

## Hot Water Dipping in Northern Germany- on farm results after four years of scientific work

Stand der Umsetzung des Heißwassertauchverfahrens nach vierjähriger Versuchsarbeit auf den Obstbaubetrieben in Norddeutschland

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### Abstract

In general, organic grown apples (*Malus x domestica* Borkh.) are not treated with chemical fungicides to prevent storage decay and these fruits may suffer up to 30% decay during storage. Preliminary experiments had shown that hot water dipping of apples may be an alternative. To inhibit Gloeosporium rot (*Pezicula alba*, *P. malicortis*) water temperature may be of about 50°C and dipping time from 60 sec up to 240 sec. The objective was to determinate the suitable hot water treatment that prevent decay incidence and maintain fruit quality (firmness, scale symptoms). In between the years 2002 and 2005 the test were repeated and a recommendation for the apple varieties in the area Northern Germany was elaborated.

**Keywords:** Post harvest decay, Hot water dipping, *Pezicula alba*

### Introduction

The first experiments with hot water dipping started in Jork at the OVB (Obstbau- Versuchs- und Beratungszentrum) in 2002. The varieties Topaz, Elstar and Ingrid Marie suffered up to 50% decay during storage on the farms. The objective was to determinate the suitable hot water treatment that prevent decay incidence and maintain fruit quality (firmness, scale symptoms). Objective of the ÖON (Öko Obstbau Norddeutschland) consulting was to transfer our recommendation on farm. Together with the farmers we aimed at a well working dipping machine on farm.

### Material and Methods

In the present investigation hot water dipping times between one and five minutes were examined in combination with a range of temperatures between 48°C and 55°C in 'Ingrid Marie' and other cultivars of organic grown apples. The apples were sorted immediately after harvest and allocated to boxes with 42 apples each. Every variant was made in six repetitions. The 42 apples of a single box had a fresh weight between 4 and 8 kg. The boxes were dipped in a volume of 200 l water with the specific temperature and were taken out after a time period of one, two or three minutes. Between two boxes the specific temperature was regulated by refilling steaming water. After the hot water dipping, the variants were stored together with the control fruits under normal air conditions at a temperature of 2°C for a period of four month and observed in December and February to control the decay. Infected apples were taken out of the boxes and stored until the fungi developed spores in order to determine the different species, i.e. *Penicillium expansum* (Penicillium) Link ex Thom, *Botrytis cinera* (Botrytis) Pers., *Nectria galligena* (Nectria), *Monilia fructigena* (Monilia disease) Pers., *Gloeosporium album* and *G. perenans* (Gloeosporium). This investigation was repeated every year between 2002 and 2005. In between this period of time a commercial dipping machine was developed and installed on the farms.

### Results

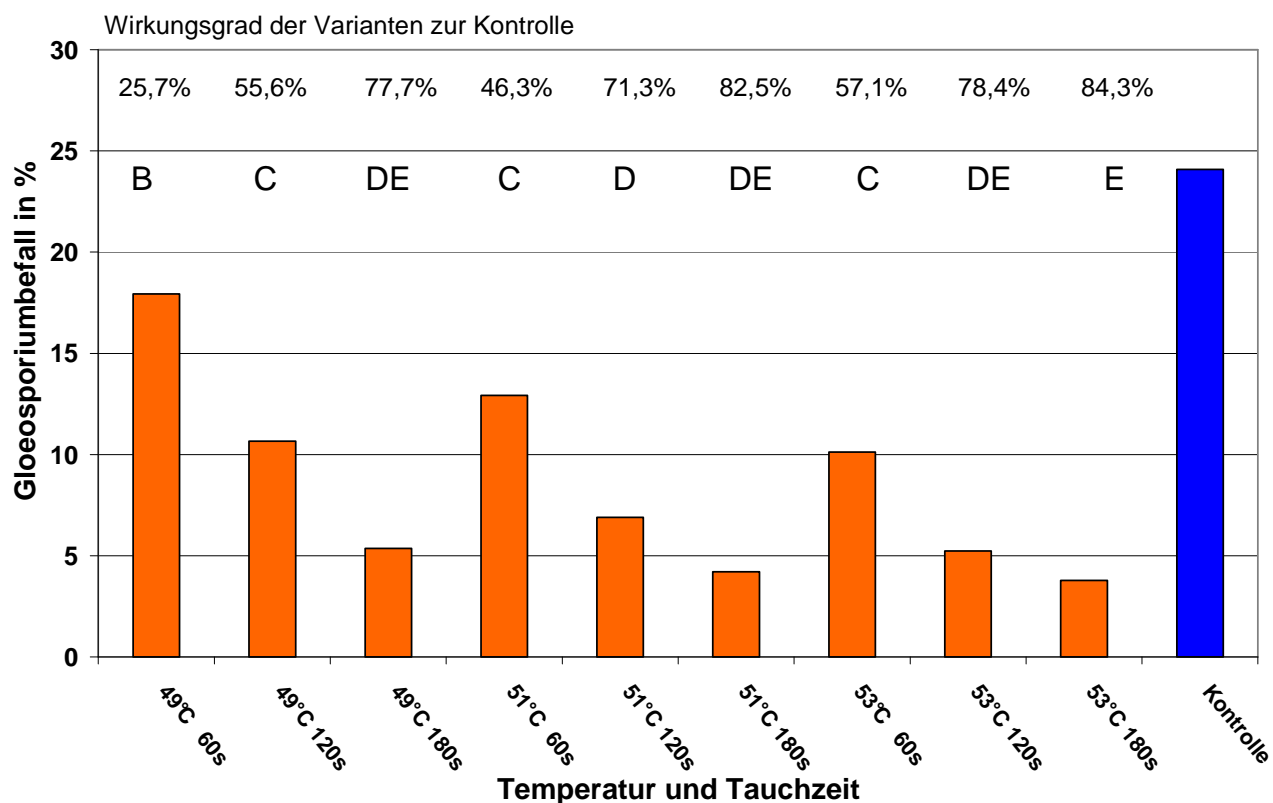
In our trials we found out that there is a dose-effect relationship between dipping time and temperature on the one side and reduction of the gloeosporium rot on the other side (Fig. 1). Gloeosporium

