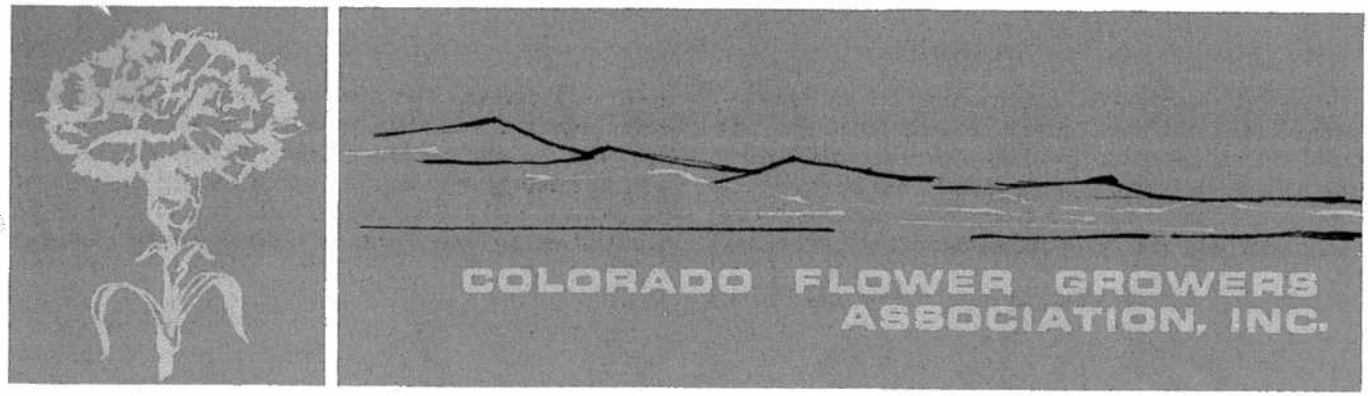

IN COOPERATION WITH COLORADO STATE UNIVERSITY
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Inert Media to Replace Soil?

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There are many reasons why this should happen. A large segment of our cultural problems arise from or are related to soils. To list a few:

Soil borne pathogens are difficult to eliminate because of inadequate soil sterilization, either because the soil is too wet or too dry when steamed.

Inadequate aeration due to tight soil structure often leads to root loss with the help of low-grade pathogens that thrive in wet, poorly aerated soils.

Water stress due to lack of water holding capacity or to inaccurate watering frequencies limits growth.

Finally, recent work completed by Hanan and Jasper shows how really important adequate water is to yield and to high quality flowers. Further, to supply 'adequate' water in soils for optimum growth requires more frequent irrigation than most soils will tolerate. To do the best possible job of growing in controlled environments such as greenhouses requires a medium that contains an excess of air even immediately following irrigation. This root environment can be supplied by an inert, relatively loose aggregate. These media are available at economical prices almost anywhere in the world.

In the late 1930's Professor Alex Laurie and his coworkers spent several years of work on gravel culture. Hydroponics is a magic word among laymen who know little of plant culture. What prevented the commercial adoption of gravel culture? Perfect aeration was inherent in the system. The required equipment was somewhat complicated and level, water-tight beds were also needed. Costs to convert from soil growing were almost prohibitive. But the major limitation that eliminated gravel culture or hydroponics at that time was probably the danger from diseases. An infection could start in a few plants and be spread to an entire planting when the nutrient solution was recirculated.

A much simpler hydroponic or nutriculture system is now available to us. Over the past decade we have evolved a satisfactory nutrient solution that needs very little modification for inert media. Since we already use a nutrient solution for each irrigation and use the solution only once, the same can be applied to inert media. By not trying to reuse the solution we avoid the requirement for water-tight benches and a pump and drainage system.

Carnations will grow in almost anything. The requirements for water, air, support and nutrients must be met in a manner to allow the grower greatest insurance against failure.

