Floral photosynthesis: What can we learn from the Christmas rose (*Helleborus niger* L.)?

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Although leaves have been traditionally considered as the main source of photo-assimilates, the reproductive structures of many plant species may also perform photosynthesis and be significant source of assimilates. Non-foliar organs, such as green petals, spathe and receptacle, developing fruits, and stem tissues, have thus been reported as potential source of photo-assimilates. Question arises: what is the role of non-foliar tissues greening and photosynthesis, and how is this process regulated? Floral greening of Christmas rose (*Helleborus niger* L.) has been examined in details and represents a good example for functionality of non-foliar photosynthesis. The sepals of the Christmas rose, which are white at anthesis, persist until the seeds are ripe and become intensely green during that period. Unpollinated or depistillated flowers survive almost as long as their fruit-bearing neighbors, but do not pass through the complete greening process. Removal of the gynoecium also affects the shape of the flower and the length of the flower scape. Fertilization and fruit development are triggers that modulate foliar photosynthesis in the Christmas rose. The correlative signals which maintain these morphogenetic processes appear to include plant hormones (cytokinins, gibberellins, auxins) synthesized in the developing fruit. The life-cycle of the flowers is almost complementary to that of the leaves. Leaves survive normal winters, but are often pressed to the ground by snow and covered with debris, and thus no longer fully operative during anthesis. They will then die back around the time when fruit development is initiated. The new generation of leaves starts appearing a few weeks later and is not always fully expanded, at seed maturity. Since leaves are only moderately functional when the fructification occurs, the green sepals of Christmas rose are thus responsible to carry out the bulk of photosynthesis and provide assimilates for the developing fruit. This flexibility should be a competitive advantage for a species exposed, during fruit set, to the stressful, ever changing, weather conditions of a South-European winter and early spring.