HORIZONTAL AIR FLOW CHARACTERISTICS

Jay S. Koths
Extension Floriculturist

Horizontal air flow (HAF) is "the best circulation system we evaluated and one which I feel deserves wide adoption." This quote by Professor John Walker of the University of Kentucky was made in 1973.

Since then many HAF systems have been installed. But not as many as expected. The primary reason for lack of application is low cost! This may sound contradictory but appears to be true. Other less efficient systems such as the fan powered convection tube are more expensive and return more profit to the salesmen and manufacturers producing them. HAF systems are usually installed by the greenhouse operator.

Horizontal movement of air may be visualized as a fluid flowing in a large box. Air is relatively heavy. A 30 x 100 foot greenhouse will contain about 1 1/2 tons of air. If this air is moved in a circular pattern, little energy is required to keep it moving.

Professor Walker recommends that the air be moved at a minimum of 40 feet per min. (fpm). Remember that the air moves 100 fpm for summer cooling if pulled lengthwise in a 100 foot house. This is roughly one mile per hour. Comparable speeds are readily attained in HAF systems.

For individual houses, small, 16-18" fans (1/12-1/20 horsepower) are used, one fan per 50 feet of wall on both sides of the house. Install the first fan 15 to 20 feet from the end of the house, the last fan 40-50 feet from the end toward which it is blowing. All fans should be installed about 1/4 of the way across the

house and pointed directly down the house to minimize turbulence. If mounted less than 7 feet high, the blades must be guarded.

If unit heaters are used, they may be installed as with the small fans described above. This is illustrated in Figure 1 but note that the near heater on the left is too close to this end. It should have been placed near the middle of the house. For maximum effectiveness the heater fans should run continuously except when venting. The fans pictured may be of sufficient capacity to require continuous operation of only two in this small house for effective HAF.

Figure 2 shows small fans in a 30,000 sq. ft. house. These should be mounted so that 2 or 3 bays have air movement in the same direction. This is especially important in ridge and furrow houses with high gutters so that the eddies in the passing air streams will not cause undue turbulence and loss of air speed.

In houses with hot air furnaces, the ducts should be all faced in the same direction (Figure 3). In adjacent ridge and furrow (R&F)

Figure 1

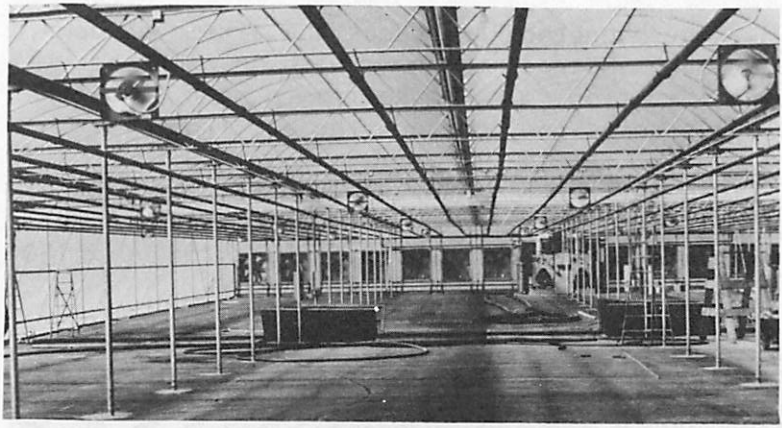

Figure 2

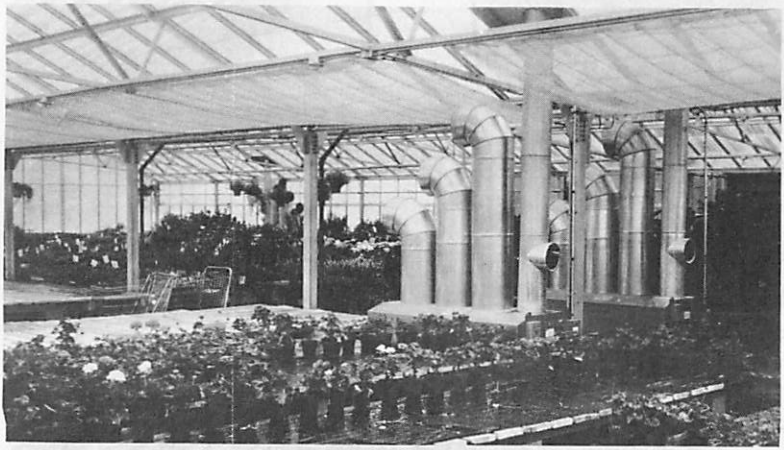

Figure 3

houses, the heaters provide HAF. Note that the heaters are side by side in one end while the other heaters are in opposing corners.

