NSE TECHNICAL TRANSACTIONS

ISSN 1119 - 5363

A Technical Publication of The Nigerian Society of Engineers

IN THIS ISSUE

APRIL - JUNE, 1997 VOL. 32 NO. 2

PROBLEMS AND PROSPECTS OF METAL SILOS FOR GRAIN STORAGE IN WESTERN NIGERIA

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ABSTRACT

A survey involving the use of structured questionnaires and personal communication was carried out in Western Nigeria to ascertain the type and extent of use of silos for the storage of grains. Steel and Aluminium were found to be the predominant materials used for the construction of the silos. They are mainly used to store shelled corn and in a few instances, rice, cowpea and soybean. The prohibitive cost of silo acquisition limits their ownership and use to the Ministries of Agriculture, Co-operative Societies, agro-based industries, Teaching and Research Institutes and a few large scale private farms. Silos are not used by the small to medium scale farms. The withdrawal of the Ministries of Agriculture from direct grain production and the collapse of co-operative grain storage programmes have resulted in the abandonment of many silos. The metal silos experience the problem of moisture condensation on the roofs and walls which leads to the deterioration of stored grains through moulding, caking and rapid multiplication of insects. Losses of as much as 10% of total storage through these sources have been recorded for some silos. Adequate funding of current research efforts to develop local materials for grain silo construction is recommended.

Keywords: Condensation, Fluctuation, Postharvest, Prohibitive, Silos.

INTRODUCTION

The silo, a basically huge container, is used for the storage of agricultural produce. It is more popularly used for the storage of grains in Nigeria. The structure has the advantages of large storage capacity and of long duration. Although Steel, Aluminimum, Concrete, Wood, Clay and Rubber can be used for the construction of silos, the steel and Aluminium types are more commonly used in Nigeria.

In Nigeria, the metal silos were first introduced by the United States Department of Agriculture in 1957 as a component of the co-operative grain storage programme of Western Nigeria. The first two metal silos in the country were therefore erected at Ilero in Oyo State in 1957 and at Ilaro in Ogun State in 1958. Plates 1 and 2. These first two silos were to be tested as possible storage structures for grains. Following the initial success recorded from the tests, more metal silos were erected at various locations in Western Nigeria for the Storage Programme while Educational and Research Institutions also acquired some for the purpose of teaching and research (1). The use of metal silos especially in the execution of the co-operative storage programme was popular in the 1960s but if gradually faded out as one farmer after the other pulled out of the co-operatives (2).

Metal silos received a boost in the early 1980s following the various agrarian programmes of the government such as the "Green Revolution of 1979" and the "Back to Land Programme of 1985". The result of both programmes was a bumper harvest of grains for which the traditional storage structures especially the crib proved inadequate in terms of storage capacity. Silos were therefore imported both by the Government, Corporate bodies and private entrepreneurs. Since then, the importation of Metal Silos into the country has been on the increase and without a detailed survey which will be prohibitive in cost, it is not possible to estimate the number of metal silos in Nigeria at present.

With almost four decades of use of metal silos in Nigeria, severe losses are still associated with stored grains resulting to as much as 30-50% of total production (3). The efficiency of the existing metal silos in Nigeria to reduce storage losses is therefore in doubt.

This paper discusses the results of a survey conducted in Western Nigeria to identify the types of silos in use, their limitations and potentials as grain storage structures.

METHODOLOGY

In order to collect information relevant to this paper, a survey was carried out in Western Nigeria. The survey involved the use of structured questionnaires which sought for information on the type of materials used for silo construction; average number of silo units erected at a location and range of unit capacities; type, sources and utilization of grains stored, frequency of silo use and percentage of silo capacity utilization, cost of silo acquisition and installation, problems experienced with their use and attempts made at reducing such bottlenecks. Additional information items were gathered through personal communication and on-the-sport assessment while administering the questionnaires.

The surveyed sites were not selected but rather visits were made to places where silos were known to be in use. These cut across the Ministries of Agriculture; feed and flour mills, breweries, private commercial farms, Teaching and Research Institutions, co-operative societies and grain storage centres.

RESULTS AND DISCUSSION

The results of the survey are summarised in Table 1 and further discussed. Steel and Aluminium are the most common materials used for the construction of the silos identified. Out of over 65 sites surveyed, concrete silos were found in four sites while wooden and clay silos were each found in only one location. Shelled corn is the most common grain for which the silos were used to store; and on very rare occasions, they could also be used to store rice, cowpea and soybean. These grains are all cultivated in Western Nigeria.

3.1 PROBLEMS IDENTIFIED

The problems that confront the use of silos as grain storage structures in Western Nigeria are moisture condensation, low capacity utilization and prohibitive cost of acquisition and maintenance.

