Blossom Drop and Reduced Fruit Set in Tomato

Monica Omares-Hampton and Fnu Kiran
and Gene McAvoy

UNIVERSITY OF FLORIDA
Reproductive Features of Tomato

- A tomato flower has both male (stamens) and female (pistil) parts within the same flower
- The ‘yellow’ stamens wrap around the ‘greenish’ pistil in the center of the flower
- Stamen: filament and anther
- The pistil: ovary, style and stigma
- The style is the long stalk reaching up to the bumpy and sticky stigma, which extends out well beyond the surrounding stamens
Pollination in Tomato

- The tomato are self-pollinated at the rate of 98% or more (10am to 4pm).
- There are often no insect pollinators.
- No pollination means blossom drop.
- Tomatoes need biotic or abiotic agent to pollinate.
Agents of Pollination in Tomato

Biotic agent (Greenhouse)

Insects - Bees e.g. bumblebee sonicates for pollination. Sonication is the vibration of the wing muscles without flight, causing the whole flower to vibrate, and a cloud of pollen to be released onto the bee's body and at the same time, onto the stigma.

Bumblebee pollinating a tomato blossom
Image copyright 2009, David L. Green
Agents of Pollination in Tomato

Abiotic agent

- Wind (Open fields)
- Mechanical shaking (Greenhouse)

Shaking by wind or mechanical means can cause the release of the pollen, which drops down (the blossoms normally hanging downward) through the stamen tube to the stigma.
What is Blossom Drop?

Blossom drop is defined as the loss of flowers. It is a condition suffered by tomatoes, peppers, snap beans, and some other fruiting vegetables.

This is usually preceded by the yellowing of the pedicle.

Tomato flowers need to be pollinated with 50 h (2 days) or they will abort and drop off. It takes that long for the pollen to germinate and travel up the style to fertilize the ovary at above 55°F.
Any stress which interferes with the pollination or fertilization process that results in abortion of flowers

Major Potential Causes of Blossom Drop

Stress (Abiotic)
- Environmental (Temperature & Relative Humidity)
- Nutritional

Other Potential Causes of Blossom Drop!
- Lack of water
- Lack or extended light exposure
- Excessive wind
- Biotic
- Insect damage
- Foliar disease
- Excessive pruning
- Too heavy fruit set
Temperature: Blossom Drop in Tomato

Temperature

Day
More than 85⁰ F

Night
More than 70⁰ F
or
Lower than 55⁰ F

Flower drop
**Temperature: Blossom Drop in Tomato**

**Low temperature:** Interference with the growth of pollen tubes prevents normal fertilization. The pollen may even become sterile, causing blossoms to drop. *Tomato fruit will not set until nighttime temperature is above 55°F for at least 2 nights in a row.*

**Hot temperature:** Due to the sustained hot temperature especially in night, the food reserves in the tomato produced during the day burns. The result is sticky pollen, altered viability and no pollination. *Ultimately the blossom dries and falls off. Also, female flower morphology changes such drying of the stigma.*
# Relative Humidity and Nitrogen

## Abiotic Stress

<table>
<thead>
<tr>
<th>Factor</th>
<th>Rate</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity</td>
<td>Too high or too low</td>
<td>Low: Interference in pollen release. Pollen is dry, no able to stick to stigma.</td>
</tr>
<tr>
<td>Plays major role in pollen transfer</td>
<td>Ideal range: 40-70%</td>
<td>High: The pollen will not shed properly.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>High</td>
<td>Encourage vegetative growth and inhibit flower production and/or pollination. This led to poor fruit set.</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Produce spindly vines with low food reserves that cannot support a crop.</td>
</tr>
</tbody>
</table>
### Other Potential Causes of Blossom Drop in Tomato

<table>
<thead>
<tr>
<th>Abiotic/Biotic Stress</th>
<th>Factor</th>
<th>Rate</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water</td>
<td>Low/Lack</td>
<td>Deep root of tomato are stress and weaken the plants.</td>
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<tr>
<td></td>
<td></td>
<td>High</td>
<td>Excess of water cause oxygen starvation in roots</td>
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<tr>
<td></td>
<td><strong>Excessive Wind</strong></td>
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<td>Wind can desiccate flowers and/or physically knock off flowers reducing fruit set.</td>
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<td></td>
<td><strong>Excessive pruning</strong></td>
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<td>Pruning can reduce the amount of energy the plant can produce and thus reduce yield.</td>
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<td></td>
<td><strong>Foliar Disease/insect</strong></td>
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<td>Fungal diseases such as botrytis or heavy bacterial spot or speck pressure.</td>
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<td></td>
<td><strong>Heavy fruit set</strong></td>
<td></td>
<td>When a tomato plant has too many blossoms, the resulting fruits are all competing for the limited food supplied by the crop. Once the initial crop is harvested, the problem should subside</td>
</tr>
</tbody>
</table>
Control of Blossom Drop in Tomato

- Grow varieties suited to your climate Variety! Variety! variety!
- Ensure pollination
- Used recommended N rates
- Water deeply during dry weather
- Control insect and diseases

**High temperatures and low RD:** In greenhouses, directing a gentle spray of water at the blossoms twice during a hot day will improve flower set when daytime temperatures range between 90° and 100° F and below 75° F at night. The evaporating moisture lowers the temperature, raises the humidity and jars the pollen loose, therefore improving flower set. If daytime temperatures exceed 100 °F and night temperatures above 75° F, this technique is not effective.

