

LARGE SCALE GRAIN STORAGE STRUCTURES AND THEIR MANAGEMENT IN THE HUMID PART OF NIGERIA

By

A. A. Okunola*, B. A. Adewumi** and O. W. Faseyi***

*Agricultural Engineering Department, Federal College of Agriculture, Akure, Nigeria

** Agricultural Engineering Department, Federal University of Technology Akure, Nigeria

*** Strategic Grains Reserve, Akure, Nigeria.

1. ABSTRACT

Survey of available warehouses and silo structure for storage in humid parts of South Western Nigeria was done to assess the factors and problems associated and affecting grain quality deterioration in these large scale storage structures. A questionnaire was administered for the study to identify the types of large scale storage structures used in South Western Nigeria, and the management problems associated.

Good quality grains were only accepted for storage after thorough examination in most establishments. Manipulation of the storage environment by controlled atmosphere has retard grain quality degradation and possesses good seed viability and consumer friendly. Silo capacity ranges between 5 to 2,500 metric tonnes while ware houses are between 200 to 5,000 metric tonnes. Modern storage structures ages are between 10 to 46 years within this region.

The predominant environmental problems of conventional silos were ambient temperatures fluctuations and high relative humidity.

Key words: *Silo, Warehouse, Bulk grain storage, Relative humidity and Temperature.*

2. INTRODUCTION

Storage of grain constitutes an essential phase between harvesting, processing and consumption. Stored products are subject to losses that may occasionally be very high. An estimated grain loss in Nigeria was between 20% and 35% of annual production (1). Traditionally, peasant farmers have been known to store their grains over the years in wooden cribs, fire places, roof ceilings, rhumbus, gourds, sacks and by hanging on trees. These mean of storage do not provide adequate protection against rain, insects and rats. Poor hygiene also makes the grains susceptible to mould and pest infestation (2). Traditional methods of storage are unreliable and can store small quantities of grains. The peasant farmers who are the primary producers of grains lack the technology of checking and protecting their grains from mould development and insect infestation (3).

Modern method for bulk storage of grains has been adopted in the Nigeria since 1957 (4). Silos and warehouses of various capacities have been built by government agencies as intervention efforts and for research purposes to prevent food shortages; while private organisations utilize them for storage of

bumper harvest and temporary storage in agro-allied industries. Silo can be classified into five types based on their construction materials. These include metal, concrete, wooden, mud and composite silos (4, 5). Convectional silos are available in various sizes and can handle up to 2,500 metric tones of grains. Mechanical ventilation is carried out to remove moisture and reduce grain temperature.

Controlled atmosphere storage system is being introduced as a technique of preserving grains in a modified atmosphere to give a mixture of gases which will inhibit the development and effect of quality degradation agents. The concentration of oxygen gas which supports life is reduced and the environment is enriched with carbon dioxide or nitrogen. "Hermetic" storage in form of underground pit storage is a variant of the controlled atmosphere with the longest continuous history of use in Nigeria.

(6). Warehouses have also been used for the storage of bagged grains stacked on pallet inside a well ventilated building. This system of storage is widely used in research institutes and National Seed Service Centres in Nigeria. The warehouse as a storage structure must be able to protect stored grains from moist conditions, high temperature and pest infestation. It is a large scale storage structure used for granular produce such as beans, rice, cocoa and maize. The modern storage aims to ensure good storage practices that will maintain conditions in the grain bulk and preserve the marketing and processing quality of grains at a high level. The main objective of the study is to assess the size, age, capacity utilization, grain quality, present

condition and peculiar problems in management of the silo and warehouse used for large scale storage structures in the South Western Nigeria.

3.0 FACTORS AFFECTING GRAIN STORAGE AND DETERIORATION

There are various natural and artificial factors that limit silo performance. Brummer (7) identified grain respiration, equilibrium relative humidity, moisture condensation, temperature and heat transfer capacity of grains as factors affecting metal silo in the humid tropic. During storage, deterioration of stored grains results from interactions among physical, chemical and biological variables in the grain bulk micro-environment.

3.1 Physical Variables

All living organisms remain alive and thrive only within certain limits of temperature. Atmospheric, grain and inter-granular air temperatures are considered to be crucial variables for safe and prolonged storage of grains. Grains stored at 25°C have been found to deteriorate twice as fast as those stored at 20°C which is lower than optimum growth temperature range for micro organisms (8). Moisture content is strongly associated with sprouting, mould growth, black spot growth and rot growth (9, 10).

The amount of physically "bound free water" contained by a cereal at harvest time and during storage in most cases determines the keeping quality of the grain. Moisture content of grains

