

# Agronomic Spotlight: Puffy or Hollow Fruit in Tomatoes

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The Farmacy on behalf of Seminis Australia

In some cases, growers have observed “*hollow*” or “*puffy fruit*” in their tomato crop. This information sheet provides growers with agronomic advice on the causes and management of puffy or hollow fruit.

## ISSUE

Hollow or puffy fruit occurs when air-filled pockets are developed in the locules (or locular cavity) leaving the fruit misshapen, such as slab or angular sides. This can lead to real or apparent lack of firmness and can reduce fruit shelf-life. The fruit may also feel light and in some extreme cases, can be difficult to meet packaging requirements.

## CAUSES

Upon cutting open the fruit, it will be observed that one or more locules will have little or no seeds (Grierson, D. and A.A. Kader, 1986). It should be noted that every seed is supported by its own placenta (portion of gel around the seed). Therefore, the less seed, the less placenta (gel) which leads to an air-filled pocket in the locule (locular cavity), where the seed and gel should be.

Any factor that affects fruit, including inadequate pollination, fertilization, or seed development can exacerbate this issue (Olsen, 2004).

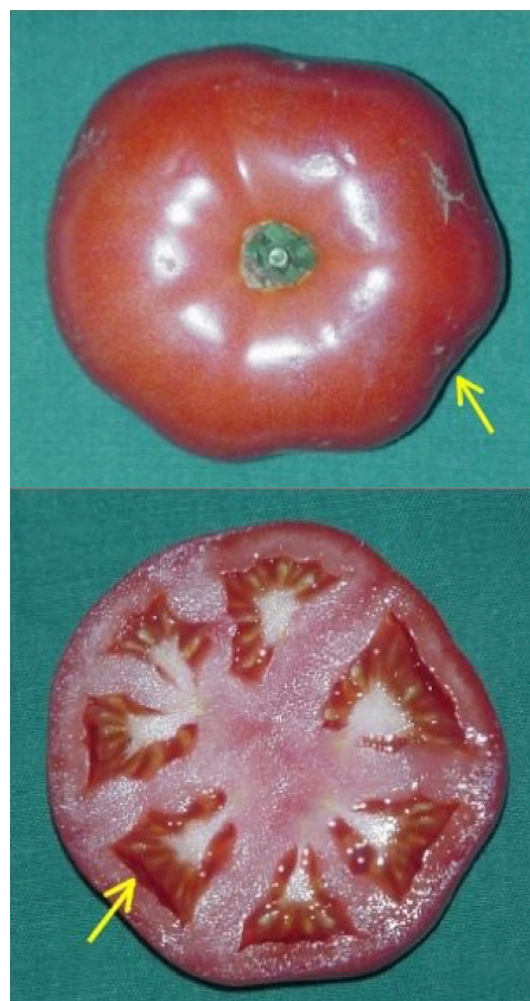


Image 1. Photo from Olsen, 2004, showing a slab sided (yellow arrow). When cut, the same area has little seed development.

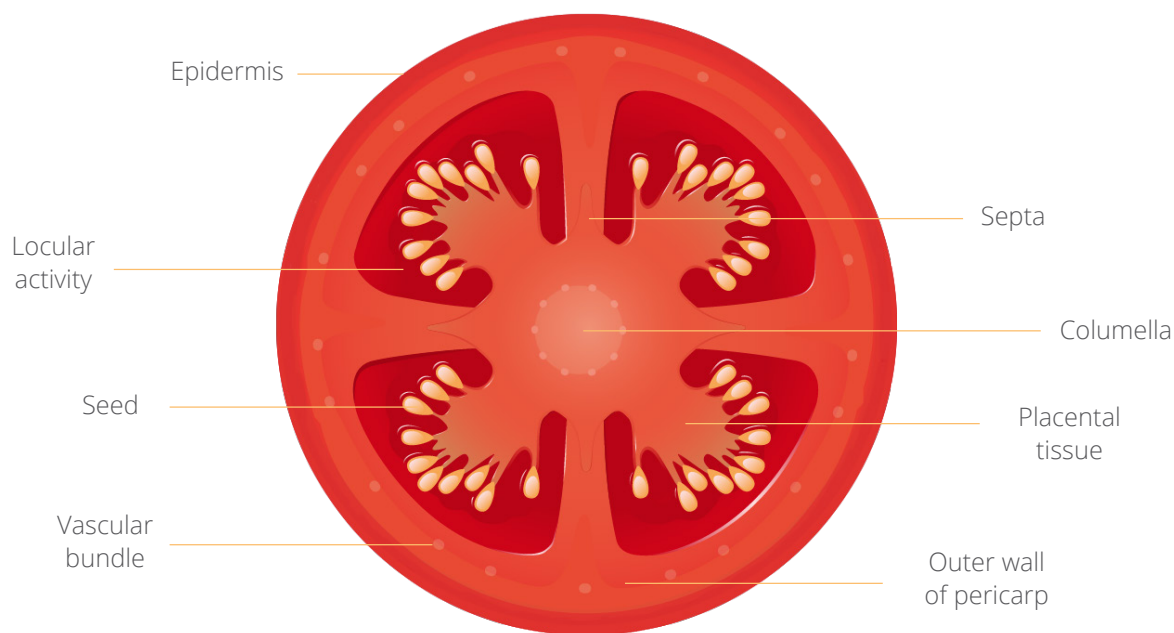


Image 2. Tomato internal structure

## WEATHER CONDITIONS

Most notable in Queensland, hollow or puffy fruit can be caused by excessive rain, humidity and temperatures that are too high (32C) or too low (12C) for the selected varieties, excessive nitrogen and low light (Olsen, 2004; Imas, 1999; Peet, 2009).

