# Organic Matter, Carbon Dioxide and Plant Growth

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Recent studies have related carbon dioxide ($CO_2$) enrichment of greenhouse atmospheres with increased yields, improved quality, and earlier maturity of vegetables and flower crops. Thus, some of the merits of the historical practice of using large quantities of animal manures and mulches in greenhouse crop culture, have become apparent. These materials provide in their decomposition, a natural source for $CO_2$.

Sphagnum peat, sawdust, "well-rotted" manure, muck, sand, peanut hulls and ground corn cobs were compared in their capacity to give-off $CO_2$. A Beckman infra-red gas analyzer monitored and recorded the $CO_2$ levels. The most potent source was peanut hulls followed by corn cobs. Sawdust and manure also provided levels slightly above normal. (table 1)

Table I. Potential of various materials as sources of carbon dioxide.

| Material | Relative $CO_2$ levels (percent increase above that for sand) |
|---|---|
| Peat | 100 |
| Soil | 100 |
| Corn Cobs | 175 |
| Peanut Hulls | 230 |
| Manure | 110 |
| Muck | 100 |
| Sawdust | 110 |

Growth of some vegetables and flower seedlings was enhanced when they were grown in conjunction with organic mulches added to supply $CO_2$. The most promising of the materials, peanut hulls, and corn cobs were mixed half and half with #2 vermiculite (Cornell mix style) and placed in 15 cubic feet Mylar plastic chambers. Seedlings of snapdragon, cucumber, lettuce, and tomato were potted in soil and placed alongside of standard wooden flats containing the mixes. Air was blown through the chambers to maintain a positive pressure and $CO_2$ levels inside the chambers were recorded. The mixes were watered regularly with a complete nutrient solution to simulate green house conditions and promote $CO_2$ release. The results are presented in Table II.

Table II. Comparative growth of seedlings maintained with mixes containing various organic materials.

| Composition of the Mixes | $CO_2$ level in chamber (ppm) | Dry Wt. (grams) | Fresh Wt. (grams) |
|---|---|---|---|
| 1. Peanut hulls/vermiculite (1:1) | 620 | all dead | all dead |
| 2. Corn cobs/vermiculite(1:1) | 665 | 44.8 | 3.23 |
| 3. Soil/sand/muck (1/3:1/3:1/3) | 300 | 31.4 | 2.13 |
| 4. Sphagnumpeat vermiculite (1:1) | 300 | 32.1 | 2.07 |

†A summary of part of the work done for his Master's Thesis. The senior author is an Associate County Agriculturist Agent in Nassau County.

There was a 41% increase in fresh weight and 51% increase in dry weight of the seedlings in the corn cob atmosphere compared to the soil chamber. All plants in the peanut hull chambers died within 14 days after the plants were placed inside the chambers. The odor of ammonia could be detected in the peanut hull containing chambers, and this may have caused the death of the seedings. A larger air to medium ratio, would probably have eliminated this toxic condition.

From these preliminary experiments it has been shown that differences exist among organic materials as potential sources for $CO_2$ production under favorable moisture and fertility levels. Peanut hulls and ground corn cobs gave the highest release rate of any material tried and maintained a level of $CO_2$ significantly above atmospheric levels for at least 40 days. Seedlings of tomato, lettuce snapdragon and cucumber respond to increased $CO_2$ levels produced by decomposition of corn cobs mixed half and half with vermiculite and fertilized with a complete nutrient solution. These responses were observed during November to December when days were short and light intensities were low. Some byproduct(s) in the decomposition of peanut hulls (probably ammonia) was toxic to tomato, lettuce, cucumber, and snapdragon seedlings at the levels produced under conditions of this trial.