BE AWARE OF THE GASES IN YOUR GREENHOUSE

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Greenhouse heating systems and carbon dioxide (CO_2) enrichment systems will soon be in operation. But when your furnace and CO_2 injectors burn, will they produce gases that are harmful to the plants? Ethylene (C_2H_4), Carbon monoxide (CO), and sulfur dioxide (SO_2) are harmful gases that could be produced.

Furnaces and CO_2 injectors ideally produce CO_2, heat, and some water vapor (H_2O). However, if air circulation is limited enough to cause incomplete combustion or if low quality propane, kerosene, oil, or natural gases are burned, then the potential for CO, C_2H_4, and SO_2 production exists.

Ethylene gas and CO are the 2 major trouble-makers. One of the reasons for this is that there are sources of these gases other than incomplete combustion and poor quality fuels. Examples of these sources include furnaces and stoves that are not adjusted properly, gasoline and diesel engines such as rototillers, gas-powered sprayers, and delivery trucks, and even smoke from cigarettes, pipes, and cigars. Because C_2H_4 is a plant hormone, it affects plants at a concentration of 1 ppm or less. It takes 500 - 5000 times more CO than C_2H_4 to cause problems (2), therefore, you would probably see C_2H_4 damage before CO damage. Symptoms for both gases include:

1) Increased rates of flower senescence (sleepiness in carnations),
2) petal abscission in plants such as snapdragons and African violets,
3) leaf drop,
4) leaf epinasty (i.e. downward bending) on sensitive plants like poinsettias and tomatoes,
5) prevention of flower initiation especially in short-day plants such as chrysanthemums,
6) shortened internodes,
7) increased axillary branching, and
8) distorted flowers.

SO_2 results from burning fuels that have a high sulfur content. It too is harmful at concentrations as low as 1 ppm. When SO_2 comes in contact with water it is converted to sulfurous acid which may be oxidized to sulfuric acid and these are what burn the plant. Chlorotic markings are symptomatic of minor SO_2 damage, with the middle-aged leaves being most susceptible and the older leaves being the next most susceptible (1). At higher SO_2 concentrations large, dull-colored water-soaked areas between veins that later change to dry, bleached lesions are the symptoms; the cells immediately adjacent to the veins may remain green. If plants are damaged by SO_2, the new growth will be normal if the problem is remedied.

Because greenhouse heaters are the major culprits behind the production of potentially harmful gases, they are the first things to check. Unit heaters and furnaces must be equipped with stacks to exhaust flue gases to the outside of the greenhouse, and the smokestacks must be high enough to avert downdrafts from the roof. Insufficient oxygen will cause incomplete combustion, therefore adequate air must be supplied to all burners. It is recommended that 1 square inch of opening exists in the air inlet for each 2,500 BTU of burner capacity per hour. Periodically check for gas leaks because manufactured gases, and to a degree, natural gas, may contain propylene and butylene which injure plants similarly to ethylene. Proper maintenance and cleaning of heating systems will also decrease the change of C_2H_4 and CO production.

As far as the CO_2 generators are concerned, make sure there are fans to remove the CO_2 gases from the vicinity of the generator. Without adequate air circulation oxygen may be depleted and result in incomplete combustion. External air is not necessary since little oxygen is depleted in CO_2 generation. Periodically inspect the CO_2 burners to make certain that a clear blue flame is burning.

In order to prevent SO_2 problems, burn fuels that have a low sulfur content. If you are using natural gas make sure the sulfur content is less than 1 grain (64.86 mg) per 100 cubic feet. If you are using propane, use a H.D. 5 grade.

If the above precautions are taken, you should not have to worry about these harmful gases causing problems in your greenhouses.

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DO YOU NEED STANDBY POWER

John W. Bartok, Jr.
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Standby generators and alarm systems are an absolute must for nurserymen who depend on continuous electric service to operate heating and ventilating equipment. A generator is an inexpensive year-round insurance that can save your crop from excessive heat in the summer and freezing conditions in the winter.

An Extension bulletin, "Standby Equipment For Electric Power Interruptions", explains the installation, operation and maintenance of this equipment and is available from your nearby Extension Office.

GROWING CHRISTMAS CACTUS

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There is a distinction between the Christmas cactus and the Thanksgiving cactus. Schlumbergera (formerly Zygocactus) bridgesii, the Christmas cactus, has rounded lobes on the upper margin of the phylloclades (leaves), and blooms naturally in mid December. Schlumbergera truncata, which blooms naturally in middle to late November, is the Thanksgiving cactus. While S. truncata can be easily identified by the two to six serrate projections of its phylloclades, it has often been mistakenly called Christmas cactus (1).

