



Figure 1: Petunia flowers are an example of single-flowers, with only one petal opening-up. Thus, sprays get in touch with all the tissue.

Flower petals of double-flowering species

Double-flower forms pose a unique challenge because the inner layers of petals are not contacted by spray applications until the flowers are open. Calcium sprays only protect the tissues that are directly treated, thus only the most external tissue will get in touch with the sprays. For bedding plants or potted flowering plants, sprays must be made as the flowers are opening or after they open entirely. For cut flowers, heavy showers of calcium solutions or flower dips in the postharvest environment are an effective means of treating partially open flowers/buds and achieve the coverage of all the petals, e.g., roses. Dips involve submerging the entire flower in calcium solution for several seconds. As with all calcium applications, a surfactant can improve contact of the solution with the tissue and thus improves calcium uptake.



Figure 2: Rose flowers are an example of double-flowers, whit the inner petals only getting in touch with spray applications once the flower opens.

The flower receptacle

The base of the flower can be highly susceptible to botrytis blight and also 'bent neck'. A combination of a high calcium concentration in the fertigation solution, spray, and/or dip applications can target this tissue and improve plant performance. This issue is particularly important on potted and cut flower forms of gerbera daisy and roses.



Figure 2: Receptacle of gerbera and rose flowers affected by Botrytis

A note on low-volume spray applications (Fogging)

Fogging is an effective method of covering plant tissues with spray applications; however, the volume of solution landing on a flower petal or leaf is quite low, thus the total quantity of calcium coming in contact with the tissue is also quite low unless the calcium concentration in the solution is increased. Calcium concentrations of >2000 ppm may be necessary to achieve the desired calcium levels in the plant tissues. Again, in-house testing is required to figure out the details for each unique situation (equipment and crop).

A note on calcium forms

The form of calcium is not critical, although calcium chloride has provided the best results in our experiments. Calcium chloride is low cost and has relatively low phytotoxicity. Calcium nitrate is effective, but the additional nitrogen can complicate the plant nutrition situation. Several commercial calcium formulations are available specifically for foliar application. Calcium-EDTA is not recommended because the EDTA molecule causes severe phytotoxicity. Calcium silicate is not highly soluble, so it is difficult to prepare solutions with an adequate calcium concentration.

A note on application frequency

Weekly calcium applications are typically sufficient to protect newly developing flowers and tissues. Additional postharvest applications are recommended for flowers that are particularly susceptible to botrytis infections during shipping.

Summary

Different application techniques are needed to improve calcium concentrations in different tissues and different flower forms. The ultimate goal is to get as much calcium as possible in contact with the tissues. For leaves, this can be achieved with the fertigation solution. Stems, particularly at the base of the flower can benefit from additional spray applications. Single flowers respond well to spray applications, while double-flower forms required a heavy shower or a whole flower/stem dip to treat the inner petals. Surfactants are always beneficial for aiding in calcium uptake through above-ground tissues.