فناوری پس از برداشت ۵

Post-harvest handling for roots, tubers, and bulb crops

Drying

Dry Cleaning Equipment

If the packhouse requires that potatoes should be delivered in boxes 'as dug' (i.e. harvested directly into boxes and not handled thereafter), potatoes arriving straight from the field may have large amounts of adhering soil present. This may vary from moist and sticky to dry and crumbly, depending on the ground conditions at lifting. Any soil on crops arriving from store should be dry, assuming the store is well-ventilated. Potatoes removed from bulk stores by bucket can also contain soil. If, in contrast, crop has been pre-graded on farm or removed from a bulk store using an elevator fitted with a soil extractor, the amount of adhering soil will be minimal.

Where a considerable quantity of soil is present on delivered potatoes, a dry cleaning system should be used (Fig. 11.4). The separated soil can then be put into boxes or skips for return to the farm of origin (Fig. 11.5). This avoids the wash water becoming too contaminated with soil.

There are a number of ways to remove soil and trash from potatoes. In all cases a compromise has to be reached between the level of cleaning and the possibility of inflicting bruises or damage to the tubers.

Fig. 11.4. Star wheel dry cleaner followed by endless screen grader. (Courtesy of RJ Herbert Engineering Ltd, Cambridgeshire, UK.)