The Christmas cactus grows as an epiphyte on the branches of trees and decaying bark in its native habitat of Brazil. For this reason, the growing medium should contain a high percentage of organic matter, with the addition of good drainage for commercial growing. Schlumbergera should be grown moist but not overwatered to avert disesase problems during months of low light intensity and low temperatures. The pH of the root medium should be 5.5 to 6.2. Fertilizer applied at the rate of 200-300 ppm nitrogen from 20-10-20, 15-16-17 (1), or 20-20-20 (2), every two weeks is generally sufficient. Osmocote has also been effective for large pots applied at 1/2 the recommended rate. In order to prevent iron deficiency, cupping of new growth and marginal chlorosis, apply chelated iron at 4 oz. per 100 gallons water 2 or 3 times during the growing period. Stop fertilization in August or September 1 to 2 months before the start of flower bud initiation (1). In mid August, start to withhold some water. This is not to encourage flower bud development as previously thought. Instead, this slows the plant metabolism so that carbohydrates are stored in the plant instead of being used for more new growth (2). While withholding some water, the plants should not be put under excessive water stress. Water should not be withheld when buds become visible since this may cause bud abortion or undersized flowers (2).

Propagation may start as soon as select stock plants, free of disease and other problems, have finished flowering. Cuttings of one to three phylloclades can be twisted off at the joints. Bottom heat of 70°F should be used. These cuttings will begin rooting in 2 to 3 weeks at which time light fertilization may begin (1). Propagation begins in late December and is generally completed in February. The cuttings made in late December will be for larger pots (2).

Low temperature and/or short days induce flower bud initiation in the fall. Thus, there are several ways in which to induce flower initiation. First, flowering will take place below 55^{o}F night temperature, no matter what the day length is, but flowering is not uniform. Temperatures less than 50^{o}F prevent flower initiation. Flowers are readily initiated at temperatures of 59-68^{o}F with nights of 12 hours or more. Twenty to twenty-five long nights are adequate for flower initiation. After this time, the photoperiod will not affect the development of the flowers. At a night temperature of 52^{o}F flowering should occur in nine or ten weeks after initiation (1). Thus, to ensure a Christmas crop, at 55^{o}F with nine hour days, begin using black cloth about September 15 (2).

As reported by Heins et. al. (5), 100 ppm benzylamina purine will increase flower bud numbers by forty percent when applied two weeks after the start of short days. Also, when applied during the vegetative growth period,the phylloclades increased by as much as one hundred fifty percent (5).

Environmental stresses such as high temperature and low light intensity during shipping of Schlumbergera cause a C_2H_4 (ethylene) build up within the plant. The ethylene in turn has caused as much as thirty percent bud and flower drop during shipping. It has been noted that silver nitrate prevented C_2H_4 - induced abscission in plants. However, its use is limited because of poor mobility in the plant and phytotoxic effects (4). Veen and Van de Geijn (3) found that silver thiosulfate (STS) was mobile.

Various tests have been conducted with STS on a variety of plants including Schlumbergera by Cameron and Reid in 1981 (4). Some of their tests showed that cactus pretreated with .4mM silver thiosulfate (STS) spray kept ninety percent of their flowers and eighty percent of their buds after having been exposed to 0.5 uL/liter ethylene for a seven day period. The 4mM was made by mixing silver nitrate with sodium thiosulfate in a molar ratio of 1:4. In comparison the control plants lost all flowers and dropped eighty-five percent of their buds. When using this treatment caution must be exercised. They found that the 4mM spray did cause some blistering of phylloclades that left dark pits. However, they did find that 2mM sprays** also provided the same protection from ethylene, but without any appreciable phytotoxicity. Lower STS concentrations gave decreasing protection. In another test Schlumbergera held at 26^{o}C in the dark for four days dropped all their buds and flowers, due to ethylene build up within the plant. However, plants sprayed with 4mM STS lost few of their flowers and buds when sprayed at 2, 3, or 4 weeks ahead of storage (simulated shipment). The cost of STS was figured to be less than 0.1 cents per plant at 1981 prices (4).

After consideration of these tests, it is easy to see how advantageous it would be to use 2mM STS before shipping. However, silver thiosulfate is not currently registered for use as described herein. Check with your local extension agent for the up to date information on STS usage in your area.

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* Presented as a term paper in a greenhouse crop production course.

**A 2mM spray is made by dissolving 680 mg silver nitrate in a liter of water and 4 g sodium thiosulfate in another liter of water. The silver nitrate solution is slowly stirred into the sodium thiosulfate solution to make 2 liters of 2mM spray. Note that this concentration is about 7 times as concentrated as the STS spray recommended for seed type geraniums.

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MINIATURE AFRICAN VIOLETS

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Although the horticultural industry has been well acquainted with the standard size African violet (Saintpaulia sp.) for many years and has made it one of the most popular flowering pot plants, it has not yet realized the full potential of its dwarf cultivars, the miniature African violets. These smaller growing cultivars are only about half the size of the standard cultivars, yet offer most of the colors, floral variations and leaf patterns of the larger cultivars. These miniature plants offer the grower advantages in their production and sale because of their smaller size.

