Postharvest phenotyping kit: core collection

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Resume

Two different harvest and postharvest evaluation protocols are proposed depending on the type of tomato (Long shelf life (LSL), Short shelf life (SSL)) and are related to postharvest behaviour of each varietal type and normally respond also to the normal commercial practices for each type of tomato

For salad/fresh market genotypes (SSL, normal-ripening tomatoes having shelf live ranging between 5-9 days), fruits are normaly harvested at breaker stage and evaluated with the SSL evaluation protocol.

In the case of LSL genotypes (having shelf live longer than 15-30 days such as 'de penjar', 'de ramellet', 'da serbo', 'piennolo'', 'invernale, 'appendere') fruits are normally harvested at red ripe stage and evaluated by the LSL evaluation protocol.

1.1.Methodology for salad/fresh market fruits (SSL evaluation)

1. Harvest at least 9 fruits at Br stage (12 fruits in the case of cherry types)and bring them to the lab asap (is important to define Br in a consistent manner so that all the fruit have started ripening and are at the same ripening stage).If less than 5 fruits are available for a given variety then collect those at Br and repeat another day until you have 9 fruits (not recommended as this complicates the experiment).

2. Label each fruit (H harvest or Breaker Br) from 1-9. Measure fruits for color, firmness and fruit weight as follows .

Color: measure all fruits with the Minolta CR-400 Colorimeter (Minolta Camera Co., Ltd., Ramsey, NJ). Two opposite measures per fruit in the equatorial part of the fruits. If possible use also a DA-meter (Turoni) that gives estimation of Chl content.

Firmness: measure fruits 1, 4 and 7 by using Turoni durometer or Agrosta Durofel . Two opposite measures per fruit in the equatorial part of the fruits.

Weight each fruit with a precision balance (at least +/-10 mg)

3. Store fruits in packing boxes at 12ºC for 7 days and 90-95%HR (CS or Br+7) to slow down ripening and to simulate commercial practices. After this cold storage CS period, temper fruits during 30 min and measure fruits for color and firmness

Color: measure all fruits with the Minolta CR-400 Colorimeter (Minolta Camera Co., Ltd., Ramsey, NJ). Two opposite measures per fruit in the equatorial part of the fruits. Idem with the DA-meter

Firmness: measure fruits 3, 6 and 9 by using Turoni durometer or Agrosta Durofel Two opposite measures per fruit in the equatorial part of the fruits.

Weight each fruit with a precision balance (at least +/-10 mg)

4. Move mesured CS or Br+7 fruits to shelf life ripening and store during 2-3 days at 20ºC and and 90-95%HR (CS+SLR or Br+10). Temper fruits during 30 min and measure fruits for color (minolta and DA-meter) and firmness.

Color: measure all fruits with the Minolta CR-400 Colorimeter (Minolta Camera Co., Ltd., Ramsey, NJ). Two opposite measures per fruit in the equatorial part of the fruits. And DA-meter if possible

Firmness: measure fruits 2, 5 and 8 by using Turoni durometer or Agrosta Durofel .Two opposite measures per fruit in the equatorial part of the fruits.

Weight each fruit with a precision balance (at least +/-10 mg)

1.2. Calculation ripening rates of SSL fruits and classification method

Evaluate the SSL behavior of each accession as % of Firmness loss (**FL**) and Color change (**CI**) during cold (CS), SL after cold (SLR), and both (total).

Firmness loss (FL) is expressed as the average of the % of firmness loss (FL) and is calculated as $FL=100-(F_t*100/F_0)$. Where F_t is the measured firmness at each time and F_0, the measured firmness at the reference time.

- **FLR_CS** : % of firmness loss per day at the end of cold storage in relation to Br values.

- **FLR_SLR** : % of firmness loss per day at the end of SLR in relation to CS values
- **FLR_total** :% of firmness loss per day at the end of the postharvest period (CS+SLR) in relation to Br values.

For each treatment or combination of treatments, score tomato varieties as very fast FL, fast FL, medium FL, slow FL or not FL following the next criteria:

- **Very fast FL(VFFL):** FL > 50% in relation to the reference time
- **Fast FL(FFL):** FL ranging between 30-50% in relation to the reference time
- **Medium (MFL):** FL ranging between 20-30% in relation to the reference time.
- **Low (LFL):** FL ranging between 10-20% in relation to the reference time.
- **Very low FL(VLFL):** FL <10% in relation to the reference time
- **No FL (NFL):** those varieties showing negative values (ie. increasing firmness during the evaluated period).
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Color change (ΔC$_{a/b}$ or CI) is expressed as the average of ratio a/b increment.

- **ΔC$_{a/b}$ _CS:** increment of color a/b ratio at the end of cold storage in relation to Br values,
- **ΔC$_{a/b}$ _SLR** : increment of color a/b ratio at the end of SLR in relation to CS values
- **ΔC$_{a/b}$ _total**: increment of color a/b ratio at the end of the postharvest period (CS+SLR) in relation to Br values.

For each treatment or combination of treatments, score tomato varieties as very fast CI, fast CI, medium CI, slow CI or not CI following the next criteria:

- **Very fast (VFCI):** ΔC$_{a/b}$ >1.6 in relation to the reference time.
- **Fast (FCI)**: ΔC$_{a/b}$ ranging between 1.2- 1.6 in relation to the reference time
- **Medium (MCI):** ΔC$_{a/b}$ ranging between 0.4- 1.2 in relation to the reference time
- **Low (SCI):** ΔC$_{a/b}$ ranging between 0.2- 0.4 in relation to the reference time
- **Very low CI(VSCI):** ΔC$_{a/b}$ <0.2 in relation to the reference time.
- **No CI (NCI):** those varieties showing negative values.

