POST HARVEST BULB DRYING

♦ **Frank Ward, Hennock Industries Ltd.**

The process of drying bulbs after harvest is one of the most critical stages in the bulb production season. It is essential that it is done correctly otherwise significant losses will be incurred in the stocks and therefore in the financial performance of the bulb enterprise.

In this paper we will look at the aims, methods, systems and practice of bulb drying.

BULB DRYING - AIMS

The overall aim in drying bulbs is to provide the cost-effective removal of moisture with no risk of deterioration/loss. This implies that the drying process must proceed evenly throughout the whole of the stock. Generally bulb drying is split into two main phases.

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Phase1 involves a drying process to provide rapid removal external moisture

Phase 2 follows phase 1 and is aimed at the removal of cell sap from roots and old foliage. This by it's very nature is a much slower process.

These being the aims, the system must then be designed to allow this in the most cost effective manner.

BULB DRYING – SYSTEMS

Bulbs may be dried in one of several basic systems:

- Box drying
- Bulk drying

♦ Bulk drying

Drying bulbs in bulk or 'on the floor' requires a drying system designed for handling bulbs and relatively high air flows. However, with careful management, this can be satisfactorily achieved in a grain drying system, with some minor modifications.

Drying in bulk should generally follow these guidelines:

- Drying depth 1.8m - 3.0m (6' - 10')
- Air flow requirements
  - 0.12 $m^3/s/T$ (250 cfm/t) Phase 1
  - 0.047 $m^3/s/T$ (100cfm/t) Phase 2

♦ Bulk drying equipment requirements

To allow dring of bulbs in bulk, the following items are usually required:

- Building
- Tunnel
- Drying floor (laterals)
- Drying fan
- Heater (HT drying)
- Cooling fan (HT drying)
  - ☛ Remember that this could double up with an existing grain store to save money

♦ Drying in Bins

Many growers prefer to handle their bulbs continuously in bins. To dry bulbs in bins, the following guidelines should be followed:

- Drying depth off wall
  - Depends on pallet base of box
  - Air speed in the pallet bases <5m/s
  - Recommended max 5-6 boxes (phase1)
  - Recommended max 8-10 boxes (phase2)
- Stacking height
  - Depends on letter box wall & stability of boxes
  - Recommended maximum 6 boxes
- Air flow requirements
  - 0.21 $m^3/s/T$ (450cfm/t) phase 1 drying
  - 0.083 $m^3/s/T$ (175 cfm/t) phase 2 drying

Air flow requirements for bin drying are much higher than those for bulk. This is to account for the significant losses that occur between the bins.

♦ Bin drying equipment requirements

To enable bulbs to be dried in bins, the following times are required:

- Building
- Letter box wall
- Bins
- Drying fan
- Heater (HT drying)
- Cooling fan (HT drying)

BULK VS BIN

In deciding which system is most appropriate to your needs, the comparison of capital and running costs is important.

♦ Capital Costs (300T drier, based on 1998 prices)

Based on approximate budget figures the cost to design and build a basic bulb drying system can be compared as follows:

- Bulk drying £215/T
- Bin drying £283/T

Drying in bins is more capital intensive, as it includes the significant cost of specially designed bulb drying bins. These can add in excess of £60 per tonne. Generally, these cannot double with potato bins, as the potato bin does not normally provide adequate air flow to the whole of the crop.

♦ Drying costs

In terms of running the system, the costs can be compared as follows:

- Bulk drying 100%
- Bin drying 120%

The cost of drying in bins is higher simply because greater fan power and gas is required to allow for the higher air flow rates.