The ideal medium should change little, if any, over many years of usage. This in itself eliminates the use of organic matter, if we seek permanency in a medium. A balance between water holding capacity and air supplying power should be sought. Of the two, aeration is more important. With automation, irrigation frequency is not a real problem. The ideal medium should have enough weight to give firm support for the plants; but the lighter weight material we can use, the cheaper it can be handled.

Volcanic scoria has been used for at least 10 years in growing a part of our carnations at Colorado State University. Nucleus stock plants have been grown in 10-inch pots of scoria since the inception of the shoot-tip program. One bench of roses has been grown 8 years and it's one of the most productive benches we have.

This past year six possible mixtures of three inert ingredients were tried for carnations. Although records for the year are incomplete, all mixtures were highly satisfactory. Two inert media, scoria and Idealite, were used for growing separate benches of Forever Yours roses. These roses are without a doubt the finest we have produced in 18 years of research. We attribute these fine results to the fact that water stress was almost non-existent.

Possible inert media that are available at reasonable prices may be limited. Scoria (5/16'' minus grade) is an excellent medium at a reasonable price but freight charges make the final cost prohibitive. This is a natural product from the crushing of volcanic rock and particles are heavier than perlite but extremely porous.

Idealite is a manufactured light-weight aggregate. This can be obtained to almost any specification. Delivery cost per cubic yard to any point in Colorado is cheaper than the price of questionable top soil. A part of the aggregates are porous. A given, uniform-sized particle can be used, but much more desirable is a mixture of sizes from possibly as high as 1/2'' mesh to particles retained on a 20 mesh screen.

A naturally occurring perlite that is a bit heavier than manufactured perlite is being mined at Salida, Colorado. This product can be used but delivery prices are not known.

There are other suitable naturally occurring or manufactured aggregates available in almost every location. Florida has crushed coral rock. The mid-west has Haydite, etc. To use any product requires a knowledge of the nutrients it contains and its water holding capacity. The latter will be the key to irrigation frequency. The former will indicate modifications needed in nutrition.

Scoria and naturally occurring perlites usually do not contain calcium. It is advisable to add 3 to 5% of 1/2 to 3/4'' mesh limestone chips when filling benches with calcium-free materials to avoid the necessity of adding calcium salts to the nutrient solution. Idealite contains adequate calcium. Phosphate may be added to the medium at 3 to 6 month intervals, or it may be incorporated in the nutrient solution at the rate of 1 1/2 lbs. of 11-37-0 per 1,000 gallons of irrigation water. 11-37-0 or similar analyses are liquids available from fertilizer dealers servicing farmers in the Rocky Mountain area. Unless magnesium is high in irrigation water, around 1/2 lb. Epsom salts per 1,000 gallons should be used.

Soil testing is not practical on inert media. Total conductance and pH tests can be run on the first drip of leachate from the bench during irrigation. If salinity is much higher than that of the nutrient solution, leaching with clear water is indicated. Tissue analyses are being worked out for fertility checks on the growing plants. Our experience has been that if plants are thriving in soil with a given nutrient solution, they will do even better in an inert media.

Several points in planting and handling inert media should be added. Saran screen may be necessary to block large cracks in raised benches unless the aggregate contains fairly coarse fractions. Wet aggregate will bridge over cracks or holes much better than if it is dry. A minimum of tilling, possibly none, should be necessary between crops. Removal of all plants and large roots should prevent accumulation of organic matter in the medium. Inert media should be moist to wet when steamed - never dry.

Finally, planting cannot be done with bare hands in

most aggregates. The medium should be watered before planting. A sterile trowel is used to slice into the medium and make a narrow slit behind it as it is pulled slightly forward. A rooted cutting is inserted in the slit and the aggregate falls around the base of the cutting as the trowel is removed. Hose watering to settle the medium around the cutting completes the job.

A Gates watering system has proven most satisfactory, since it applies water uniformly over the entire bed surface. Drip system hose watering, etc., are not adequate for these media.