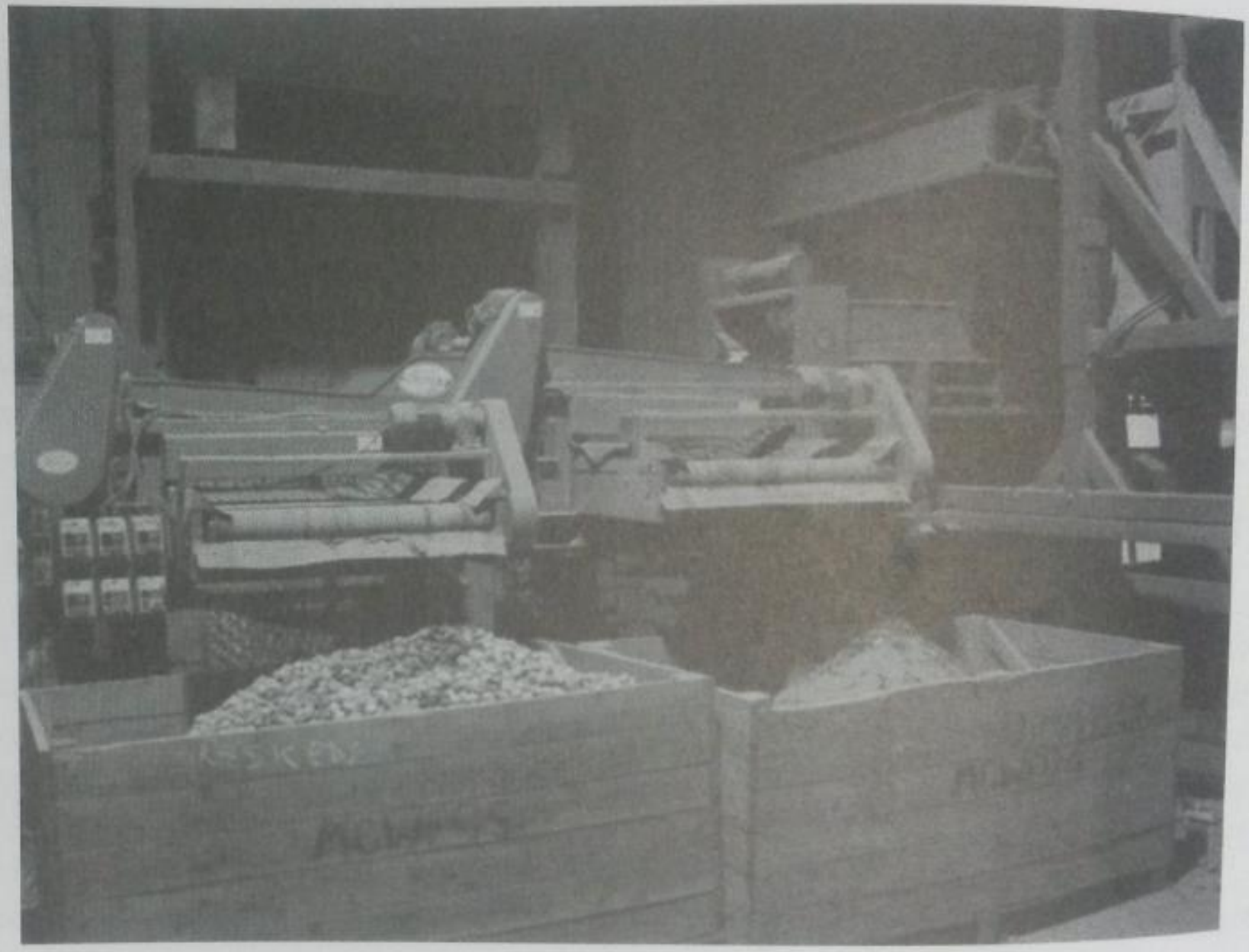


Fig. 11.5. Discharge of undersize tubers (left) and soil (right) from dry cleaning equipment.

Curing

Curing of roots, tubers, and bulb crops

When roots and tubers are to be stored for long periods, curing is necessary to extend the shelf life. The curing process involves the application of high temperatures and high relative humidity to the roots and tubers for long periods, in order to heal the skins wounded during harvesting. With this process a new protected layer of cells is formed. Initially the curing process is expensive, but in the long run, it is worthwhile. The conditions for curing roots and tubers are presented in Table 2.6.

Table 2.6. Conditions for curing roots and tubers.

Commodity	Temperature (°C)	Relative Humidity (%)	Storage time (days)
Potato	15-20	90-95	5-10
Sweet potato	30-32	85-90	4-7
Yams	32-40	90-100	1-4
Cassava	30-40	90-95	2-5

Source: FAO (1995)

Optimum Conditions for Curing Vegetables

Commodities	Temperature (°C)	RH (%)	Days
Cassava	30–40	90–95	2.5
	25–40	80–85	7–14
Potato	15–20	90–95	5–10
Sweet potato	30–32	85–95	4–7
	29–32	80–90	4–7
	30–33	85–95	5–7
Yam	32–40	90–100	1–4

Table 5. The best conditions for curing crops

Commodity	*Temperature*		*Relative Humidity*	*Days*
	°C	°F	(%)	
Potato	15-20	59-68	90-95	5-10
Sweetpotato	30-32	86-90	85-90	4-7
Yams	32-40	90-104	90-100	1-4
Cassava	30-40	86-104	90-95	2-5