**High temperatures and high RD:** No water

**Low temperatures:** Maybe hormones?
Hormone and Tomato Fruit Set

Hormones: **natural organic compounds** that are produced in the plant and regulate certain responses such as bud development, root growth and fruit setting. **Hormones can be produced artificially.**

- Hormone treatment is effective in low night temperature only.
- However, favorable results were obtained when the hormones were applied with hand sprayers directly on the flowers rather than the whole plant (injury).
- Hormone treatments do not increase total marketable yields of tomatoes but can shift a portion of the yield earlier in the season (by increased fruit size). Puffiness and blossom end rot may be higher.
- 2 treatments at flower better results

**Hormones and nutritional products:**

Commercially available blossom-set hormones should not be relied upon because they do not give consistent results. Caution!
Plant Biomass (in \( \text{m}^2 \))

<table>
<thead>
<tr>
<th>Treatments</th>
<th>0</th>
<th>300</th>
<th>600</th>
<th>900</th>
<th>1,200</th>
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<tbody>
<tr>
<td>T1</td>
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<td>T2</td>
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<td>T6</td>
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<td>T7</td>
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</tbody>
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Marketable Yield (25-lb boxes/acre)

<table>
<thead>
<tr>
<th>Tomato size</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
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</thead>
<tbody>
<tr>
<td>5/6</td>
<td>0</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
<td>5/6</td>
<td>6/6</td>
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<td>6/6</td>
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<td>6/7</td>
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<tr>
<td>Culls</td>
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<td>Total Marketable</td>
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</tbody>
</table>
Post-Pollination Disorder

CATFACE

Reference: 3 forums.gardenweb.com
Reference: 2wintersown.org
Catface

- Catface is a condition involving malformation and scarring of fruits, particularly at blossom ends. Affected fruits are puckered with swollen protuberances and can have cavities extending deep into the flesh.

**Causes:** Possible extreme heat, cold weather with night temperatures 58°F or lower at flowering time, drought, or high N levels. The tomato varieties with very large fruits are more susceptible.

**Control:** Avoid setting transplants too early in the season, grow catface resistant varieties, and avoid herbicide injury.
Post-Pollination Disorder

Zippering

Reference: omafra.gov.on.ca
Zippering
It is characterized by the presence of brown tissue (resembling a zipper) usually running from the stem end to the blossom end due to abnormalities in early flower development.

Causes:
- Zippering is the result of an anther remaining attached to newly forming fruit.
- It is also associated with incomplete shedding of flower petals when fruit is forming.
- Although sometimes attributed to high humidity.
- In cooler weather, parts of the flower may adhere to the developing fruit and result in zippering.

Control
The only control is to select varieties that are not prone to zippering.
Post-Pollination Disorder

Puffiness

Reference: omafra.gov.on.ca
Post-Pollination Disorder

Puffiness
Puffiness causes fruit to appear somewhat bloated, flat-sided or angular leading to oddly shaped fruit. The locular gel (the liquid that surrounds the seeds) fails to fill the fruit's inner cavity resulting in a fruit with flattened sides that lacks firmness.

Causes:
- Poor pollination It can be due to:
- Incomplete fertilization or seed development due to cool temperatures
- In greenhouse, a lack of vibration or shaking that mixes the blossoms' pollen
- Other factors such as low light or rainy conditions can also cause seed set problems
- High N or low K

Control:
Ensure adequate growing conditions and nutrition to prevent this problem.

Reference: vegetablemdonline.ppath.cornell.edu
In south Florida, tomatoes are planted continuously between August and February. Historical temperature (average +/- standard deviation, in °F) from a weather station located in Immokalee, FL are 79.6 +/- 1.5, 69.0 +/- 4.4, and 67.4 +/- 6.2 for fall, winter and spring, respectively.
<table>
<thead>
<tr>
<th>Month</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
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</thead>
<tbody>
<tr>
<td><strong>No Fusarium Crown Rot</strong></td>
<td>Phoenix/FL 91</td>
<td>Phoenix/FL 91</td>
<td>Phoenix/FL 91</td>
<td>Phoenix/FL 91</td>
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<tr>
<td>August</td>
<td>FL 91/FL 47</td>
<td>FL 91/FL 47</td>
<td>FL 47</td>
<td>FL 47</td>
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<tr>
<td>September</td>
<td>FL 47</td>
<td>FL 47</td>
<td>FL 47</td>
<td>FL 47</td>
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<td>October</td>
<td>FL 47</td>
<td>FL 47</td>
<td>FL 47</td>
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<td>November</td>
<td>FL 47</td>
<td>FL 47</td>
<td>FL 47</td>
<td>FL 47</td>
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<tr>
<td>December</td>
<td>FL 47/Tygress/SVR 200</td>
<td>Fl 47/Tygress/SVR 200</td>
<td>Tygress/SVR 200</td>
<td>Tygress/SVR 200</td>
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<tr>
<td>January</td>
<td>FL 47/Tygress/SVR 200</td>
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<td>Phoenix</td>
<td>Phoenix</td>
</tr>
<tr>
<td>September</td>
<td>Soraya/BHN 585</td>
<td>Soraya/BHN 585</td>
<td>Soraya/BHN 585</td>
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<tr>
<td>December</td>
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In Southwest Florida tomato variety recommendations are normally based on disease packages, especially resistance to soil pathogens prevalent in the area and not on optimal flower and fruit set temperature and RH which is a main driving force for increasing tomato production.
Conclusions

Temperature and RH are out of the grower control. Sometimes you have to wait for favorable weather conditions.

Now, if weather conditions are optimal and other growers are not having fruit set problems, you should consider the cultural causes of tomato blossom drop.

Selecting a suitable variety, adequate N fertilizer, water and controlling insect and diseases will potentially insured high yields.