



Agriculture & Horticulture
DEVELOPMENT BOARD



New Project

PE/PO 013

Refrigeration-based
dehumidification: energy
performance and cropping effect on
commercial nurseries.

Project Number:	PE/PO 013
Project Title:	Refrigeration-based dehumidification: energy performance and cropping effect on commercial nurseries.
Project Leader:	Tim Pratt
Contractor:	FEC Services Ltd
Industry Representative:	Chris Durnford (Red Roofs) Howard Braime (Double H)
Start Date:	01 December 2012
End Date:	31 March 2014
Project Cost (Total project cost):	£60,877 (£169,877)

Project Summary:

Energy costs and associated CO₂ emissions continue to be important to growers of high temperature protected crops. Refrigerant-based dehumidifiers have the potential to both reduce energy costs / emissions and improve crop performance. This project will carry out trials on a commercial tomato nursery to quantify the benefits of a modern dehumidifier in UK conditions. A combination of monitoring and modelling will also be carried out to calculate the benefits for ornamental growers.

Trials with dehumidifiers in the early 1990s concluded that the return on investment was not attractive to growers. However, continued development and a reduction in capital cost relative to the cost of energy mean that dehumidifiers may now be a good investment for growers.

A dehumidifier could provide heat at the equivalent of 30 pence per Therm (p/Therm) for natural gas, compared to current prices of around 60 p/Therm; combined with a small yield / disease benefit a payback within five years seems possible.

Equipment and technical support, worth £109,000, will be supplied free of charge to the project by DryGair, giving significant gearing of HDC funds.

Aims & Objectives:

The overall aims of the project are to:

- Reduce energy use and cost in heated glasshouses.
- Reduce carbon dioxide (CO₂) emissions associated with glasshouse production.
- Improve yield and quality.
- Reduce disease incidence and therefore the use of crop protection chemicals.

The specific objectives are to:

- Quantify the energy saving delivered by a refrigeration-based dehumidification system in a commercial greenhouse.
- Determine the impact on the uniformity of the internal environment.
- Determine the impact, if any, on crop development.
- Quantify the effect on both crop yield and disease levels.
- Effectively communicate the results to HDC members.

Benefits to industry

For growers of protected edible crops in particular, energy costs represent 30-40% of the variable cost of production. There is an estimated 350 hectares (Ha) of high temperature edible crops in the UK, with an average energy cost of £100,000/Ha per annum (p.a). The fundamental physics associated with a dehumidifier suggest that the cost of heat produced by one could be half that of a natural gas-fuelled boiler. The need for CO₂ enrichment from burning natural gas means that a dehumidifier is likely to be restricted to running for only 50% of the time. Taking account of this, an energy saving of £25,000/Ha seems possible. Indicative figures from DryGair suggest a capital cost of £150,000/Ha which would give a return on investment in six years based on energy savings alone.

Additional crop-related benefits are expected. These are potentially quite varied:

- A dehumidifier adds less energy to the greenhouse for humidity control than traditional heat and vent. This means that the grower will have better control of the greenhouse temperature especially during the summer and therefore more control over plant development.
- There will be less venting, which should lead to higher CO₂ levels especially during the shoulder seasons and less cold shock to the heads of the plants, which can lead to tip burn and the development of botrytis.
- The active removal of water rather than relying on ventilation especially on warm summer nights will deliver better humidity control than can currently be achieved. This should give lower disease incidence.

A crop related benefit of only £1.00/square meter (m²) would reduce the return on investment to just over four years.

Once installed, a dehumidifier requires minimal management input and if disease benefits are proven will, if anything, reduce labour requirements. There are no regulatory hurdles e.g. Specific off label approval (SOLA) applications to overcome. Whether further research and development is required after this project is uncertain. Although this project will focus on a tomato crop the results will be broadly applicable to growers of all high temperature crops (edible and ornamental).

If proven, the main limitation of uptake by the industry is likely to be the availability of capital. However, an uptake of only 2% of the edible crop growing area per annum would deliver compound savings of £2.6 million over five years and £9.6 million over 10 years.

As ever, communication of the results of the project is critical to ensuring maximum value is delivered to growers. Previous projects of this type have benefitted from a suite of knowledge transfer (KT) activities. We envisage:

- New project article in HDC News.
- Updates via www.growsave.co.uk.
- Attendance at tomato study group visits to the nursery.
- A nursery open day in early October.
- Presentation of the results at an industry event.
- Final results article in HDC News.

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