HAF provided by squirrel cage blowers in heaters is not as power efficient as from fans. The air is in effect "pumped," similar to the Fan-Jet. In HAF, the air is in effect just "pushed" around and power consumption is only a fraction of that required for "pumping" air.

In connected R&F houses the air moves down one house and back the next with no apparent stratification. The smoke from a bomb in Figure 4 illustrates how coherent the air front is.

In large R&F houses, low-horsepower fans with large blades are even more power efficient. In this range (Figures 5-10), the three 40 x 150'

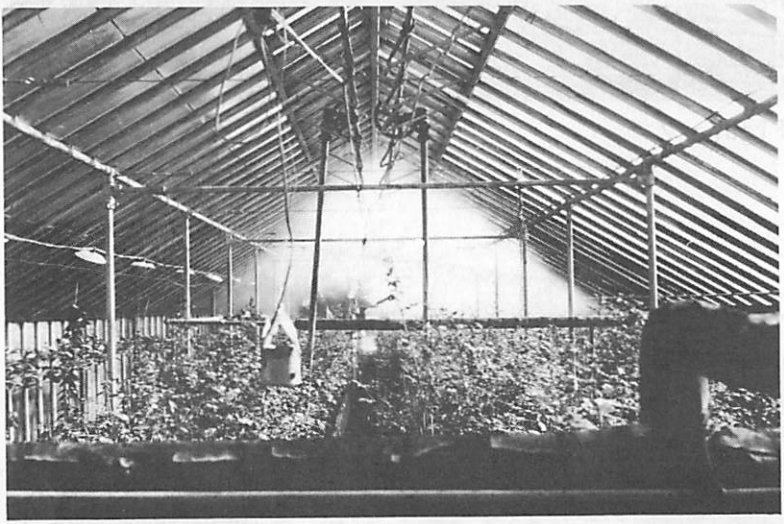

Figure 4

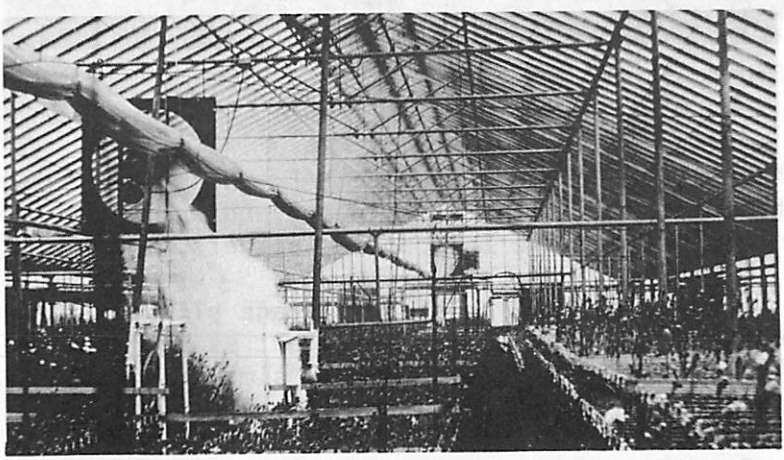

Figure 5

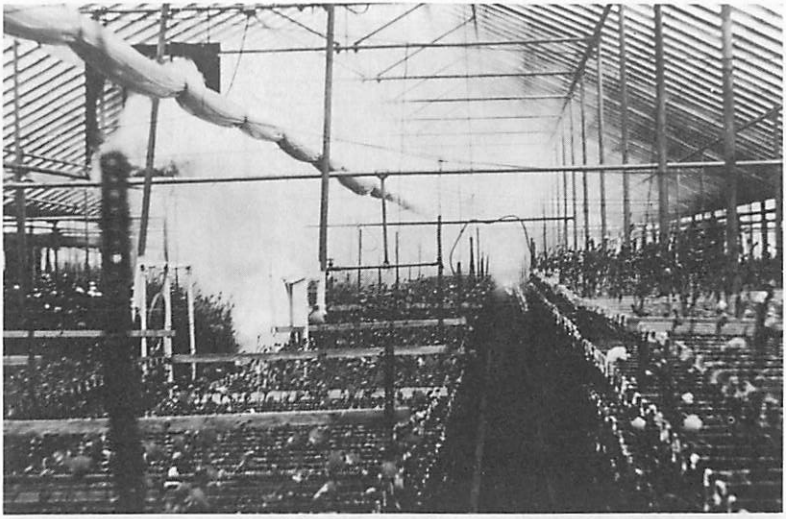

Figure 6

houses would normally be equipped with three 36" 1/4 HP (or 1/3 HP) fans. The owner happened to have a 48" 3/4 HP fan available. He mounted it in the center house, planning to add other fans if necessary. It wasn't.

