



BY JOHN W. BARTOK JR.

# Ventilation optimization

Choose the proper fans to obtain highest efficiency at the lowest cost

**F**ans are an important component of greenhouses. They cool the greenhouse, remove excess humidity and exchange CO<sub>2</sub>-depleted air. They also provide positive movement of air, as compared to natural ventilation that is dependent on wind movement and thermal buoyancy.

There are many types of fans on the market, so selection to achieve maximum efficiency at the lowest cost is important. The following are some important points to consider when selecting a fan.

**A larger-diameter fan with a smaller motor horsepower is more efficient.** For example, a 48-inch diameter, ½ horsepower (HP) fan has an output of 12,983 cfm and uses 662 watts/hour. A 36-inch diameter, 1 HP fan has an output of 12,168 cfm and uses 1,193 watts/hour. Based on 2,000 hours of operation and 15 cents/kwhr electric cost, the 48-inch fan will provide the same cooling and save \$159 a year — a 44

percent savings.

**Choose a ventilation fan based on 1/10-inch static pressure.** Air flowing through shutters, discharging into a headwind or being drawn through evaporative cooling pads requires greater pressure from the fan. This reduces output. The airflow difference between zero static pressure and 1/10 inch is 10 to 15 percent. Beware of manufacturers who only furnish performance at zero static pressure difference.

**Select a fan with a high-efficiency, totally enclosed motor.** Split-phase or capacitor-start motors are more efficient. Due to the dusty, high-moisture conditions in a greenhouse, totally enclosed motors should be selected to give better service and longer life. Dual-speed motors with a two-stage thermostat or controller provide better temperature control.

**Choose a fan that has a Ventilation Efficiency Ratio (VER) rating of 15 or higher.** The Bioenvironmental and

Structural Systems (BESS) laboratory at the University of Illinois evaluates the performance of fans. The VER is the fan efficiency in cfm output/watt of electrical input. The fan VER is rated at different static pressure and with accessories such as shutter, cone and screen to simulate installation in the greenhouse. They have found that the performance of fans between the best and poorest vary by a factor of two. Most manufacturers have their fans tested at the lab, and data for all fans tested can be found on the BESS website at [www.bess.illinois.edu](http://www.bess.illinois.edu).

**A slant-leg or slant frame is best.** This design increases efficiency by 2 to 3 percent by reducing the influence of wind currents. It is also easier to install and clean, as the shutter is integral and on the indoor building side of the fan housing.

**A fan with an exterior cone is 10 to 15 percent more efficient.** Adding a tapered cone to the outlet of a fan increases airflow and reduces wind influence. Cost is about \$100 to \$125 for a 48-inch fan.

**Use belt-driven fans.** Although direct-drive fans have a lower initial cost and require less maintenance, they are less efficient and produce more noise.

**Shutters influence airflow and efficiency.** Shutters located on the intake side increase airflow about 10 percent, as compared to shutters on the exhaust side. Making

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## HAVE A QUESTION?

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the shutter motorized provides positive opening and increases airflow. It also keeps the shutter closed when the fan is off, thus reducing heat loss. Shutter motors use 7 to 15 watt/hour.

**Provide frequent fan maintenance.** This includes cleaning the shutter and fan blades. Tests at the BESS laboratory showed that dust and dirt can reduce airflow as much as 30 percent. Tighten belts when they start to squeal and replace them when they start to show wear.

**The fan should meet OSHA safety standards.** A well-designed guard will disrupt airflow and efficiency by less than 5 percent.

Fans are an important tool for the greenhouse environment. Selection should be made to get the highest efficiency at lowest operating cost. **GM**



Adding a discharge cone to a fan provides at least 15 percent increased airflow.