The miniature African violet is for all practical purposes identical in form to the standard size African violet, but scaled down in all parts with the possible exception of the flowers which in some cultivars are equal in size to those of the standard cultivars. The average size of a miniature Afrjcan violet plant is about six inches across when mature, compared with the ten to twelve inches of a standard size cultivar. The leaves of the miniature African violet may be smooth or scalloped and come in various shades of green, some being mottled with white on the upper surface. The flowers come in shades of blue, purple, red, pink, and pure white; they may be single, semi-double, or double. The plant has a neat and attractive appearance and offers good variety.

Miniature African violets are propagated by leaf cuttings. The cuttings should be taken from healthy stock plants grown under optimum conditions. Leaves used for cuttings should be mature with no signs of damage. They should be healthy and have about a one inch petiole. The cutting may then be treated with a weak rooting hormone if desired although good rooting will take place without the use of one. The leaves are stuck about one inch apart. There are many diferent choices of medium which are usable as long as they provide the necessary moisture retention, drainage and aeration. Possible rooting media would be sand, peat, vermiculite or some combination of these. The leaves form rootlets and then several small shoots, each one producing a separate plant when transplanted.

The shoots produced from a leaf cutting are generally ready to transplant in about 5 months after being stuck. The shoots can be potted up individually in 2 to 2 1/2 inch plastic pots using a loose well aerated medium, such as two parts peat, one part soil and one part extender such as perlite or shredded styrofoam, amended with superphosphate and enough lime to give a pH of 6.0 to 6.5. Plastic pots are used because African violet leaf petioles are sensitive to burning caused by the accumulation of fertilizer salts on the rims of clay pots. After potting, they should be fed weekly with a fertilizer solution such as 15-15-15 or 15-0-18 at a rate of 8 oz/100 gals.

As in the production of any plant, light and water are major factors in the growing of quality miniature African violet plants. Miniature African violets should never be allowed to dry out, the potting medium always kept moist, but not wet. If the soil mix is kept too moist it may result in rotting of the succulent roots, crowns, and leaf petioles; if allowed to dry for any length of time poor growth and flower production will result. It is important to remember that cold water on the leaves of African violets will cause spotting. Leaf spotting will be averted by watering with warm water or by the use of capillary mats to water from below. African violets are also sensitive to too much or too little light. Excessive light, such as in a improperly shaded greenhouse during the summer, will result in burning of leaves and flowers and shortened leaf petioles. Under insufficient light, poor flowering and leaf petiole elongation will occur. A good light intensity for miniature African violets would be in the area of 1000-2000 foot candles. One way of assuring proper lighting for African violets is to grow them under artificial lights; 600 foot candles for 16 hours a day should result in good growth and flower production.

Miniature African violet plants are not only attractive; they offer the grower advantages over the larger Saintpaulia cultivars with increased numbers per unit area and lower shipping costs. They present the retailer a good looking and saleable plant. Give these charming little plants a try.

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GOOD/BAD NEWS

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Extension Floriculturist

I just finished reading the book "The Good News Is The Bad News Is Wrong". The author must agree with me. By extreme extrapolation, one may conclude that the bad news about northern greenhouses is wrong.

Ben J. Wattenberg's forthcoming book is the most refreshing bit of optimism to cross my desk in a long time. He talks of social issues, not greenhouses, but looks at the positive side of each situation and refutes the pessimists.

He feels that the news media present bad news. They glorify it. They make it seem that it is the normal. Good news frequently must sneak in the back door. Take his example (edited) of colleges closing because their graduates can't get jobs because school enrollment is down. PS. The good news is that the birth rate is down.

We can parallel that in the northern greenhouse industry. Greenhouses will close because of expensive energy required to heat them and labor costs greater than that attributed to imported flowers. PS. The cost of energy for cooling and shipping in the sun belt (thirst belt) are nearly as high as our heat while Dutch labor costs more than ours.

Optimism abounds for northern greenhouses. Look for it. Opportunity is here. Growing structures must be energy and labor efficient just like the competition (or better). We simply need optimistic, agressive and astute activity to place our industry in the competitive and vibrantly healthy condition it deserves.

Now a confession. I didn't read the entire book. Just the condensation in the April '84 Reader's Digest. If your reservoir of optimistic thoughts needs replenishing, let this book spill a few good thoughts into your head.

IS YOUR ELECTRICAL SYSTEM SAFE

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Extension Agricultural Engineer

How many electrical devices do you have in your greenhouse? 25, 50, 100 or more! With this many electrical motors, fans, light, thermostats, solenoids and other mechanisms, it is easy to get shocked and/or hurt if these are not installed and maintained properly.

It is a good idea to have a licensed electrician check out your system periodically. The load installed on the system today may be more than the system was designed for several years ago.

To protect yourself and your employees from shocks, most pieces of electrical equipment should be grounded. This can be accomplished by using an electric cable with a ground wire connected to a grounded distribution system or by installing a separate ground wire connected to a ground rod.

An electrical device properly installed and maintained can be depended on to give good service.

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