**TIP:** Ensure adequate variety selection for growing window.

## FERTILIZER APPLICATIONS - UREA AND NITROGEN

Urea can be a problematic form of nitrogen fertilizer. Plants can only take up nitrogen in the ammonium and nitrate form, while Urea needs to be broken down by soil bacterial to release ammonium. This is called hydrolysis, the soil's reaction can be found in the diagram to the right (Figure 1).

When the soil is too wet or too cold, or potentially both (Figure 2) the breakdown slows dramatically. While most tomatoes are grown on plastic mulch, it's possible that in wet weather conditions there will be little to no irrigation to leach the Urea out of the root zone. As a result, it will stay there until it breaks down

and is taken up by the crop. Plants have the potential to get a burst of available ammonium much later, even when not required.

**TIP:** It is advised that growers use more predictable forms of nitrogen in the ammonium form (MAP, DAP, Sulphate of Ammonia) or nitrate form (Potassium Nitrate, Calcium Nitrate) or both (liquid Ammonium Nitrate, Calcium Ammonium Nitrate).

## Reactions of Urea in soil

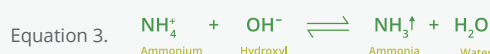
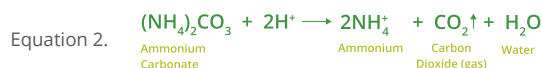


Figure 1. Reactions of urea in soil

### Rates of Urea hydrolysis in a silt loam soil at three temperatures

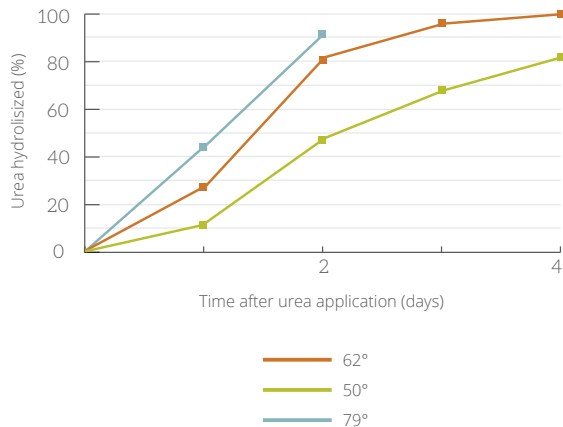


Figure 2. Rates of urea hydrolysis in a silt loam at three temperatures <http://www.soils.wisc.edu/extension/materials/ManagingUrea.pdf>

### Effect of Potassium on tomato fruit quality



Figure 3. Effect of potassium (Kg/Ha) on the percentage of some parameters of tomato fruit quality (Windsor, 1973).

## FERTILIZER APPLICATION – POTASSIUM

Furthermore, Yara<sup>1</sup> notes that low Electrical Conductivity (EC) of soil water is a factor, and can relate to high rainfall, irrigation and low potassium applications.

Low EC is caused by too much water and not enough dissolved nutrients. High EC can cause salt damage to the crop. The correct balance for your soil, season and crop is important but the acceptable range is usually quite broad when using soil rather than hydroponics.

A relationship between low potassium and hollowness (or puffiness) or irregular shaped fruit has also been noted<sup>2</sup>. Figure 3 shows how low potassium can also contribute to other tomato quality issues.

Hollowness or puffiness can be exacerbated by excessive irrigation<sup>3</sup>. This also ties in with comments from other experts regarding low EC and high rainfall.

## MINIMISATION OF ISSUE

- When possible, time the planting of the crop to avoid weather that has the potential of being unfavourable (not as easy as it sounds).
- Select appropriate varieties for the season.
- Manage irrigation, excessive nitrogen and low potassium from fruit set onwards (aim for a N:K

ratio of 1:2 after fruit set rises to 1:3 during later fruit fill).

- Site selection is critical as a free draining soil is needed to easily manipulate a root zone, water, nitrogen and potassium (as above) to minimize the unavoidable effects of rain.
- Manage EC by minimizing the chance of over irrigation. When rainfall or irrigation accidents drop EC levels, the addition of normal rates of fertilizer doesn't raise it sufficiently. Seek advice on the temporary addition of high EC fertilizers to the program.
- Managing EC can help improve fruit firmness and reduced cracking. High EC can reduce overall fruit size, while the process needs to be carefully managed.

<sup>1</sup> <https://www.yara.us/crop-nutrition/tomato/preventing-other-physical-disorders/>

<sup>2</sup> Imas, 1999

<sup>3</sup> Hector Valenzuela, Randall T. Hamasaki, and Ted M. Hori

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