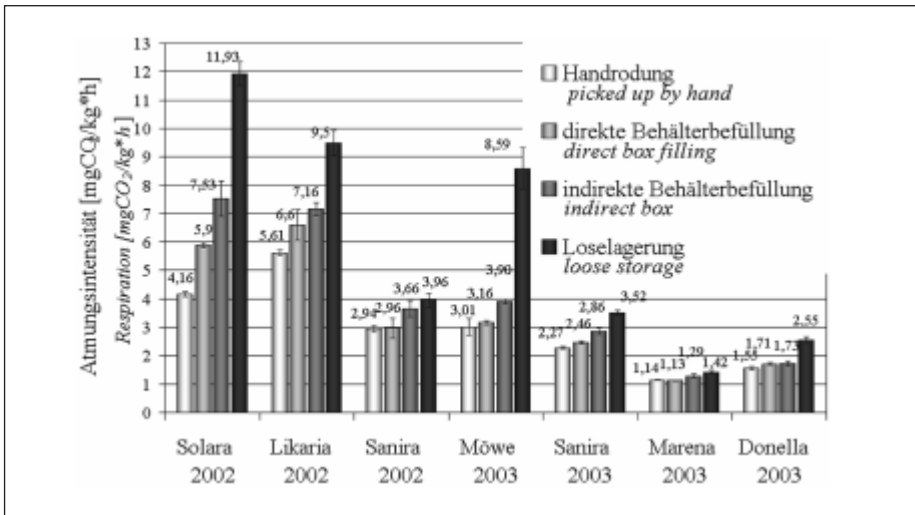


Fig. 2: Respiration intensity measured shortly after harvest

2003 a sample of totally 1200 kg (100 kg per variety and method) was analysed. Compared with the other methods the direct box filling had the smallest part of discoloured tubers. Eminently significant differences were found in case of the sensitive variety 'Möwe'. Direct box filling caused 33 % less discoloured tubers than indirect box filling and a 44 % less than loose storage.

The loss of mass during long-term storage was determined by measuring the weight of potato samples packed in net bags. After a storage period of six months the direct box filling method had the lowest mass loss (2.3 %) in comparison with indirect box filling (2.9 %) and loose storage (5.6 %).

Respiration intensities of the potato tubers were measured shortly after the harvest. The higher the level of mechanical stress the higher the level of respiration [2].

Potatoes picked up by hand serve as the best reference for the lowest level of stress and respiration as possible (Fig. 2). The method of direct box filling is closer to the reference level than the other two methods.

The level of mechanical stress during har-

vest, transfer, transport and placing in storage was measured by the pressure measuring sphere PMS 60. Compared with the two other conventional methods direct box filling decreases the number and the intensity of impacts (Fig. 3).

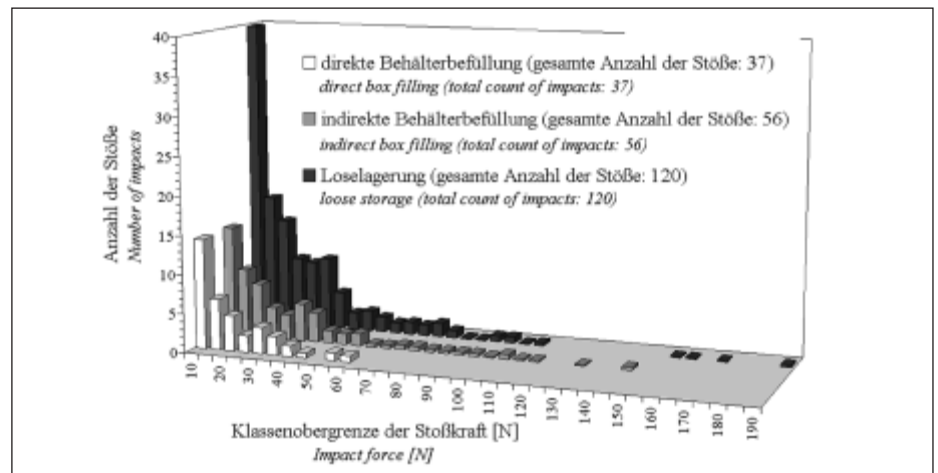


Fig. 3: Number and intensity of impact from the picking conveyot to the store

		direct box filling	indirect	loose storage
Purchase price of the harvester	T	98 ¹	83	83
Area per time unit T04	ha/h	0.55	0.57	0.58
Harvester working costs	/ha	189.60	164.71	163.89
Tractor working costs	/h	24.80	24.80	24.80
Driver + 4 workers	/h	48.52	48.52	48.52
Sum harvest	/ha	322.91	293.34	290.30
Costs of harvest	/t	9.23	8.38	8.29
Costs of transport	/t	4.54	4.45	5.01
Storage costs	/t	0.37	0.37	2.15
Total costs	/t	14.14	13.20	15.45
¹ prospective price				

Table 2: Costs of harvest, transport and placing

tubers is reduced explicitly. Therefore the degree of damages and black spots inside the tubers and the loss of mass during long-term storage is decreasing. Through better product quality, a higher sales price can be attained and thus can fully compensate higher processing costs.