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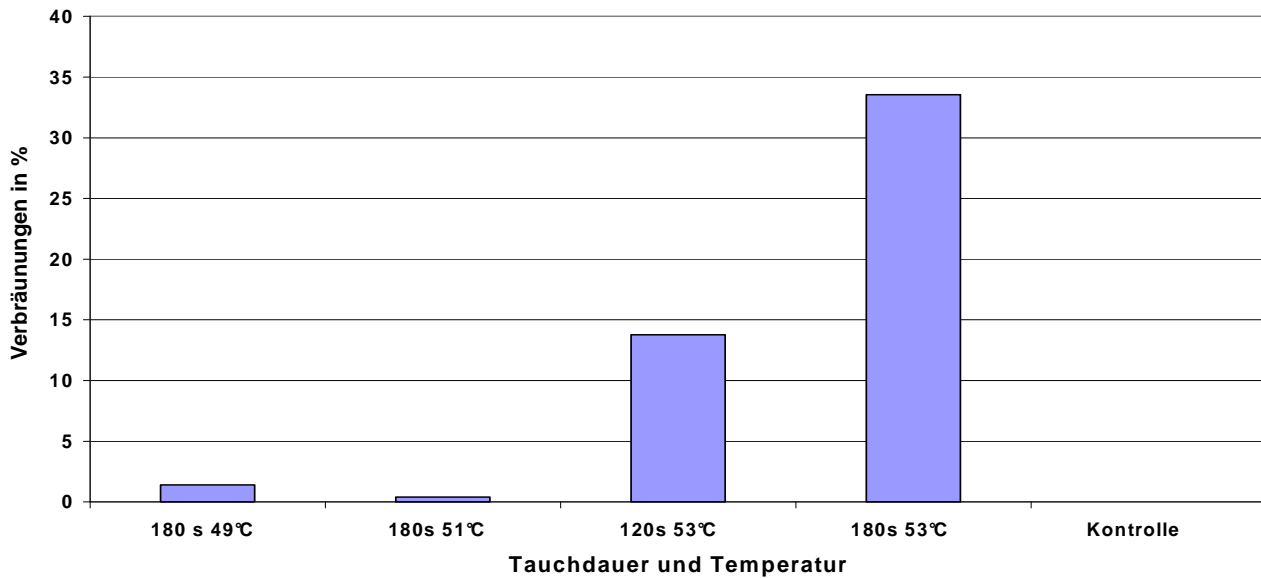
rot is reduced up 95% (Abbott) in the variety `Topaz` (not shown). The hot water dipping has a side effect in the reduction of *Monilia fructigena*, *Nectria galligena* and the development of *Venturia inequalis* in storage.



**Fig. 1:** Reduction of Gloeosporium rot (Summery of 2002-2004 all Varieties)

Fruit quality suffers in the hot water treatment. Some varieties got physiological browning in storage i.e. Ingrid Marie, Elstar and Pinova, there is a dose effect relationship between time/temperature and browning, too (Fig. 2). All varieties got riper than the control group in storage.

## Verbräunungen Pinova



**Fig. 2:** Physiological Browning (i.e. Pinova)

There are four dipping machines (Burgs) installed in the year 2006 in the area "Altes Land". 2003 180 tons, 2004 470 tons and in the year 2005 were dipped 370 tons of apple fruits on the farms. The quantity dipped was always less than 10% of our crop.

### Discussion

The Burgs dipping machine works quite well. After four years of scientific work there is an instrument to control gloeosporium rot on the farms. We recommend hot water dipping of apples only for varieties or charges of the crop, which are expected to lose more than 10% fruits by rotting during storage time. In the climate of Northern Germany there is a benefit in dipping Topaz, Pinova and Ingrid Marie. On the other side there is no need of hot water dipping for the varieties Jonagold/Jonagored, Gloster, Boskoop and Holsteiner Cox.

### Literature

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