

Increase the Efficiency of Your Greenhouses

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With up to 50% of the cost of producing vegetable and ornamental plants classified as labor and 10 – 20% as energy, exploring ways to reduce these costs makes sense. Installing improved handling methods, simple mechanization, insulation and better controls can result in greater efficiency. The following is a review of some of the methods and equipment that growers are using to address the energy and labor issues.

Labor Efficiency and Productivity

Let Controls Make the Decisions

Growers spend a considerable amount of time making routine decisions. Do the plants need to be watered? Should the vents be opened? Is it time to draw the shade or energy curtain? Simple, low cost devices, such as electronic controllers, time clocks or alarms can make these decisions for you. Computers can integrate environmental factors and keep a history of crop growing conditions.

Workstation Design

Workstation height – the best table height is elbow height. Adjustment should be provided for different size workers. It is best to provide for both standing and sitting positions as greater efficiency is achieved when workers alternate position.

Hand and arm motion – the reach from the normal arm rest position should be limited to 24” radius to the side and front for women and 27” for men. The location of the flat that is being transplanted into should be no more than 18” from the resting elbow.

Location of materials – materials should be located as close to the work area as possible. Walking 10’ to pick up or set down a flat will add about two cents to its production cost. Tipping the plug flat toward the transplanter can reduce reaching distance. Prefilled containers eliminate one operation. They can be supplied to the transplanters by belt conveyor or on pallets. Removal of materials from the workstation can be by cart or conveyor.

Materials Handling

Overhead conveyors – good for moving pots or flats to or from the growing area. Track is usually suspended from greenhouse trusses. Track can be run to greenhouses, headhouse or shipping area. Plant carrier will hold 10 to 20 flats at one time. System is low cost.

Carts – Most large department stores require that plants be shipped on carts. They should be selected for the size of container to be carried. Hard level surfaces are needed to aid movement. They can be pushed by hand or pulled with a power unit. Most carts have removable shelves to accommodate different size plants.

Pallet handling equipment – Most materials that growers receive is transported on pallets for ease of handling. A pallet truck or forklift can save considerable time in unloading. Dock facilities may be needed.

Energy Conservation

Increasing energy costs make conservation and efficient use of facilities an important part of today's greenhouse operation. New greenhouse designs, better glazing, improved heating and ventilating equipment and new management systems should be included when upgrading or adding on. With typical annual energy usage being 75% for heating, 15% for electricity and 10% for vehicles, efforts and resources should be put where the greatest savings can be realized.

Reduce Air Leaks

Keep doors closed - use door closer or springs.

Weatherstrip doors, vents and fan openings. Close gap around stovepipe penetration.

Lubricate fan shutters frequently so that they close tight. A partially open louver may allow several air changes per hour. For example, a 48" fan louver that fails to close properly leaving 1" gaps, allows 23,000 Btu/hr of heat to escape costing \$0.46 if you are burning \$2.00 fuel oil. Shut off some fans during the winter and cover openings with insulation or plastic to reduce infiltration of air.

Use poly with an infrared inhibitor on the inner layer for 15% savings. Payback is 2-3 months.

Energy Conserving Screen

Install a thermal screen overhead and on sidewalls for 20%-50% savings. Cost is \$2.00 - \$3.00/sq ft. Payback is 1-3 years. A double screen will save an additional 10 – 15%. Tight closures should be maintained where curtains meet sidewalls, framing or gutters. Heat and water lines should be insulated or located below the screen.

Insulation

Insulate the kneewall or sidewall to bench height. Use 1" to 2" of insulation board. Applying 2" of foam insulation to a 3' high kneewall on a 28' x 100' greenhouse will save about 400 gallons of fuel oil/year.

Space Utilization

Increase space utilization to 80% - 90% with peninsular or movable benches.

Install multi-level racks for crops that don't require high light levels.

Grow a crop of hanging baskets on overhead rails or truss-mounted conveyor system.

Efficient Heating System

Installation of floor or under-bench heat will allow air temperature to be set 5° - 10°F lower.

Yearly maintenance - Check boiler, burner and backup systems to make sure they are operating at peak efficiency. Have furnaces cleaned and adjusted and an efficiency test run before heating season. A 2% increase in efficiency for a 30' x 150' greenhouse will save about 200 gallons of fuel oil.

Check accuracy of thermostats – correcting a reading that is 2°F high will save \$100-\$200.

Install electronic thermostats or controllers with a +/-1°F accuracy. Potential yearly savings of 500 gallons of fuel oil in a 30' x 100' greenhouse when changing from a mechanical to an electronic control.

Aspirate thermostats or sensors for more uniform temperature control. Differential between on and off can be reduced as much as 6°F.

Install horizontal air flow (HAF) fans to get more uniform temperature in the growing area.

Additional information can be found in **Energy Conservation for Commercial Greenhouses** – NRAES-3, 100 pages, \$21.25 available from CIT Resource Store, Unit 4035, W.B. Young Building – Rm 2, Storrs CT 06269-4035. Make check payable to UConn. Price includes postage and handling. Revised – September 2008.