

# Dehumidification for onion stores

## Humidity problems in onion stores

For successful long term storage onions, unlike most other vegetables, need fairly low store relative humidities. An RH of 70% will keep onion skins dry and golden on colour so that best market prices can be achieved.

In ambient cooled stores, this low RH is often difficult to achieve. During the spring months especially, there is little cold outside air available to cool the crop and it stands for long periods unventilated. During these periods building RH increases and temperature gradients form on the layers of the stack and the air above the stack.

If these temperature gradients are sufficiently great and the RH is high, condensation can form in the upper levels of the stack. This will lead to skin blemishes and spoilage of the onions.

## Desiccant dehumidification

Dehumidification can be carried out in several ways. The most common uses a refrigeration technique. With this the air is first cooled to condense out the water vapour. The air is then re-heated by returning the energy given up during the condensation process.

This type of dehumidification works well both at and above room temperatures, but efficiencies drop off dramatically below 5°C.

At low temperatures desiccant dehumidification is more efficient. Here a water absorbing material 'soaks-up' the moisture in the air. This material is formed into a wheel, through which the air to be dried passes. The rotation of the wheel takes the material through a second high temperature airstream. This drives off the moisture held in the material (regeneration) so that it can immediately go through another absorption cycle (Figure 1).

## Installation details

A dehumidifier can be added to an existing store ventilation system. It should be positioned within the store, on top of, or adjacent to the main air duct (Figure 2). A secondary fan sized to give an airflow of 8.5m<sup>3</sup>/h/t, should be let into the main duct to take air from the dehumidifier and force it upwards through the onions and back into the air space above the crop. To ensure that air does not reverse through either the main fan or the recirculation fan when the other one is being used, backdraught shutters need to be fitted on both fans.

A small flexible duct is provided with the dehumidifier to exhaust warm humid air from the equipment to outside the building.

### Control system

Existing ventilation control systems ensure that the main fan operates only when outside temperatures are low enough to give cooling inside the store.

The dehumidifier and recirculation fan should be controlled to operate when the RH in the store is above 70% except when the main ventilation fan is operating. This involves the installation of a building humidistat and some interconnection between the existing ventilation controller and the new system.

## Trial details

Trials were undertaken in a 350t bulk store in Lincolnshire during the 1988/89 storage season and a second store in the same region in the following season, to test the effectiveness of dehumidification.



## Results 1988/89 season

### General operation

The dehumidifier operated as designed and kept RH within acceptable limits in all conditions (Figure 3 and Figure 3a). No condensation was evident in the stack.

Running hours 1151hours

Energy consumption 6906kWh (£406.07)

### Crop condition

The condition of the onions was good throughout the storage period. Quantifying exactly the differences in condition was difficult. It was felt however that the onions were in better condition than those kept in the ambient cooled store without dehumidification.

## Conclusions

The outlay and running costs of the equipment could be justified over a 5 year write-off period if a premium of over £5 per tonne could be achieved. This should be possible with the better quality onions that were obtained in the trial.

### Equipment costs and details

The following sizes and cost details have been supplied by Munters, Blackstone Road, Huntingdon, Cambs, PE18 6EF and the equipment can be purchased, hired or leased.

Store size	Dehumidifier required	Power
200t	MD300	2.1kW
400t	MD600	4.6kW
600t	MD1200	8.85kW
1000t	MD1500	17.2kW

