



COLORADO FLOWER GROWERS ASSOCIATION, INC.

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Photosynthesis in Roses II. Effect of Leaf Age

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New leaves serve as factories for sugar production. As the photosynthetic mechanism of a leaf develops, the ability of the leaf to produce sugars reaches a maximum and then slowly declines. In older leaves, chloroplasts, the site of photosynthesis, tend to break down.

According to Kohl and Smith (1), in roses, as a new flowering cane develops, it contributes little to its own development, until the leaves are sufficiently mature for adequate photosynthetic rates. Soon after the leaves mature, nearly all are removed with the flower, and much of the sugars the parent cane sent into the new cane in its early development may not be replaced. A problem might exist if the parent plant does not have a large supply of stored food. As canes develop, there could be a loss in food reserves. As leaves are most important in providing adequate food reserves, this study was designed to observe the nature of rose photosynthesis as it varied with leaf age.

Materials and Methods

The technique for determining photosynthetic rates, or CO₂ uptake, was described in CFGA Bull. 289.

To study the effects of leaf age, a base point in leaf development had to be determined. In other plant species, full leaf expansion is commonly used. However, sizes of rose leaves at this stage vary greatly, so some other guide had to be found.

Immature Forever Yours leaves are red on the leaf underside. As the leaf matures, this red color gradually bleaches, and the underside appears green. The date a leaf reaches the stage when bleaching is complete (i.e., the reddish color is all removed) occurs at a fairly uniform leaf age. The day this bleaching was completed was designated "day zero."

Leaves were tagged with the dates when "day zero" occurred for each leaf. Leaves used were of varying ages. Samples from these leaves were taken on five occasions, each time sampling leaves of differing ages.

Results and Discussion

Fig. 1 is a plot of CO₂ uptake versus leaf age. Two scales of leaf age are presented. The upper, for any rose leaf, is based upon the time from when bleaching of red color from the leaf underside was completed ("day zero"). The lower scale is the time in days after the last flower was cut, and the line plotted is the photosynthetic activity of the first five-leaflet leaf that developed from the base of the new cane. Photosynthesis is in milligrams of CO₂ absorbed by one square decimeter of leaf area in an hour's time (1 dm₂ = about 16 sq. in. and 1000 mg = 0.04 oz).

From the upper scale (bleaching date), peak activity of any leaf occurred approximately seven days past "day zero". About 6 to 8 days later, the CO₂ uptake rate fell to 75% of the peak, and on down to 50% of the peak in another 6 to 8 days.

On the lower scale, the first five leaflet leaf reached "day zero" approximately 28 days after the last cut, and reached its peak activity 35 days after the last cut. It was determined that the last leaves to mature just below the bud reach "day zero" about 33 days after the

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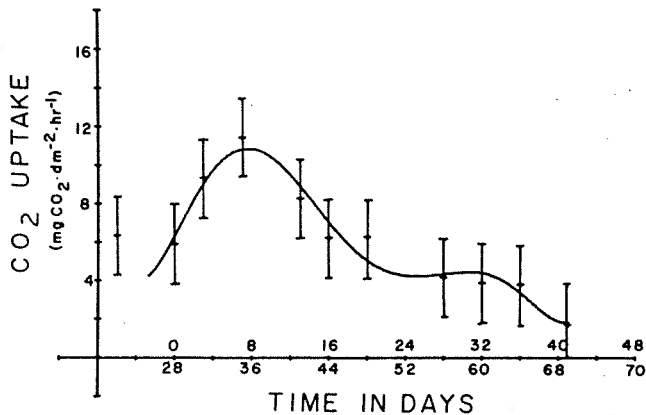


Figure 1. Rose photosynthesis as it varied with leaf age. Two scales of leaf age presented. Upper scale is based on the time from when bleaching of the red color from leaf underside was completed ("0" on the scale). Lower scale is time in days from the last cut date, and the line plotted is the photosynthetic activity of the first five-leaflet leaf. Vertical bars illustrate the amount of variation encountered. Any two means are significantly different from one another at the 5% level if their "tails" do not overlap. (Avg. number of samples per mean — 7.2) .

last cut. This means these leaves reached their peak activity about 40 days from the last cut. Assuming 40 to 50 days from cut to cut, all the leaves on a rose cane

reach their peak activity and begin to decline before the flower is harvested. Also, those leaves that remain on the plant after harvest, assuming they are still green, are producing carbohydrates at only half the rate at which they were producing when they were first mature and at peak CO₂ uptake rates.

Summary

The answer to the question, "Does the developing cane contribute anything to the parent plant before the flower is harvested?" has not been answered. However, this work does indicate that all the leaves on a cane reach a photosynthetic peak before the flower is cut, which means each leaf undergoes maximum sugar production prior to harvest. Where these sugars move to is yet to be determined. It can be speculated that most stay in the immediate cane for its continuing development. New canes do draw on the food reserves of the parent plant, but how much stored food a new cane uses is not yet known. It is obvious, however, that the greenhouse environment should be favorable for maintaining as many of the leaves on the lower plant canopy as possible to provide the needed foods for new canes until they can maintain themselves.

Literature Cited

1. Kohl, H. C. and D. E. Smith. 1970. Rose plant renewal. *Roses, Inc. Bull.* Dec.