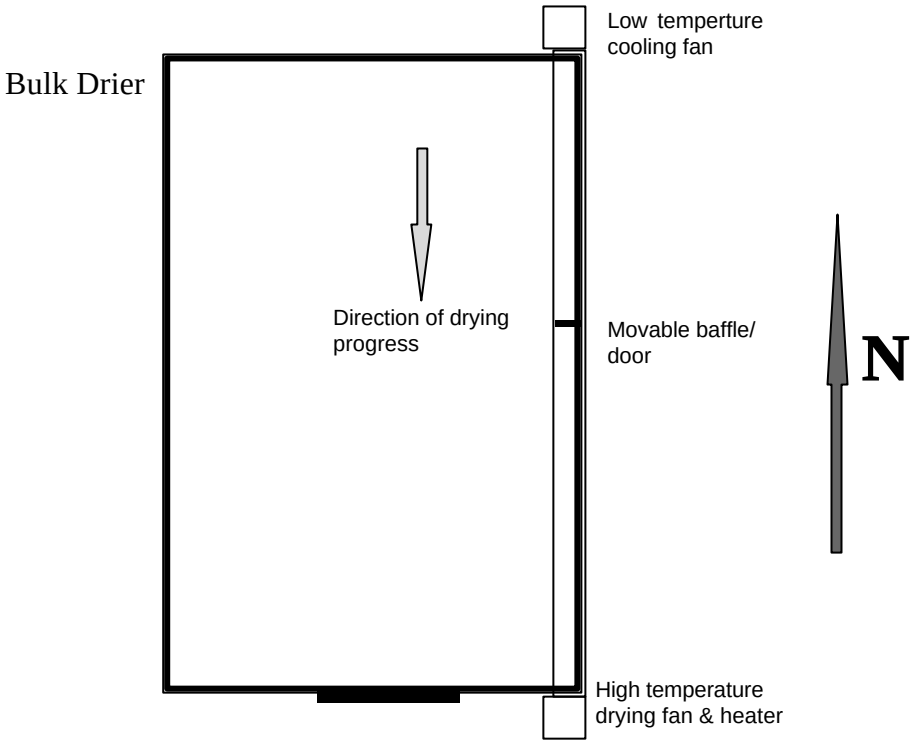
DRYING REGIMES

Regardless of the system employed, bulk or bin, there are also basically three drying regimes that may be adopted:

- Ambient drying (no additional heat) <20°C
- High temperature (added heat) >34°C
- Dehumidification (added heat and moisture removal) <20°C >34°C & 75%RH

One of the major hazards in drying bulbs is the risk of developing basal rot. This occurs most readily in the 20°C to 30°C temperature range. For this reason, many growers are now opting for high temperature regimes. This brings an added element to the management and equipment required, as a cooling fan is also required to bring the bulb temperature down to ambient as rapidly as possible, and to provide the stage 2 drying for the earliest bulbs into the system, whilst maintaining stage 1 drying for the stock latest into the system. The diagram below shows a typical layout for a high temperature drying system.

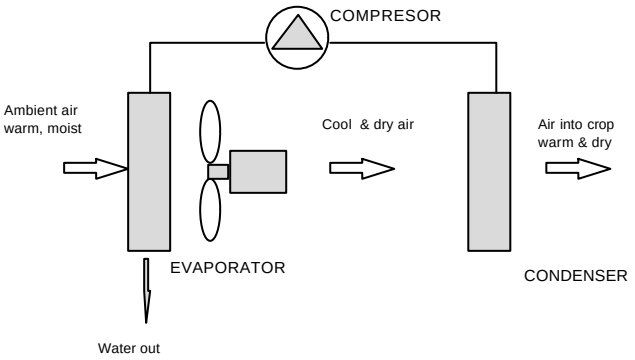
♦ Management of high temperature drying



♦ Principles of dehumidfication

Dehumdification has been used in the past for grain drying, though it's application has also been used for bulb drying in the South West. The system works on a refrigeration principle as follows:

- Removal of water from air by cooling past dew point
- Replace extracted heat to give dry warmer air
- Blow air through crop



Where dehumidification is being used for bulb drying, the air temperature is continuously recycled, thus allowing the temperature to rise to provide warm, dry air for drying

COMPARISON OF DRYING REGIME COSTS (300T BULK)

For each of the drying regimes mentioned, there are differences in both capital and running costs. These are outlined below, based on approximate budget figures in 1998.

- **Ambient**
  - ☛Additional capital 0
  - ☛Energy cost 100%

- **High temperature**
  - ☛Additional capital - Heater £4,800 - Cooling fan £3,200
  - ☛Running cost 270%

- **Dehumidification**
  - ☛Additional capital £20,000
  - ☛Running cost 80% - 110%
  - ☛**Maintenance?!**

BENEFITS AND DRAWBACKS –

- **Ambient drying**

  For
  - ☛Low capital cost

  Against
  - ☛Risk of basal rot
  - ☛Slow
  - ☛Higher risk of losses

- **High temperature drying**

  For
  - ☛Low risk of basal rot
  - ☛Rapid drying (2 - 3 days phase 1)
  - ☛Reduced risk of losses

  Against
  - ☛Higher capital cost
  - ☛Higher running costs

- **Dehumidification**

  For

  ☛Low energy costs

  ☛Could be combined with grain drying

  Against

  ☛Very high capital cost

  ☛Requires accurate control to reduce losses/basal rot

  ☛High servicing costs

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