A smoke bomb was ignited (Figure 5). The large fan blew the smoke the length of the house rather rapidly. Soon the far end of the center house was full of smoke (Figure 6). It moved across to both side houses (Figure 7) and began moving back (Figure 8). In spite of the initial mixing by the oversized fan, the air front moving back up the side house was quite distinct (Figures 9 + 10).

One of the obvious features of the smoke flow was the "scrubbing" of the corners. There were no hot or cold spots. Temperature readings indicated no stratification of heat.

When is HAF not efficient? Some greenhouses for foliage plant production are equipped with racks and so many hanging plants, that mass air

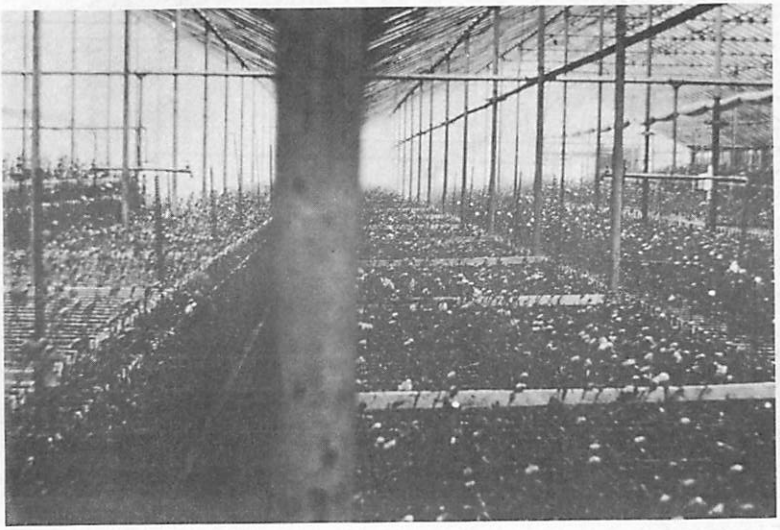

Figure 7

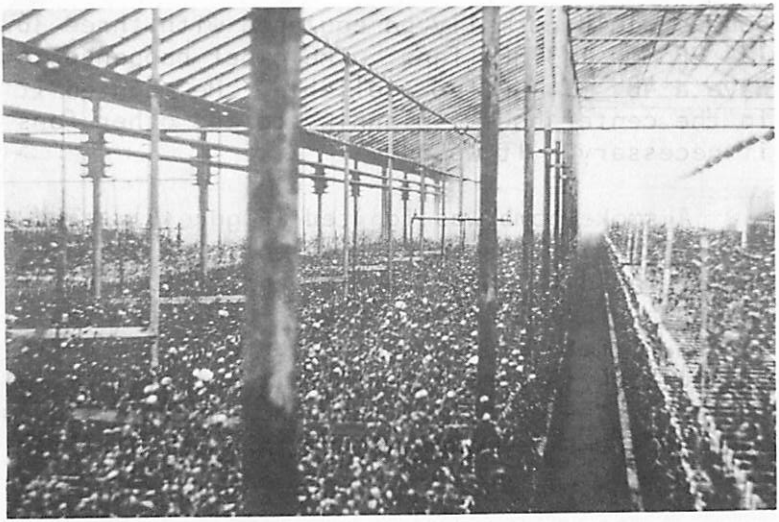

Figure 8

flow is not efficient. Even convection tubes do not work very well. It would seem that increasing the number of small fans in such crowded houses might overcome the resistance to air flow. HAF is also less effective in narrow, low individual houses.

