# ETHYLENE AFFECTS DORMANT ROSES[1]

R.E. Widmer and B.T. Swanson[2]

Last spring, numerous Minnesota greenhouse operators reported poor and erratic growth of some of the potted roses forced for Mother's Day. Symptoms included limited growth and blindness or abortion of above average numbers of growing tips. Plants of the same cultivars from the same source forced for Easter had grown normally.

The rose plants were sealed in polyethylene film in the cases and shipped

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[2]Professor and graduate student in horticulture-plant physiology, respectively.

to Minnesota in closed heated railroad refrigerator cars. The cars were enroute for an above average period of time. After arrival the roses were placed in commercial cold storage.

## Treatments

As a result of the abnormal plant response, a small trial was initiated at the University to determine the effect of ethylene on stored roses. Plants of the floribunda cultivar 'Fashion' were obtained in late April. Four check plants were potted and placed in the greenhouse. All other plants were sealed, two to a bag, in three polyethylene bags, enclosed in a brown kraft bag, and then sealed in two more polyethylene bags. These bags were filled with air (control) and approximately 3, 70, and 280 p.p.m. ethylene. They were then placed in a 40° F. refrigerator on May 1.

One set of bags was removed after 88 hours, at which time the ethylene levels were as shown in table 1.

Table 1. Ethylene levels in polyethylene bags stored 88 hours at 40° F.

| Treatment | Start | After 88 hours |
|---|---|---|
| | p.p.m. | p.p.m. |
| air | .064 | .085 |
| 3 p.p.m. | 2.57 | 1.58 |
| 70 p.p.m. | 68.70 | 30.20 |
| 280 p.p.m. | 282.20 | 134.20 |

The plants were removed from the bags, potted, and placed in the greenhouse.

A second set of bags was kept in the refrigerator for 3 weeks. Ethylene levels in the bags were checked after 1 and 2 weeks (table 2) and supplemental ethylene injected.

Table 2. Ethylene levels in polyethylene ba s stored 3 weeks at 40° F.

| Time | Treatment | | | |
|---|---|---|---|---|
| | Air | 3 p.p.m. | 70 p.p.m. | 280 p.p.m. |
| | p.p.m. | p.p.m. | p.p.m. | p.p.m. |
| Start | 0.043 | 2.57 | 68.70 | 282.20 |
| 1 wk. before add. | 0.145 | 0.64 | 9.14 | 83.80 |
| 1 wk. after add. | -- | 7.06 | 82.00 | 253.90 |
| 2 wk. before add. | 0.09 | 0.40 | 2.66 | 56.20 |
| 2 wk. after add. | -- | 4.42 | 76.00 | 335.70 |
| 3 wk. removal | 0.11 | 0.13 | 0.08 | 5.38 |

Obviously the ethylene levels dropped once again in all but the control treatments. All plants were then potted and placed in the greenhouse.

## Growth Results

Plant growth was checked regularly. The data shown in table 3 were recorded on June 15 (88 hour plants) and July 2 (3 week plants).

Table 3. Growth responses following exposure of roses to ethylene.

| Treatment | Total new shoots | | Total budded shoots | | Percentage budded shoots | |
|---|---|---|---|---|---|---|
| | 88 hr. | 3 wk. | 88 hr. | 3 wk. | 88 hr. | 3 wk. |
| Check direct planting | 18 | 17 | 7 | 6 | 39 | 35 |
| Control (air) | 21 | 15 | 8 | 7 | 38 | 47 |
| 3 p.p.m. | 21 | 21 | 2 | 7 | 10 | 33 |
| 70 p.p.m. | 16 | 21 | 1 | 4 | 6 | 19 |
| 280 p.p.m. | 14 | 23 | 3 | 2 | 21 | 9 |

With one exception, the percentage of budded shoots decreased progressively with increases in ethylene during storage. Some variation is to be expected when working with small plant numbers. Visually, the symptoms resembled those noted earlier on plants in commercial ranges. A level of about 0.1 p.p.m. ethylene did not appear to be injurious, whereas a level of 2-3 p.p.m. was injurious even for the short duration of 88 hours.

## Discussion

Shull (3) reported that the rose cultivar 'Red Radiance' was defoliated by exposure to illuminating gas (which contained ethylene, whereas today's natural gas is relatively free of ethylene). When the plants were removed from the gas, the shoots present prior to treatment lost their apical dominance. Milbrath et al. (2) defoliated rose plants by exposing them to ethylene from apples for 3-5 days at 65°-70° F. The writers were unable to locate any reports of the effect of ethylene on dormant plants.

Plant tissue that has been injured through diseases, insects, or by mechanical means is capable of producing ethylene (1). Ethylene release by plant tissue is very limited at temperatures below 40° F. and increases in proportion to temperature increases. Sensitivity of plant material is also limited at low temperatures.

Roses tightly packed in crates could conceivably release significant quantities of ethylene over a period of time. Further, extended exposure to relatively low levels of ethylene could have a compounding effect on the plants. This might explain why Easter plants were usually normal, but Mother's Day plants frequently were affected.

Polyethylene film such as was used to line the crates is permeable to gasses such as ethylene. Table 2 shows that ethylene levels dropped appreciably in all but the control bags, where the level increased to approximately 0.1 p.p.m. This level did not appear to be injurious, but the plant density in the commercial crates was much greater, providing greater potential for ethylene buildup. Plants in commercial storage also may have been exposed to temperatures higher than the 40° F. used in our trial. Although polyethylene film is permeable to ethylene, the loss of ethylene from the crates was in all probability slowed by the layer of film around the plants.

## Conclusions

Although this study did not prove conclusively that ethylene was the cause of the difficulty with the commercial crop, it did show that exposure of dormant roses to relatively low ethylene levels caused a similar plant response. Further study is recommended to obtain conclusive answers. At

present the plant producer would be wise to place an ethylene absorbent within the polyethylene liner in each crate to lessen the possibility of a recurrance of the difficulties encountered with the 1970 Mother's Day crop.

## Literature Cited

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