



SASKATCHEWAN
ALFALFA SEED
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NEW ALFALFA LEAFCUTTING BEE INCUBATOR DESIGN FOR OPTIMIZING PARASITE CONTROL

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Research on the development of a new leafcutting bee incubator design, incorporating features which will optimize parasite control, has been undertaken in order to provide important technical information to producers which will allow them to either construct new leafcutting bee incubators or retrofit existing incubators to a recommended set of specifications in order to enhance parasite control efforts. The first prototype incubator to be constructed was utilized during the 1998 field season to further evaluate use of a pyrethrin aerosol compound for chalcid parasite control. A second incubator of identical design was subsequently constructed and both incubators were utilized for chalcid parasite control research during the 1999 and 2000 field seasons.

The prototype incubators were designed in 45 foot van trailers with sufficient capacity (~2,170 ft³) to incubate 10 million leafcutting bee cells per unit. The incubator ventilation system was designed around an air conditioning fan - coil unit whereby the air circulating in the incubators could be either pushed or pulled over incubation trays containing the leafcutting bee cells. Thus the air, whether being pushed or pulled, could be cooled. The heat source utilized for the incubators was electric baseboard heaters.

The heating and air conditioning systems were controlled by a thermostat, which employed sensors mounted at points within the leafcutting bee incubation trays and at other points in the incubation chamber in order to provide input for the thermostat to maintain programmed temperature set-points. Control of the push - pull ventilation system was attained by dampers installed on both sides of the intake and discharge points of the air conditioning fan - coil unit.

Ventilation over the trays was achieved through 0.125 inch vertical slots situated directly behind each row of trays. Return or intake ventilation on the wall opposite the leafcutting bee incubation trays was attained with 0.125 inch horizontal slots that were baffled to control the direction of air movement. Air movement in the incubator with the push - pull ventilation system may be characterized as follows ...

Pull system - good mixing of air from top to bottom in the incubator opposite the leafcutting bee incubation trays. Air movement over the leafcutting bee incubation trays was 50 feet per minute or less. Push system - positive and vigorous movement of air over leafcutting bee incubation trays with even capture of return air opposite the incubation trays.

HVAC calculations took into account all construction components of the incubators, as well as heating and venting required to maintain the leafcutting bees at the required incubation temperature. Heat produced by the developing leafcutting bee pupae, and ventilation required for removing residual pyrethrin aerosol, was also considered in the calculations. Selection of a suitable air conditioning unit was based on the HVAC calculation and the fan capacity was matched to the heat loss calculation of the vent circuit.

Table 1. Mean temperatures in incubator during typical incubation period

Top incubation tray	30.42 °C
Middle incubation tray	30.49 °C
Bottom incubation tray	29.16 °C
Ambient air temperature	29.55 °C

The air circulation design was highly effective in maintaining uniform incubation temperature, delivering pyrethrin aerosol, and dissipating pyrethrin aerosol residue. Parasite control research undertaken in the prototype leafcutting bee incubators has also shown the efficacy of utilizing screen bottom trays in conjunction with pyrethrin aerosol treatment for parasite control, and the potential for use of several pyrethrin aerosol formulations. A complete set of incubator plans is available for purchase from SASPA.

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Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6

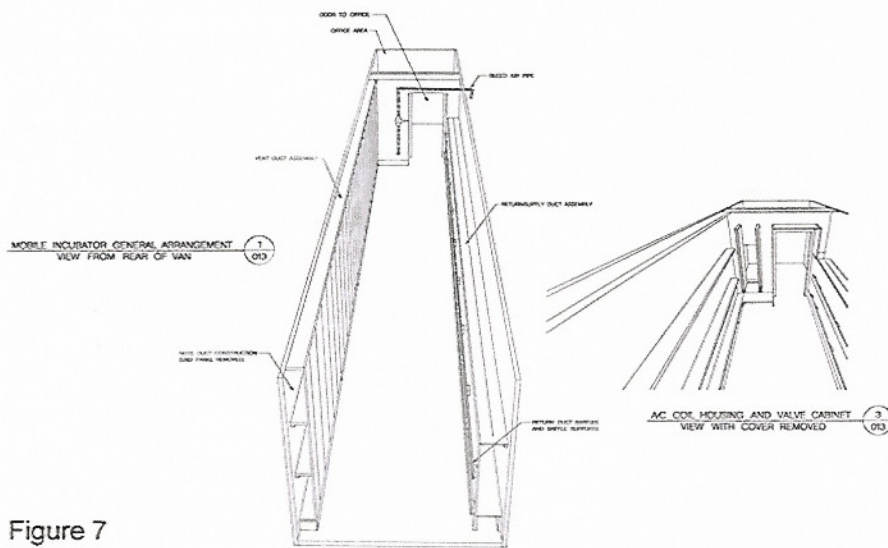


Figure 7

- Figure 1. Exterior front view of prototype alfalfa leafcutting bee incubator vans.
- Figure 2. View of incubation tray set-up in prototype leafcutting bee incubator.
- Figure 3. View of air ducting assembly (one side) in prototype leafcutting bee incubator.
- Figure 4. Detail of temperature control sensor mounted in leafcutting bee incubation tray.
- Figure 5. Detail of prototype leafcutting bee incubator temperature control system.
- Figure 6. Detail of prototype leafcutting bee incubator fresh air intake ventilation unit.
- Figure 7. Diagram detailing return / supply air ducting assembly in prototype incubator.

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