Cut-away view of yam curing

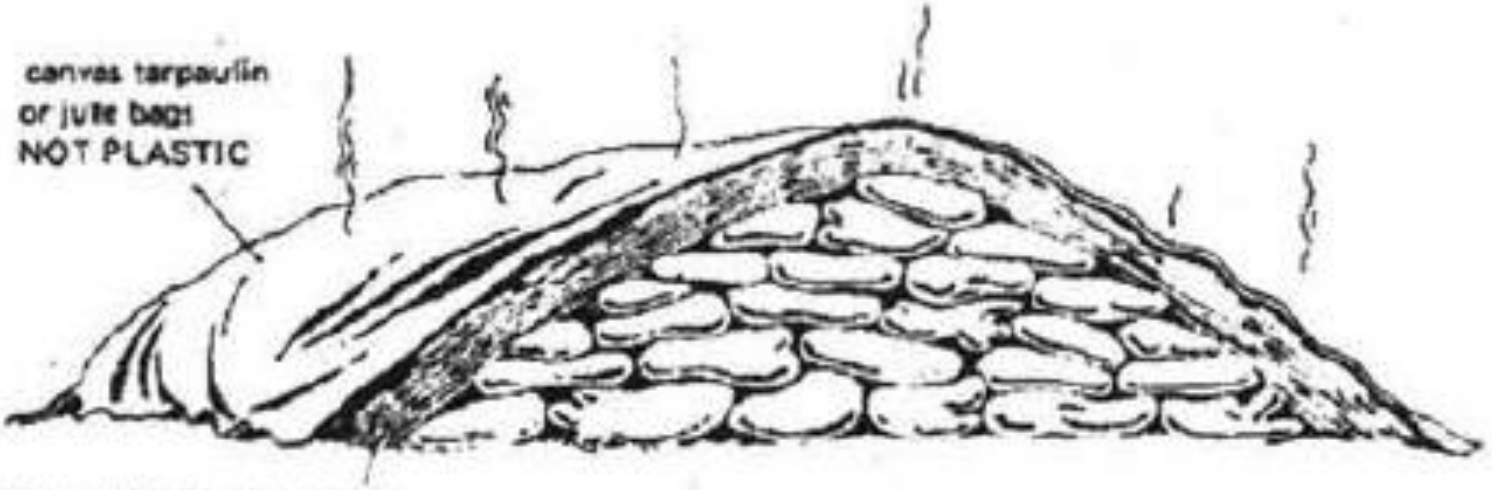


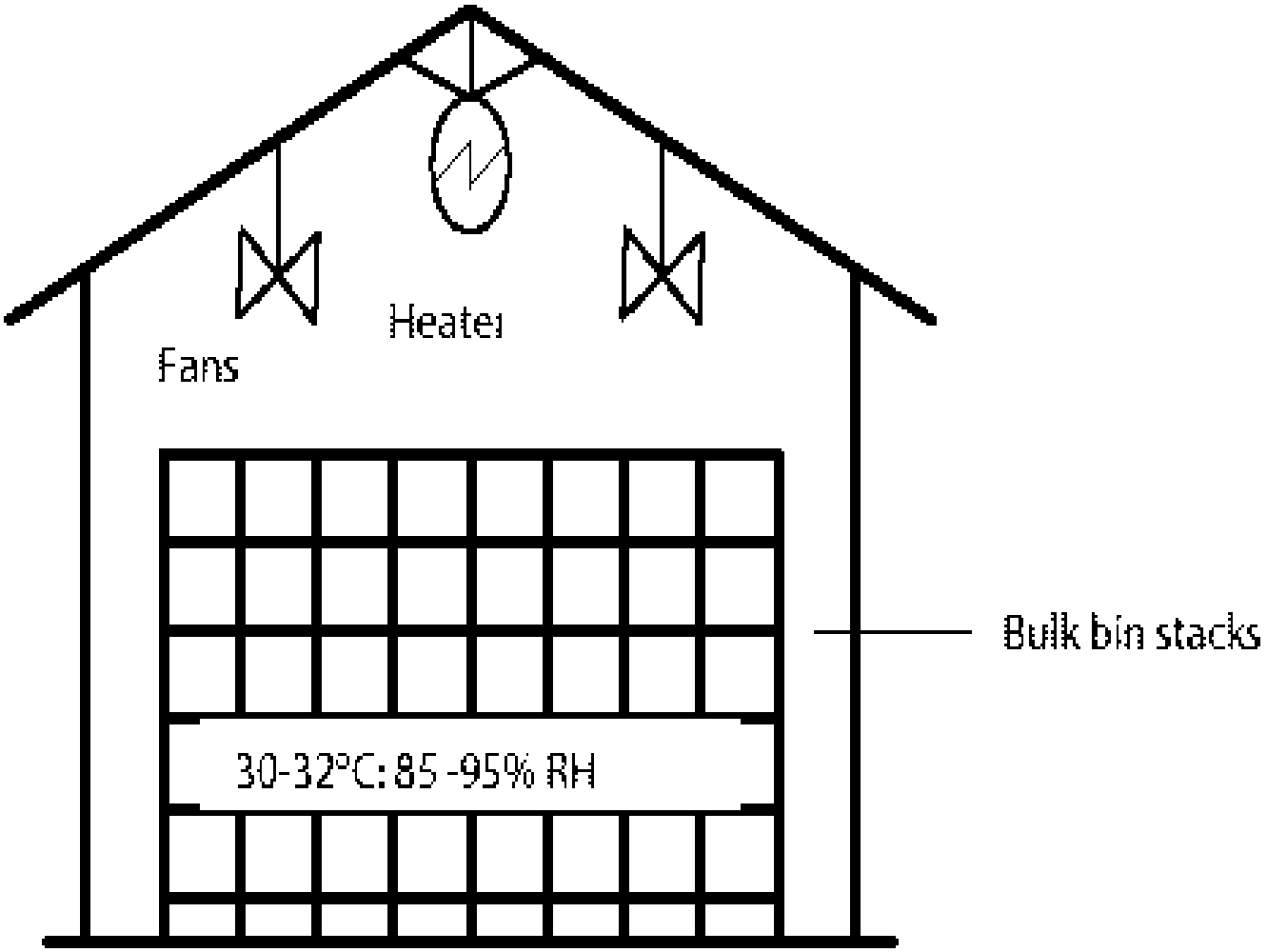
Figure 14. Cut-away view of yam curing

Curing can be accomplished in the field or in curing structures conditioned for that purpose. Commodities such as yams can be cured in the field by piling them in a partially shaded area. Cut grass or straw can serve as insulating material while covering the pile with canvas, burlap, or woven grass matting. This covering will provide sufficient heat to reach high temperatures and high relative humidity. The stack can be left in this state for up to four days.

Onions and garlic can be cured in the field in windrows or after being packed into large fibre or net sacks. Modern curing systems have been implemented in housing conditioned with fans and heaters to produce the heat necessary for high temperatures and high relative humidity, as illustrated below:

The fans are used to redistribute the heat to the lower part of the room where the produce is stored. Bulk bins are stacked with a gap of 10 to 15 cm between rows to allow adequate air passage. The system shown in Figure 2.6 can be used for curing onions; an exhaust opening near the ceiling must be provided for air recirculation. Care should be taken to prevent over-dryness of the onion bulbs.

Figure 2.6 Typical curing houses for roots and tubers.