Water loss (WL) is estimated from fruit weight. It is calculated as the % of cumulative weight loss at the end of each storage period respect to the reference time.

- **Very high water loss (VHWL):** weight loss higher than 7% respect to reference time
- **High water loss HFWL:** weight loss between 5.5- 7% respect to reference time
- **Medium water loss MFWL:** weight loss between 3.5- 5.5% respect to reference time
- **Low water loss (LFL):** weight loss between 2- 3.5% respect to reference time
- **very low water loss VLWL:** weight loss lower than 2% respect to reference time

2.1. Methodology for long shelf life fruits (LSL evaluation)

1. Harvest 20 (o 30) fruits at red ripe stage (discard all fruits that seem affected by pathogens or looks injured) from the 3-4 trusses. Harvest and store the fruits with the pedicel attached.

2. Label each fruit from 1-30. Measure fruits at harvest (H or RR) for weight, color and firmness. Appearence of wrinkles or loss of shape and identifcation of type of decay (grey mold, etc.). Take pictures

Weight each fruit with a precision balance (at least +/-10 mg)

Color: measure 6 fruits with the Minolta CR-400 Colorimeter (Minolta Camera Co., Ltd., Ramsey, NJ). Two opposite measures per fruit in the equatorial part of the fruits

Firmness: measure fruits 3 by using Turoni durometer or Agrosta Durofel Two opposite measures per fruit in the equatorial part of the fruits

3.Store fruits according to traditional practices. positioned in a single layer on wooden boxes and at room temperature without humidity conditioning according to traditional orchad practices for these fruit types.

 4. After 15 days discard fruits affected by pathogens or looking injured. Let 20-25 fruits. Store up 6 months. Measure every month for weight, color and firmness, and evaluate wrinkling and sound fruits take pictures, identify fungi). Before measurements discard those affected by pathogens or looking injured

Weight each fruit with a precision balance (+/-10mg)

Wrinkling: count fruits showing wrinkling. Do not discard.

Sound fruit: count remaining sound fruits

Color: measure 6 fruits with the Minolta CR-400 Colorimeter (Minolta Camera Co., Ltd., Ramsey, NJ). Two opposite measures per fruit in the equatorial part of the fruit

Firmness: measure 3 fruits (but not the same one had been measured earlier) by using Turoni durometer or Agrosta Durofel Two opposite measures per fruit in the equatorial part of the fruits

2.2. Assessment of LSL fruit post-harvest response and classification method

Firmness loss (FL) is expressed as the average of the % of firmness loss (FL) and calculated as FL=100-(F_t*100/F_0). Where F_t is the measured firmness at each time and F_0 the measured firmness at the reference time.

Score tomato varieties for LSL behavior as very high FL, high FL, medium FL, low FL, very low FL or not FL following the following criteria:

- **Very high FL(VHFL):** loss of firmness > 25% in less than 2 weeks
- **High FL(HFL):** loss of firmness > 25% between 2-4weeks
- **Medium (MFL):** loss of firmness > 25% between 4-8weeks
- **Low (LFL):** loss of firmness > 25% between 8-14weeks
- **Very low FL(VLFL):** FL > 25% in more than 14 weeks
- **No FL (NFL):** those varieties showing negative values (ie. Increasing firmness during the period evaluated.

Water loss (WL) is estimated from fruit weight. It is calculated as the % of cumulative weight loss at the end of each storage period respect to harvest values.

- **Very high water loss (VHWL):** loss of 25% weight in 2 weeks
- **High water loss HFWL:** loss of 25% weight between 2-4 weeks
- **Medium water loss MFWL:** loss of 25% weight between 4-8 weeks
- **Low water loss (LFL):** loss of 25% weight LFWL between 8-14 weeks
- **very low water loss VLWL:** remaining without loss of 25% weight more than 14 weeks
- **Unclassified:** accessions that loss all fruits before loss 25% water

Color change (ΔC$_{a/b}$ or CI) is expressed as the average of ratio a/b increment. To be discussed

Fruit decay (D) is calculated as the % of sound fruit after the end of each storage period in relation to harvest values. SL50 was used to classify the long shelf life behavior of each accession

- **Very high decay (VHD):** accessions that have been lost the 50% of fruits within the first two weeks
- **High decay (HD):** accessions that have been lost the 50% of fruits in between 2-4 weeks
- **Medium decay (MD):** have been lost the 50% of fruits in 4-8 weeks
- **Low decay (LD):** accessions have been lost the 50% of fruits 8-14 weeks
- **Very low decay (VLD):** accessions remaining sound more than 14 weeks

Wrinkly incidence (WI) is calculated as the cummulative percentage of wrinkled fruits at the end of each storage period. The WI is used to classify the long shelf life behavior of each accession

- **Very high wrinkly incidence(VHWI):** wrinkly incidence of 25% in the two weeks
- **High wrinkly incidence (HWI):** wrinkly incidence of 25% between 2-4 weeks
- **Medium wrinkly incidence (MWI):** wrinkly incidence of 25% between 4-8 weeks
- **Low wrinkly incidence (LWI):** wrinkly incidence of 25% between 8-14 weeks
- **Very low wrinkly incidence (VLWI):** wrinkly incidence less than 25% after 14 weeks