(A) MOISTURE CONDENSATION

The Climate of Western Nigeria is the warm humid type where as much as 10°C daily temperature range and relative humidity of over 70% are often recorded. The use of metal silos of high thermal conductivity (12-16 W/M°C for steel and 204W/M°C for Aluminium) under this climatic conditions leads to moisture condensation on the roof and walls of the structure and its redistribution within the core of the stored grains. The wall material offers very little resistance to the flow of solar heat into the stored grain which give rise to temperature gradients within the grain bulk. The ideal conditions for the storage of most grains for which silos are commonly used are 11-13.5% Mc, 27°C and 70% RH. Variation in climatic factors could raise the Mc of stored produce to as much as 20% while temperature rises up to 35-40°C. Unless there is a method of ventilation for the control of temperature and moisture, these changes in the condition of the stored grain will promote the development of insect in the event of any infestation, mould growth, development of hot spots and caking which renders the produce valueless. Survey reports indicate varied degrees of losses due to these sources. As much as 4% viability has been recorded, 5% loss in food value, 4% of total stored produce destroyed by insects while up to 5% of total stored produce has gone mouldy. Where the facilities are available, ventilation of the stored grain using heated dry air is done at regular intervals to curtail these problems.

(B) LOW CAPACITY UTILIZATION

The first silo to be erected in 1957 had a capacity of 20 tonnes but at present, the capacities of silos in the area (except those for experiments) range from 15 to 2,500 tonnes as found during the survey. This high unit capacities of silos was responsible for their popularity among co-operative societies in the 1950s who used them for grain storage.

The Ministries of Agriculture also maintained some farms the harvest from which were stored in some of the silos. At present, the ministries have withdrawn from direct grain production while many of the co-operative societies have either folded up or changed their objectives from grains storage to other crops such as Cocoa which is more lucrative. This change in the type of crop handled requires other types of storage structures and has thus resulted in the abandonment of some of the metal silos previously erected.

The annual production of the various grains and legumes commonly cultivated in Nigeria is below ten tonnes for most small scale farmers (4). With the collapse of the co-operative grain storage practice, the present day Nigerian peasant farmer is only interested in individual on-farm storage practice and for a maximum period of between one harvest and the next. The individual farmer may not be able to produce enough

grain to fill a silo and where the structure is available, it cannot be effectively utilized. This reason of inadequate grains to store has rendered many silos owned by the Ministries and Institutions under-utilized while only those belonging to large scale farms and industries who can either produce enough or buy from the peasant farmers through contractors to fill their silos are being fully utilized. Unless adequate arrangement for grain collection is made, the silos at the various strategic Grain Reserve Complexes may remain empty.

(C) PROHIBITIVE COST OF SILO ACQUISITION AND MAINTENANCE

Silos and their accessories have always been expensive right from when they were first introduced in Nigeria but the cost did not initially pose a problem because it had to be borne by a number of farmers forming a co-operative society. When some years after their introduction the co-operative grain storage programme collapsed, the cost of acquisition and installation became the sole responsibility of the individual farmers who were interested in using the silos. From information gathered during the survey, between 1980 and 1990 when a good number of the silos were acquired and installed, and the Naira was still very strong compared to the Dollar and Pound Sterling, the currencies in which payment is made for the imported silos, the cost of the structure and its installation varied from ₦15,000.00 for a 50-tonne capacity silo, ₦35,000.00 for a 100-tonne to N375,000.00 for a 250-tonne capacity silo. With the current devaluation of the Naira, the cost of these sizes of silos have risen to between 100 and 150 times the figures quoted above. These costs are beyond the income of the peasant farmers who are the major producers of grains and under whose custody most of the post-harvest losses are incurred. When an account is taken of the fact that this group of farmers usually have no collateral for loans of reasonable magnitude, the peasant farmers cannot individually afford the cost of these silos. For this reason, the use of metal silos is limited to large scale agricultural establishments and industries that can afford them.

The existing metal silos were and are still being imported in pre-fabricated forms and often unaccompanied with spare parts only to be assembled on site. In the event of any fault, the relevant spare part must be imported or as an alternative the silo is abandoned. Most of the accessories such as loading and unloading mechanisms, fans and heaters depend on electricity for their source of power and in a country with unreliable public power supply such as ours, provision must be made for a standby generator which is an additional cost. The bottleneck involved in the importation of spare parts to repair the silos when required has resulted in a number of silos being abandoned (2).

