

The Transport of Cocoa Beans in Containers

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Ten years ago we published an article (1) on the bulk handling of raw cocoa which mentioned an experiment with the use of containers for transporting cocoa beans. During the past five years many further trials have been conducted and certain conclusions have been reached. Problems affecting quality arise in this method of transport and, while possible solutions are in sight, no final answer to them has been found. Nevertheless it seems right to review the situation at this stage as containerisation is becoming well established as a standard means of transport for many goods and products.

Trials with Standard and Insulated Containers

All the trials with which we have been concerned have stemmed from West Africa because the largest traffic in cocoa is between West Africa and Europe and also because containerisation of other cargo on this route has been expanding rapidly.

The first trials were conducted in 1972/73 season using standard 20 foot (6050 mm) containers lined with plywood and partly painted internally with anti-condensation paint, which can absorb some moisture.

These trials showed clearly that the fall in temperature between West Africa and Europe which occurs during part of the main shipping season leads to condensation inside the container which is a hazard to quality. The top layer of bags receives some of the moisture which condenses on the roof and sides, commonly known as sweat damage, and this can raise the moisture content of beans in those bags to a level at which mould will develop. Moisture determinations revealed a slight movement of moisture from the lower levels to the top layer. At the experimental level using only a few containers the movement of moisture does little or no harm as the cocoa can be handled quickly and the beans processed without delay. However, large numbers of containers in a shipment could not be handled in this way and the movement of moisture would be an unacceptable hazard to quality.

Trials with Bulk Containers

Apart from the quality problem we found that it takes nearly twice as long to unload a 20 foot container as it does to off-load the same quantity of cocoa, about 15 tons, from a standard truck. There is therefore, a financial disadvantage in dealing with bagged cocoa in containers.

This disadvantage might be overcome by transporting the beans loose in a container. This would require modification to the container as well as facilities for loading and unloading in country of origin and receiving factory respectively. A few experiments were arranged with temporary modifications to a container, which held about 16 tons of beans loaded through roof hatches. In these trials moisture uptake was much worse than with bags, the top 2-3" of beans having moisture contents well over 8%, some samples reaching 15-20%. Cut tests showed that mould had developed internally in some of the damp beans.



Fig. 4 Open sided container with flaps — designed by Sea Containers Ltd

Attempts were made to overcome the condensation problem by enclosing the beans in a polythene bag but this measure was unsuccessful. No further attempts have been made to transport cocoa beans in bulk.

Measures to reduce the hazard to quality

In order to avoid the effects of moisture movement, it is necessary to either prevent moisture being given off by the beans or to absorb it or to remove the damp air. All three approaches have been tried.

1. Trials with polythene liners in jute bags

Polythene liners inside standard jute bags would prevent moisture being given off by the beans and would prevent any condensation from reaching the beans. In 1975/76 several shipments were arranged from Ghana and Nigeria using standard steel containers loaded with bags. In some containers all the bags had polythene liners, in others only 50% of the bags and in some all the bags were unlined. Some containers were loaded on deck, some in the hold. On arrival in U.K. some loads were discharged immediately, other loads were put into store. When the containers were opened those in which all the bags had polythene liners were practically free from condensation while the other containers showed considerable condensation. This showed that the condensation which occurs without polythene liners arises largely from moisture given off by the beans and only to a small extent from moisture in the air within the container. There was no sign of condensation within the polythene lined bags. All the cocoa in polythene lined bags wherever it was stowed and whether held in store or not was of satisfactory quality. Thus these trials showed that polythene liners would prevent the hazard to quality arising from condensation.

There are obvious practical difficulties in the use of polythene liners for the West African crops. Their use would involve considerable changes in the way cocoa is handled so that their use in West Africa would be confined to special circumstances. The same difficulty may not apply in other countries and the use of polythene liners where cocoa is to be shipped in standard containers and the journey will involve a considerable drop in temperature would safeguard quality. It must be stressed that the beans must be thoroughly dry — moisture content not more than 6.5% — if polythene liners are used.

At the receiving end polythene liners make the opening and emptying of bags rather more difficult and their use may be unpopular on that account.

2. Trials with silica gel

Rowntree Mackintosh have conducted two trials using standard containers and varying quantities of silica gel to absorb the moisture given off by the cocoa.

Dehydrated silica gel was supplied in 5 kg bags and amounts varying from 5 to 40 bags, i.e., 25 to 200 kg, were placed in each of nine containers, mostly on top of the bags. There was evidence that the amount of condensation was reduced but not even the larger amounts prevented it entirely.

3. Trials with ventilated containers

- (a) Container designed by East Asiatic Co. Limited. This container consisted of a standard box container with false side walls open to the interior at top and bottom. There was a ventilation grid running along the bottom of each side wall and four ventilators at the top of each side. Thus air could move between side walls, and if not obstructed, up through main chamber of the container. A trial was arranged with three containers, two loaded with bags, one in bulk, from Apapa, Nigeria to Antwerp in January - February 1976. There was considerable condensation in these containers when opened for examination and it was concluded that the ventilation had not been effective. However, it is understood that considerable modifications have been made to the design of this container in order to improve the ventilation; further trials will be arranged.
- (b) Sea Containers Limited designed a new type of container which had two steel mesh panels in the upper half of both sides which could be closed by hinged flaps (Fig. 1). With the flaps closed the containers can be used for normal goods. For transporting cocoa the flaps would be opened during the voyage and closed after off-loading to prevent rain damage between ship and destination. Three trials were arranged early in 1977 between Nigeria and U.K. All gave satisfactory results but in only one trial was the weather really cold enough in U.K. to test this method. The method is dependent on the ship's hold being adequately ventilated and in these trials only the experimental containers were loaded, all the others were empty. Therefore, these trials have not given conclusive proof that these special containers are effective but all the evidence indicates that they will prove suitable for the transport of cocoa.

General Conclusions

The work that has been done on containerisation of cocoa beans has shown:

1. Standard containers are unsuitable when a considerable drop in temperature occurs.
2. The effects of a fall in temperature can be avoided if the cocoa is packed in polythene-lined bags.
3. Condensation can be prevented by using well ventilated containers.

It should be emphasised that the difficulties arising from condensation will only occur where there is an appreciable fall in temperature. No difficulties arise where the fall is slight or non-existent.

REFERENCES

1. Hale, S. L. (1967). Bulk Handling of raw cocoa. *Cocoa Growers' Bulletin* 8. 25-28.