Greenstim/Bluestim in suppression of fruit cracking on sweet cherry

1. Introduction
Fruit cracking is a major problem and a limiting factor in sweet cherry production nearly worldwide. Most of the products used to prevent fruit cracking, such as various minerals and antitranspirants, affect the fruit surface and thereby reduce the water flow into the fruit.

Greenstim/Bluestim is a natural product based on glycine betaine which is a well known osmoregulator improving the water balance of the whole plant. Thereby foliar application of Greenstim/Bluestim during fruit maturation provides a new approach in preventing fruit cracking of sweet cherries.

2. Causes of fruit cracking
Obviously the most important reason behind fruit cracking is raining during fruit maturation and excessive water uptake by the fruits. The driving force for the water diffusion is the difference in osmotic potential between water droplets on fruit surface and fruit juice. Water is taken up by the fruit through fruit cuticula as well as translocated to the fruits through fruit stalk from other parts of the tree.

The tendency of fruits to crack is affected by the variety and environmental conditions. Fruits with large size, high concentration of sugars and thin cuticula and epidermal wall are most susceptible for cracking. Abundant and long-lasting rainfalls during fruit maturation as well as high soil moisture and relative humidity of the air around the trees increase the risk for fruit cracking.

3. Application of Greenstim/Bluestim
Greenstim/Bluestim can be applied foliarly as a water solution with normal machinery used in fruit orchards e.g. with a boom sprayer or an air blast sprayer. Full coverage of the whole foliage is important in order to achieve the adequate concentration of glycine betaine in the treated trees. Greenstim/Bluestim is easily penetrated and translocated in the plant cells and tissues, but use of wetter or adjuvant in the spraying solution is recommended especially under dry conditions. In case of application in fruit orchards, the recommended minimum water volume per ha is 1000 litres.

4. Greenstim/Bluestim in suppression of fruit cracking
Field trials for evaluating the effect of Greenstim/Bluestim in cracking of sweet cherry fruits have been conducted in many important cherry production areas in Spain, Australia, Japan and USA.

4.1 Trials in Spain
The effect of a single foliar spray of Greenstim during fruit maturation was tested on young trees of cv. Burlat. Greenstim was applied at the rate of 3.5 kg/ha when the fruit colour was turning from green to yellow. Rainfalls of altogether 24 mm were detected during one week after Greenstim application.

![Fig. 1. The effect of Greenstim in fruit cracking incidence on sweet cherry cv. Burlat. Spain 2004.](image1)

**Trial 1**
- Greenstim 3.5 kg/ha: 15%
- Control: 77.5%

**Trial 2**
- Greenstim 3.5 kg/ha: 25.6%
- Control: 77%

![Picture 1. Untreated cherries of cv. Burlat. Spain 2004.](image2)
![Picture 2. Cherries of cv. Burlat treated with Greenstim 3.5 kg/ha. Spain 2004.](image3)

4.2 Trial in Australia
The trial in Australia was conducted on mature trees of cv. Stellar using various concentrations of Greenstim spray solution. Applications were performed at two different timings. Cracking of the fruits was induced artificially by immersing the fruits in water due to lack of natural cracking stress.
Fig. 2. The effect of various concentrations of Greenstim spray solution and application timings on fruit cracking incidence. Australia 1996-1997.

4.3 Trials in Japan
In 2006 several cherry cracking trials were carried out in Japan with excellent results. As an example the following result can be presented: the percentage of cracked fruits of cv. Satonishiki was 32% when Greenstim was sprayed two times (at early and middle colouring) at one week interval, whereas the percentage was 69% in untreated cherries (Hokkaido University).

4.4 Trials in USA
The potential of Bluestim in prevention of fruit cracking was tested on some of the most important sweet cherry varieties in USA using various application rates and application timings. Furthermore, the effect of Bluestim was compared with other commercial products used against fruit cracking.

A trial in California was conducted on cv. Bing. The application was made at early colour development at the rate of 3 kg/ha. The percentage of cracked fruits was assessed 9 days after treatment.

A trial in Washington State conducted on cv. Sweetheart showed that the double application of Bluestim was more efficient than the single application. The double application was made at early colour development and at 50% of pink/red fruits. All the treatments were made using 5 kg of Bluestim per ha.

Fig. 3. The effect of Bluestim on cracking of sweet cherry cv. Bing. USA 2005.

Fig. 4. The effect of different application timings of Bluestim on cracking of sweet cherry cv. Sweetheart at first picking. USA 2005.

Fig. 5. The effect of Bluestim applications on the cracking of sweet cherry cv. Garnet.
Timing 1: late light green/start of straw colour.
Timing 2: colour break (straw/pink transition).
Timing 3: light red.
Application rate 4.5 kg/ha except 2.25 kg/ha per treatment when three applications were used. USA, California 2006.

In another cherry trial in California in 2006 with cv. Brooks, a statistically significant reduction in cracking was obtained with Bluestim. Two applications (4.5 kg/ha per treatment) resulted in less than 1% cracking compared to 3.6% in the untreated control.

5. Summary
The experience to date indicates that Greenstim/Bluestim foliar application decreases the incidence of cracking in sweet cherry fruits. Compared to the other products used against fruit cracking, Greenstim/Bluestim have provided equal or even better efficacy. Unlike mineral products such as calcium chloride, Greenstim/Bluestim does not leave visible deposit on the fruits. Greenstim/Bluestim is recommended to be used as two applications. The first one at early colour development of the fruits and the second at later stage of maturity (pink/red fruits). The appropriate application rate is 3-5kg/ha per treatment diluted in minimum of 1000 litres of water.