

Fruit Hardness Tester

Application field of the fruit hardness tester (penetrometer):

The measured value is the force which is required to penetrate a stamp of defined size up to a specified depth into the fruit flesh. The firmness of fruits is an indicator for level of maturity of several fruits and vegetables and depends on various factors. The origin, growing conditions and the variety have a decisive influence. There are different types of penetrometers commercially available, for several crops there are also special stamp forms and sizes on the market e.g. for avocados (special stamp form), strawberries, cherries, citrus fruits, plums, etc. Two interchangeable stamps are always included in the delivery of a fruit penetrometer.

The standard model of penetrometer comes with a stamp of 8 and 11 mm diameter. To exclude measurement inaccuracies, it is recommended to mount the penetrometer on a conventional drill stand (available from building store) to exert a uniform, controlled and intermittent pressure on the fruit. Measurements in the context of quality control cannot be performed with a stationary device.

Therefore, it is necessary to work with hand tools very carefully in order to obtain a reproducible result.



Composition of samples

Choose 10 representative fruits of a lot, with uniform temperature, sizing and variety. The fruits must be obviously healthy and free of pests and free from damage caused by pests and insects. Fruits with severe bruising should not be used.

Preparation of the fruits

As the firmness of the fruits flesh is to be measured, the testing area has to be free from skin. Remove a very thin piece of skin of approx. 2 cm² size from the area of the fruit equator (very sharp knife required). When mixed colored varieties are to be tested, the measurement must be done in the area of the color change.

Measurement

The choice of the right stamp size depends from the variety and the degree of ripeness of the fruit. To achieve best measurement results, select a stamp which provides readings of measured values in the middle of the scale.

Hold the fruit with one hand on a solid surface. Then push the stamp of the penetrometer with uniform pressure into the skinless flesh. On the stamp, the permissible depth of penetration is determined by a milled marking ring. Avoid jerky or lateral movements during the penetration process. The measured value is read and recorded. If the 11 mm stamp is used, read the value on the outer scale, if the 8 mm stamp is used, read on the inner scale. The measurement is repeated on the opposite side of the fruit (except mixed colored varieties). This measurement is repeated with all 10 sample fruits.

Determine the final result

Calculate the arithmetic mean from the 20 measured values obtained. To ensure the reproducibility of the results, it is necessary to note all measurement parameters such as the size of the stamp used, scale used the unit (unit kg or lbs), variety, ripeness and the calculated mean.

Orientation values for fruit hardness

The following table shows German orientation values of fruit firmness of different types of fruit for the harvest. Please use this table for guidance only, since the values partly depend on the cultivation, the climatic conditions, growing methods, the variety, etc. Therefore, it is recommended establish own optimal values for your local conditions, based on experience.

The recommended values are specified in kg / cm² (exerted force / surface) and have a tolerance of 0.5 kg / cm². All measured values that are located in this range are relevant values for the harvest of the fruit. Nevertheless it is advisable, however, to consider the experience gained from your local conditions, as the listed values are intended only as general guidance.

Use the tip with 11.3 mm diameter for measurements in apples.

Use the tip with 8 mm Diameter for pears, plums, peaches.

For smaller fruits (e.g. cherries) use 6 mm diameter tip.

Fruit	Cultivar	Firmness (*) (kg / cm²)
Pear	William's / Guyot	6,5
	Conference	5,5
	Abate Fetel	5
	Comice	4,5
Apple	Staymanred	7,5
	Stark Delicious	6
	Golden Delicious / Granny Smith	5,5
Plum	Calita	2,5
	Golden Japan / Ozark Premier	3
Peach	Creasthaven, Suncrest, Flavor Top, Red Haven	6