3.1 PROSPECTS OF SILOS

The prospect of metal silos for grain storage in Nigeria are associated with their large storage capacities and ability to preserve grains over a long period under good management. These prospects could be exploited both by the government and industries in the following ways:-

(A) FACILITIES FOR STRATEGIES GRAIN STORAGE:-

Strategic grain storage centres are locations established and managed by governments where grains are stored and to be released during emergency periods such as when there is crop failure, flood or fire disaster. Since these events are unpredictable, grains may have to be stored for upward of five years especially if the subsequent annual harvests are not enough to replace what is in store. Some functional and well managed metal silos were reported to have effectively stored grains for over three years in the area of study and hence the structure could be employed for strategic grain storage. The silos have the advantages of eliminating the cost of bags and bagging, and reduce pilferage of produce by employees compared to warehouses.

(B) SECURITY OF INDUSTRIAL RAW MATERIALS

It is a common occurrence for industries to work below capacity or to even close production temporarily due to shortage of raw materials. For Agro-allied industries, this is most pronounced during the planting season when previous harvests have almost been exhausted. Although farmers prefer individual on-farm storage to a co-operative programme, they are always prepared to sell their produce at anytime provided the price is good. Industries can buy grains at period of harvest and store to ensure the availability of raw materials all year round. A well equipped and managed silo will be very useful for such storage requirement.

CONCLUSION

Steel and Aluminium are the predominant materials used for the construction of grain silos found in Western Nigeria. Concrete silos are occasionally used for grain storage while wooden and clay silos are still being tested for possible use. The silos are used mainly for the storage of shelled corn and to a very little extent, other crops such as rice, cowpea and soybean could also be stored in the silos. A majority of the silos with a unit capacity range of 15-100 tonnes are owned by the Ministries of Agriculture and operators of co-operative storage programmes. The withdrawal of the Ministries from direct crop production and the collapse of the co-operative storage programmes have resulted in the abandonment of some of these silos since there are no grains to store in them. The high unit capacity ones which range between 200-1000 tonnes per silo are owned by feed and flour mills and breweries. These are being fully used as the owners have the capital to buy enough grains and equally meet the prohibitive cost of maintenance. The metal silos experience the problem of moisture condensation on the roofs and walls and its redistribution within the bulk grain which leads to the deterioration of the stored grains.

RECOMMENDATIONS

(a) Since the metal silos are pre-fabricated and can be dismantled without any damage, the abandoned ones should be dismantled and transferred to the strategic storage centres for re-erection and use. They could also be sold to entrepreneurs who might be interested and have the capacity to pay. This will be cheaper for the interested users rather than importing new ones. Some money will also accrue to the government.

(b) Even if metal silos are subsidized, the high capacity ones may still not be attractive to the small peasant farmers for fear of not producing enough to fill the silo. It is recommended that small sized silos (between 5-10 tonnes) should be constructed so that this group of farmers in the remote areas can effectively store their small productions.

(c) As a panacea to the problems of prohibitive cost and climatic difficulties with metal silos; it is necessary to consider some local materials for silo construction that will be cheap and reduce the wide temperature fluctuations within the silo enclosure. Current research efforts aimed at adapting wood products and laterite as possible materials for grain silos construction in Nigeria (5, 6) should be encouraged through adequate funding.

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TABLE 1
Information on Metal Silos Surveyed in western Nigeria

Ownership & Users of Silos	As % of Total Sites Surveyed	Average No. of Silo Unit per Site	Range of Unit Silo Capacities (Tonnes)	Sources of Grains Stored	Utilization of Stored Grains	Frequency of Silo use and Percentage of capacity Utilization.
Ministries of Agriculture & Natural Resources (MANR)	55	3	15 -100	Harvest from farms owned by the MANR.	Livestock feeding sale to contractors/ produce merchants.	Direct involvement of MANR in grain production has been discontinued and most of the silos are not being used.
Co-operative Societies	10	2	45 -100	Harvests from individual and jointly owned farms of co-operations	For sale to industries & redistribution to co-operators for consumption.	This programme has become moribund and the silos abandoned
Feed & Flour mills, breweries and a few private commercial farms.	25	5	200-1000	Some have farms where the stored grains are cultivated but where this is not the case, the grains are purchased through contractors.	Used as raw materials for various industrial products.	Almost always in use and percentage of capacity utilization between 75 -100%
Teaching & Research Institutions	7	4	0.15 - 45	Harvests from where owned & supply by contractors.	Livestock feed if healthy otherwise the produce is destroyed.	A good number of them especially in the research institutes are always with grains & percentage of capacity utilization high.
Strategic Grain Reserve Centres.	3	13	1000-2500	Supply by contractors or produce merchants.	To be released in case of emergency & natural disasters.	Some are still under construction while those already completed are yet to be fully operational.

Plate 1: First Metal Silo Installation in Western Nigeria, Ilero in 1957. (now abandoned)

Plate 2: Second Metal Silo Installation in Western Nigeria: Ilaro in 1958.