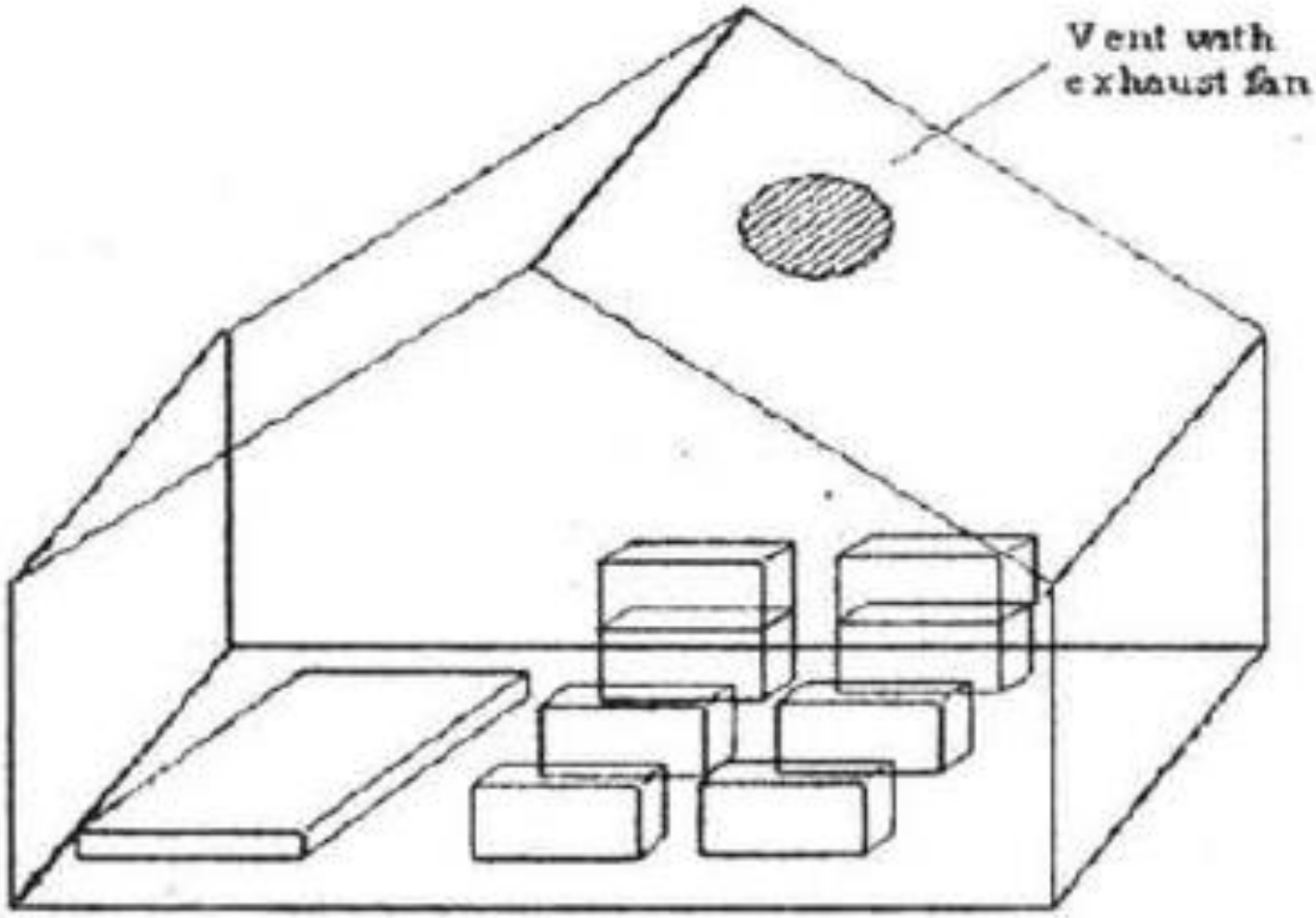


Figure 15. Curing assisted by shade and ventilation

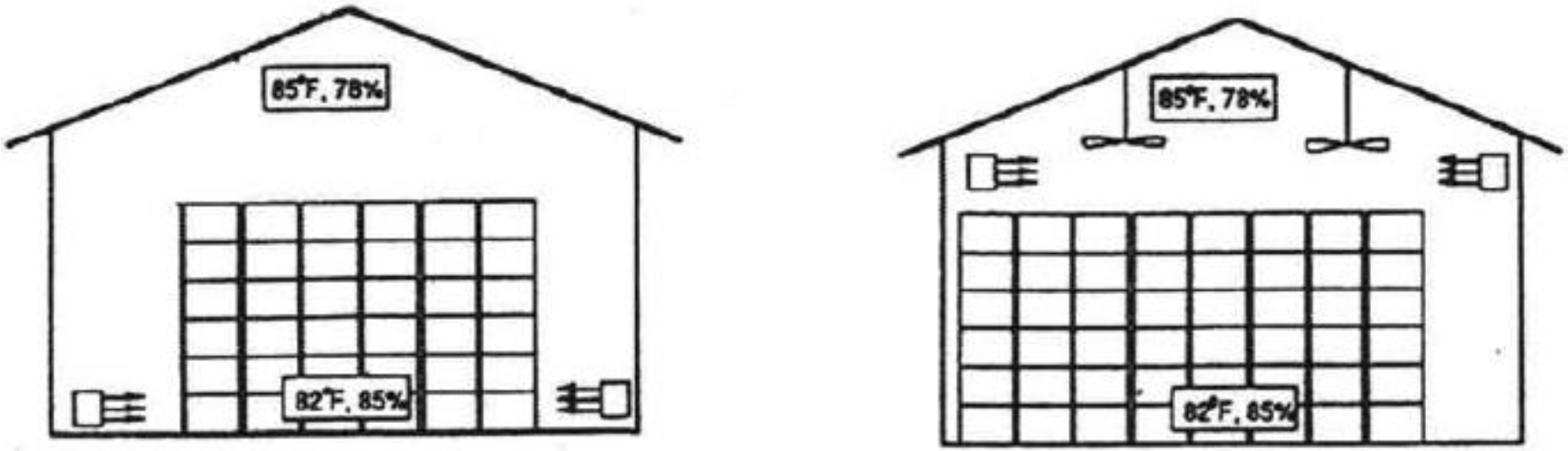


Figure 16. Curing with heated air

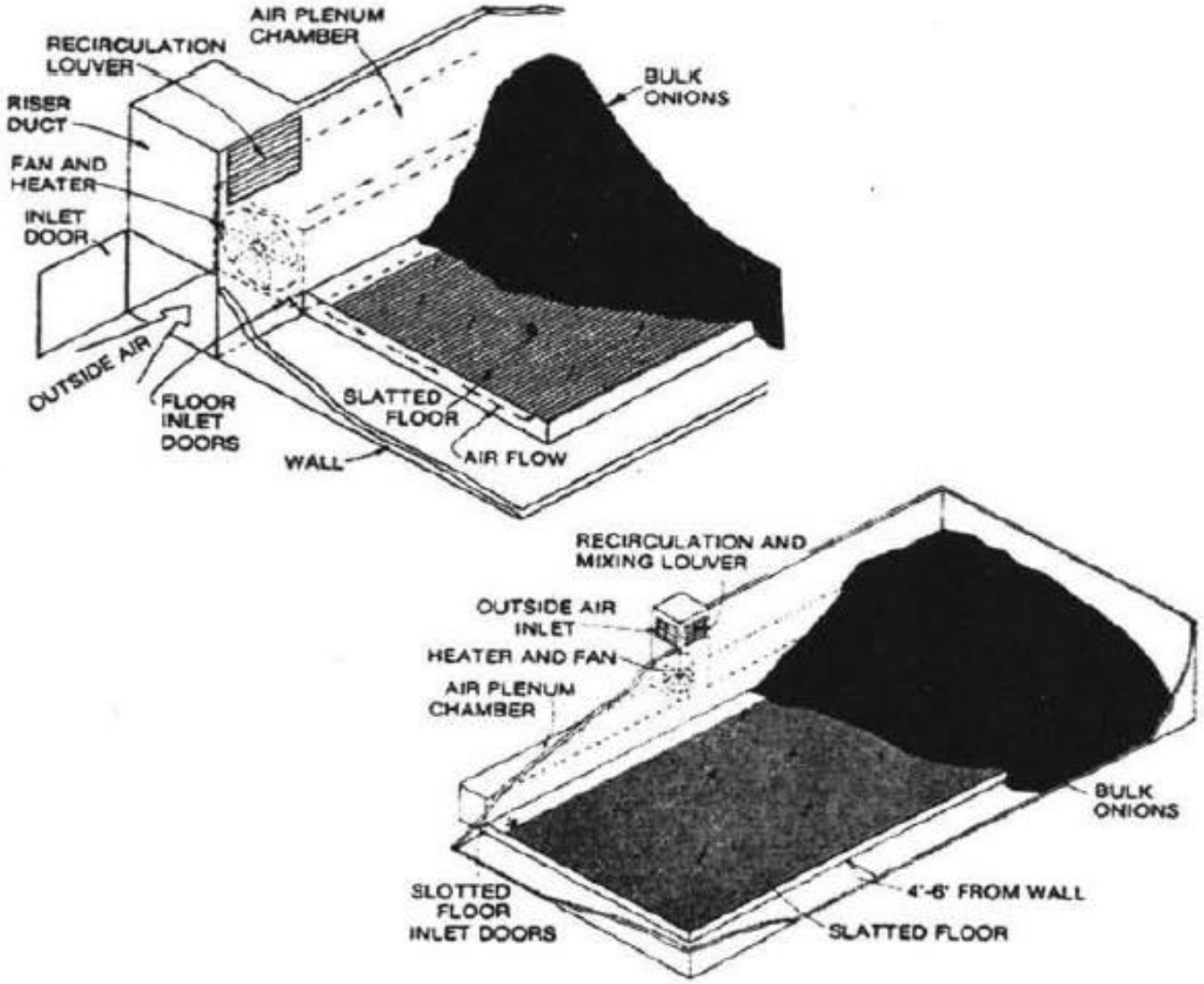


Figure 17. Bulk systems for curing onions

