

Frost Damage

Frost damage on vegetables can often occur during cold, clear nights in late winter and spring in the Salinas Valley (Photo 1). Early plantings of lettuce, cauliflower, broccoli, spinach and peas can be affected with lettuce and celery being the most frost sensitive of this group. Frost damage is primarily caused by dehydration of the plant cells as water moves out of the cell into the intercellular space and freezes. The dehydration of the cells and may explain why frost damage often looks similar to damage caused by water stress. Cole crops often display dramatic symptoms of frost damage; symptoms can vary from interveinal chlorosis (Photo 2) to necrosis (Photo 3) which typically occurs on older leaves (Photo 4). Light frosts down to 32° F are frequently tolerated by cool season vegetables; slow transitions to cold temperatures over a few days allow plants to acclimate to colder temperatures and withstand cold temperatures. However, abrupt changes in the weather often result in greater incidence and severity of cold damage.

Symptoms of frost damage vary on the crops, but the most common symptoms on lettuce include a lifting of the epidermis from the rest of the leaf (Photo 5). The damage to the epidermis allows the tissue underneath to dry out (Photo 6). However, on lettuce a variety of other symptoms also occur depending on the severity of the frost and the acclimatization of the plant (Photos 7 to 11). Photos 12 & 13 shows frost damage on peas which includes interveinal chlorosis/necrosis, which can progress to death of lower leaves of the plant.

The severity of frost damage can be made worse by dry field conditions. Moisture has two effects on the severity of frost: 1) wet soils provide more warmth for crops than dry soil, and 2) greater soil moisture assures that the plants are better hydrated to withstand the drying effects of frost. The effect of soil moisture on the severity of frost symptoms has been observed in commercial fields where areas of the field that had not been watered had more severe frost symptoms than areas of the field that had been watered.

Frost damage can at times be confused with herbicide damage. For instance, if Goal is used as a pre- or post-plant on cole crops it can cause necrotic areas on the leaves (Photo 14). Spotting on lettuce or spinach can be caused by herbicide drift, but the spotting will tend to be more rounded and may burn the veins of the plant (Photo 15). Frost damage can also be confused with some foliar diseases.

Frost damage is a non-systemic issue that may or may not affect the yield of the crop. The impact on yield will depend on how severely affected or stunted the plants were by the frost event.



Photo 1. Frost on head lettuce



Photo 2. Interveinal chlorosis from frost damage (cauliflower)



Photo 3. Interveinal necrosis from frost damage



Photo 4. Outer leaves affected on cauliflower



Photo 5. Epidermis on lettuce lifted off tissue below



Photo 6. Subsequent dehydration of tissue below epidermis



Photos 7 and 8. Severe frost damage can cause necrotic interveinal areas as well as spotting on the leaf



Photo 9. Tip of the leaf killed by frost



Photos 10 & 11. Thickening, deformity and roughening of leaf texture



Photo 12. Interveinal necrosis on peas



Photo 13. Death of older leaves on peas



Photo 14. Goal symptoms on broccoli applied post emergence



Photo 15. Goal drift on lettuce