

HORIZONTAL AIR FLOW FAN EFFICIENCY

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Horizontal Air Flow (HAF) fans are more efficient than their book ratings would indicate. We are often asked what capacity of fans should be installed in relation to the volume of the greenhouse. A figure for free air capacity of one-quarter of the greenhouse volume per minute has been used as a guideline.

Using this guideline, the air should circulate in the greenhouse every four minutes if the fans are installed using a conventional HAF method. For example, a 30 x 100 foot greenhouse would therefore have an air velocity of 50 feet per minute (fpm) if the air travels down one side and back the other, a total of 200 feet.

In a typical installation, four (1/15 HP, PSC, 1625 rpm, 16" blade) fans having a calculated free air rating of 1274 cubic feet per minute (cfm) each at 1625 rpm are used in a 30' x 100' greenhouse. The four fans will deliver 5096 cfm. With a 10' average height the volume is 30,000 cubic feet. The fan free air volume is only 17% (1/6) of the greenhouse volume, not 25% (one quarter) as suggested in the guideline, therefore air should circulate every 6 minutes, or 33 fpm.

The air has actually been measured moving faster than 50 fpm in such a house. In a house

with no hanging pots and a low growing crop the air velocity will approach 100 fpm.

Let us look at this another way. The cross sectional area of a 30 x 100' greenhouse with an average height of 10' is about 300 sq.ft. Half of this is 150 sq.ft. Air moving past any point at 100 fpm would give a volume flow of 15,000 cu.ft./min. With a free air fan rating of 1274 cfm, the air is moving past the fan with a volume nearly 12 times the free air movement rating of the fan ($15000/1274 = 11.8$).

Why does this happen? Moving air in a container (greenhouse) utilizes mass flow principles wherein the air is simply "kicked along" by the action of the fans. This is a principle advantage of the HAF system.

Compare this with a system wherein a fan is blowing air into a plastic distribution tube. The fan is working against pressure with minimal mass air flow principles. The air delivery of a quarter horsepower fan is about half of the free air delivery of the small HAF fans described above. If the air mass flow is half the HAF fan air rating and the HAF efficiency is 12 times the fan air flow rating, one might deduce that HAF is 24 times as efficient as a fan blowing into a distribution tube. This is not really true. We don't know if HAF is 2 or 5 or 24 times as efficient as a fan and distribution tube. But it is most certainly more efficient.

Similar calculations were made for a very large house, 81 x 600' x 16' average height. The fans were 30", 1/6 HP, PSC, 230 V., 1040 RPM. Air moving at only 50 fpm would total 12 times the free air rating. At 100 fpm the figure would be 24 times. Actual air flow was measured at about 90 fpm. Mass flow of air in greenhouses is efficient.