**The Birds and the Bees of Hydroponics: How to Pollinate Plants**

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Nothing can be more disappointing than having that first flush of strong, vibrant flowers fail to pollinate or those masses of young fruitlets form, only to mysteriously drop from the plant.

Pollination and the resulting fruit set are vital processes for many common hydroponic crops, and an indoor garden can pose challenges to both. Outdoors, fruiting plants may use several different pollination methods to obtain fruit set. These include wind or plant movement, which transfers pollen either from plant to plant (cross-pollination) or from flower to flower—or even within the same flower—on an individual plant (self-pollination).

Many species rely on insect or animal pollinators, such as bees, which carry pollen from one plant to another or facilitate self-pollination as they rummage around inside a flower. Inside greenhouses or indoor gardens, these natural processes may still occur to some degree with air movement, vibration, or shaking as plants are trained and pruned—all of which can help release pollen. However, many crops benefit from a well-timed helping hand as large amounts of pollen transfer, which helps ensure improved fruit size, shape, and uniformity.

**How to Pollinate Plants**

The requirements, and method used, for pollination are highly species-dependent, so it pays to know what to do and when to do it. Most fruit-bearing species require some form of pollination, with the exception being many of the commercial hydroponic cucumber types, which are seedless and exhibit parthenocarpic fruit set (that is, without pollination). Tomatoes, melons, strawberries, capsicum, and eggplant all benefit from pollination assistance and the correct growing conditions for pollen viability and transfer.

Luckily, pollination of most hydroponic crops generally doesn’t involve precise, eye-straining work with a paint brush (although this is still a requirement for some exotic ornamental species). Commercial tools and devices for greenhouse pollination work just as well in an indoor garden, but even these are not necessary for small-scale crops.

**The Artificial Bee**

In greenhouse production, crops such as tomatoes, melons, and capsicum may be pollinated by bees, which are introduced to the crop from small, portable hives. Bees are highly efficient; not only do they transfer pollen, which is carried on their hairy bodies and legs, from plant to plant, but they also assist with self-pollination by releasing a large amount of pollen as they buzz around the flower. Using bumble bees as pollinators has been shown to significantly increase fruit weight, fruit width, fruit volume, seed weight, and fruit shape, as well as reducing the number of days from fruit set to harvest.

In an indoor garden, a viable alternative is the artificial bee: a small battery-powered, hand-held device that is held against the plant stem behind the flower. When triggered, the artificial bee delivers vibrations at a frequency similar to that of a bee inside a flower, causing large amounts of pollen to be released. Artificial bees, or ‘truss vibrators’, are most commonly used for tomato crops grown in areas where bee hives are not available or not economic for small-scale systems.

**Hand Pollination**

Hand pollination is the most common method used for indoor fruiting plants. It is cheap, flexible, and if carried out correctly, highly efficient. The main consideration with hand pollination is timing. Pollen is only viable for a short period and flowers open quickly under good growing conditions, so there is a short window of opportunity to get the job done. For self-pollinating plants like tomatoes and capsicum, hand pollination simply involves tapping, shaking, or flicking the stem behind the flowering truss or the flower itself.

The gentle, but rapid, movement of the flower releases pollen from the anthers inside the plant—you can see this as a cloud a yellow dust billowing from the flower. Once released, the pollen falls on the stigma and rapidly begins to germinate. The resulting pollen tube then grows down the style, and the process of fertilization then occurs within a few hours. Fertilization of the flower results in the formation of seeds. In fruit such as tomato and capsicum, the number of seed and the growth hormone these release determines final fruit size.

For fruiting crops such as melons, hand pollination is a little more complex. These plants produce separate male and female flowers and pollen must be transferred from one to the other. While insects carry out this process outdoors, indoor-grown male flowers need to be plucked from the plant, have their petals stripped back, and their stamens, which contain the pollen grains, wiped across the stigma of the female flowers.

Female flowers can be identified by the small, green fruitlet at the base of the flower. Not all hand-pollinated flowers end up setting and growing fruit, however; it is common for some of the fruitlets to turn yellow, wither, and drop from the plant. This is normal and prevents the plant from setting more fruit than it can support. As a result, most melons produce many flowers but only carry a limited number of fruit to maturity.