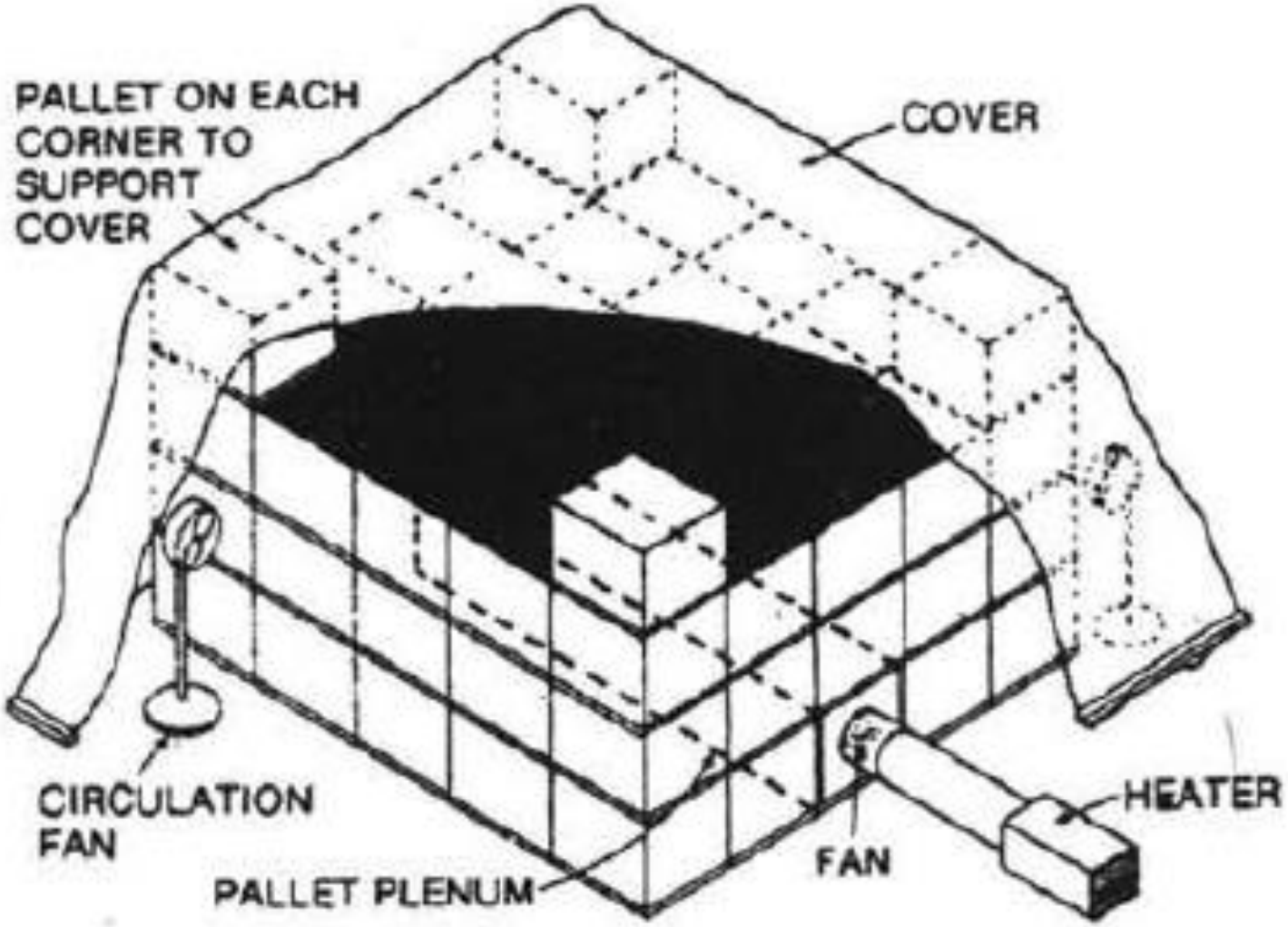


Figure 18. Emergency curing

- When extreme conditions in the field exist, such as heavy rain or flooded terrain, and curing facilities are not available, a temporary tent must be constructed from large tarpaulins or plastic sheets to cure the onions and avoid heavy loss. Heated air is forced into a hollow area at the centre of the produce-filled bins. Several fans are used to recirculate the warm air through the onions while curing.