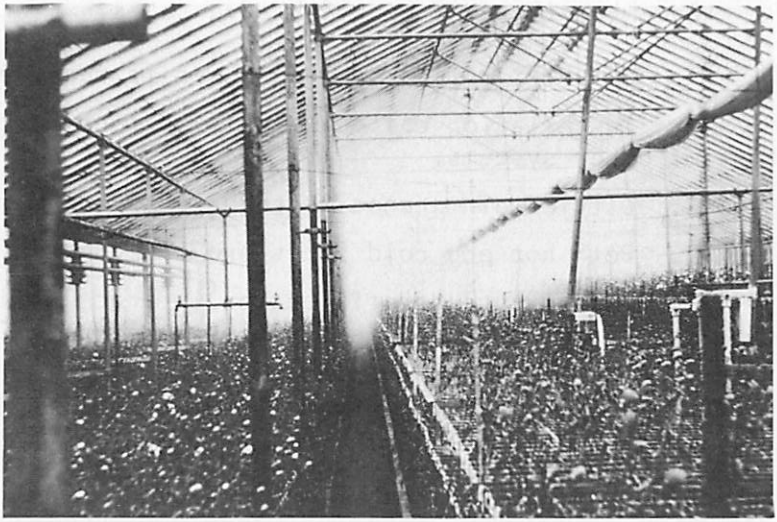

Figure 9

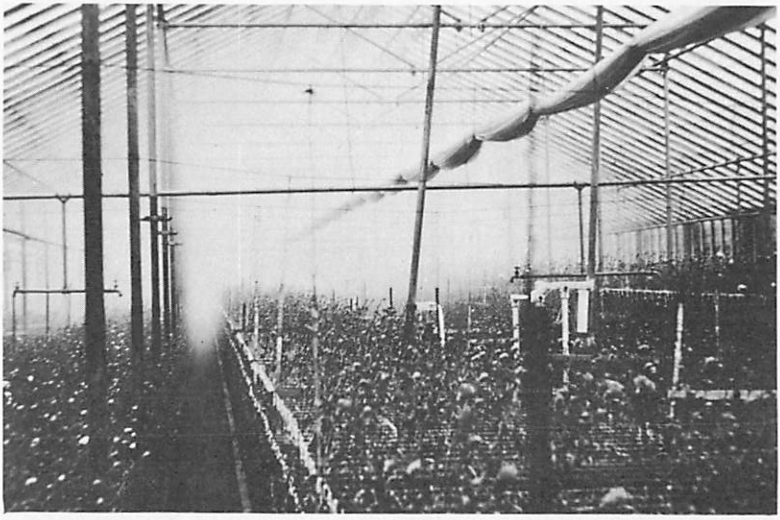

Figure 10

Remember that HAF has many advantages.

1. Only 1/2 to 1/3 as much power is required.

2. Installation costs are only a fraction of that of other systems.

3. Little maintenance is required.

4. Both hot and cold spots are eliminated.

5. Temperature stratification is practically nonexistent so heat loss in the greenhouse peak is reduced.

6. Humidity is reduced.

7. Moisture condensation on plants is reduced, aiding in disease control.

8. CO_2 utilization is improved since the leaves are "scrubbed" by the air.

9. No CO_2 distribution system is required.

A little thought on ---

WORK

Few men use a whip any more
What approach do you use?
Adopt positive thoughts!
Most people like to work--they may gripe--
but the satisfaction of a job well done
is part of the reward received from work.

Recognize it!

Applying energy to work is natural--you provide outlets. Don't stifle it--initiative is doing the right thing at the right time without being told.

Encourage it!

Responsibility is wanted by almost everyone--
the amount varies--it must create challenge
but not cause discouragement.
A capacity for imagination, ingenuity and
creativity exists in everyone.

Exploit it!!!