**Artificial Wind Pollination**

Crops such as strawberries are largely self-pollinating; however, they benefit from assistance to help release pollen inside the flower. This can be carried out by bees, but commercial greenhouse growers also use artificial wind pollination. This involves moving large air blowers along the crop rows at plant height once flowering has begun. In a smaller indoor garden, a similar effect can be achieved with the use of a hair dryer on a cool temperature setting

**Prevention of Pollination**

Seedless cucumbers are one common hydroponic crop that does not need, or benefit from, pollination. These have been bred to be pathenocarpic; that is, they set fruit without any need for pollination. Also, most commercial varieties only have female flowers. Despite this, male flowers may occasionally pop up, particularly on very young plants. These should be removed. Male flowers can produce pollen, which can transfer to a female cucumber plant and set seed. Seed set in otherwise seedless cucumbers results in fruit deformities and is best prevented.

**Pollination and Fruit Set Problems**

The main pollination problem in many crops is a lack of fruit set. After flowering, the blooms may simply wither and drop, leaving a bare stem section. This can be caused by error in the pollination process, and sometimes even the most conscientious pollination efforts don’t result in fertilization and fruit set. Yes, pollen may be transferred, but if it is non-viable, fruit set will not occur. This is a common problem when growroom temperatures are too high / low or have humidity levels below 65 per cent.

Under these conditions, pollen grains may not stick to the stigma to allow successful germination and fertilization. For crops such as tomatoes and capsicum, pollen grain germination is significantly reduced at temperatures outside the 43-97F range and the pollen tube may expire before reaching the ovule for fertilization. Similarly, low light conditions result in a lack of assimilate (sugars produced via photosynthesis), which can also lead to poor pollen viability and restricted fruit set.

Even more frustrating are the small fruitlets that appear to form, then either don’t develop further, or abscise and fall from the plant. Fruitlet drop may also stem from causes not related to poor pollination. Many fruiting plants pollinate and set many more young fruitlets than the plant can sufficiently support and grow to maturity.

This is common with melons and cucumbers, whose large fruit create a high demand for assimilate produced by the leaves. Capsicum plants also tend to abort fruitlets when the plant is already carrying a heavy fruit load. Assimilate for fruit growth is directed first to the developing or maturing fruit already on the plant, thus starving any recently set fruitlets (which will then drop from the plant). Once older fruit have been harvested from the plant, however, new fruitlets will set and start to develop.

Apart from heavy fruit loading, other causes of fruitlet drop are related to factors like genetics. Some older heirloom types are much more prone to flower and fruitlet drop if growing conditions are not completely ideal. Low light, pest infestations, diseases, excessive pruning, nutrient deficiencies, and poor root health all contribute to weakening the plant, which will jettison its flowers and recently set fruit in these situations.

Many modern hybrids, on the other hand, have been bred to resist fruit drop. However, under good growing conditions, pollination and fruit set may be so successful that too many young fruitlets develop on the plant. Allowing plants to carry more fruit than they can support not only weakens the plant for successive flowering but reduces the size of fruit that develop.

Maintaining the correct fruit loading balance is essential if good-sized and great-tasting fruit are to be produced. As a result, many of these varieties require manual fruitlet thinning. This common commercial practice involves selectively pruning off young fruitlets to a more manageable number for the size of the plant and growing conditions. For example, beefsteak tomato growers take the smallest and last set fruit from the end of the truss, allowing four to six fruit to remain.

Similarly, any cucumber fruits that set on the first few feet of main stem are removed from young plants. Strawberry flowers are pruned until the plants reach a specific size or leaf number for crop development.

Misshapen fruit are another common pollination issue, one that is often misdiagnosed by inexperienced growers. For example, the condition known as ‘cat face’ in tomatoes is caused by cool temperatures during pollination. When one or more of the locules (compartments within the fruit containing seeds) has not been fertilized and produced sufficient seeds, its growth will be restricted and the final fruit deformed.

Another deformity of tomatoes is puffy fruit, which are large, lightweight, soft, watery, and puffy. This disorder is caused by excessive nitrogen levels, use of hormone setting sprays, and other conditions that cause poor pollination. If misshapen fruit develop on the plant, these should be removed while still as small as possible so the plant can redirect assimilate into other fruit.

Pollination of fruiting plants in an indoor garden environment is not a complex or time-consuming task, but it yields huge results. Growers are rewarded with good-sized, well-shaped fruit. Understanding the specific requirements of different fruiting plant types, methods of indoor pollination, and attention to timing is all that is required to achieve that perfect degree of fruit set.

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