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Temporary Grain Storage: Insights into CAP Structures and Polyethylene Bag Silos

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Efficient grain storage plays a critical role in maintaining food security, particularly in regions where production exceeds the available permanent storage capacity. Cover and Plinth (CAP) storage has emerged as a practical, low-cost outdoor storage option for grains such as wheat and paddy. This article focus on the performance, advantages, limitations, and infestation challenges associated with CAP storage and polyethylene bag systems. Research indicates that temporary storage in polyethylene bags maintains key grain quality parameters, minimizes losses under anaerobic conditions, and offers protection from insects and moulds due to elevated carbon dioxide levels. However, challenges such as wind damage, security concerns, and the influence of moisture content on germination remain. The review highlights recent advancements, including hermetic and triple-layer storage bags, which offer promising improvements for safer and more reliable temporary grain storage.

Keywords: Cover and Plinth, short term storage, polythene bag silos

Introduction

Storage is an essential component of agricultural production systems, ensuring that grains remain available for consumption long after harvest. In many developing regions, farmers struggle to store produce safely due to natural calamities, limited infrastructure, financial constraints, and damage from insects and rodents. Increasing crop yields often force farmers and agencies to rely on temporary storage solutions. Cover and Plinth (CAP) storage, widely adopted by institutions such as the Food Corporation of India (FCI), was introduced to address the gap between rising harvest levels and insufficient permanent storage capacity. CAP storage involves creating a raised platform and covering stacked grain bags with heavy-duty polyethylene sheets. This system offers a cost-effective, scalable approach suitable for short-term storage of large grain volumes. This paper reviews CAP storage techniques, quality changes observed during storage, factors influencing moisture and temperature, infestation risks, and the potential of hermetic storage technologies to enhance temporary storage performance.

Structure and Construction of CAP Storage

CAP storage sites are established on elevated land to prevent waterlogging and protect the grain from floods. The plinth is usually constructed using brick and mortar and raised at least 450 mm above ground level. Anti-termite treatment is applied during construction. Hooks or fixtures are installed around the plinth to secure polyethylene covers tightly. A typical 150-tonne CAP unit measures approximately 8.55 m × 6.30 m and holds around 3000 bags of grain (50 kg each). Wooden dunnage is used to elevate the bags, preventing moisture absorption from the ground. Low-density polyethylene (LDPE) sheets (250–350 microns) are

used to cover the stack on all sides and the top. Paddy husk–filled bags are often placed beneath the poly cover to minimize condensation.

Performance of Polyethylene Bag Silos in Grain Storage

Polyethylene bag silos have shown that grain quality remains stable over short-term periods:

- No significant variations were observed in dry matter, pH, crude protein, starch or microbial counts across different sampling points within the bags.
- The temperature inside polyethylene bags quickly equilibrated with ambient conditions.
- No local overheating was recorded, indicating negligible microbiological heating.
- Under typical conditions, grains can be safely stored for up to six months.

Low-cost polyethylene bagging systems offer an economical alternative to investing in permanent warehouses. The elevated carbon dioxide inside hermetically sealed bags inhibits insect and mould activity, providing an additional protective benefit. However, grains stored at moisture levels above 14% may experience reduced germination and quality losses, as previously noted in high-CO_2 environments.

Moisture, Condensation, and Anaerobic Conditions

In polyethylene-based storage, rapid development of anaerobic conditions can occur. Although this restricts insect development and mould proliferation, it may trigger sour odours in high-moisture grains. Despite fluctuating ambient temperatures, condensation is rarely a problem because accumulated condensation is reabsorbed by dry grain, preventing moisture from exceeding critical limits.

Infestation in CAP Storage and Remedies

The grain borer (*Prostephanus truncatus*) poses a major threat, particularly in small-scale storage environments. Several options are used for insect control:

- Polypropylene bags effectively limit infestation by weevils and *P. truncatus*.
- Hermetic containers have shown complete insect mortality within days in controlled studies.
- Actellic Super, when used appropriately, provides insect control for up to four months.
- These methods are affordable, easy to apply, and suitable for repeated treatments.

Advances in storage technology especially hermetic and triple-layer bags demonstrate strong potential for improving CAP storage performance by limiting oxygen availability and thereby suppressing insect and mould development.

Advantages of CAP Storage

- Considerably lower construction cost about one-fourth that of conventional godowns.
- Reduced grain quality deterioration due to adequate aeration and proper elevation.
- Protection from rodents and ground moisture due to raised platforms.
- Flexibility in storage capacity, as bag length and stack size can be modified depending on grain volume.

Limitations and Challenges

- CAP storage requires consistent monitoring to prevent severe losses.
- Polyethylene covers are vulnerable to wind damage and require frequent inspection.
- Security concerns necessitate fencing and additional manpower, increasing operational expenses.
- Weather conditions may impact the durability of covers and ropes.

Conclusion

Temporary grain storage through Cover and Plinth systems and polyethylene bag silos provides a practical, low-cost solution for managing surplus harvest in regions with limited permanent storage facilities. Research confirms that when grain moisture content is kept within safe limits, quality attributes remain stable, and losses are minimal. The naturally elevated carbon dioxide environment within polyethylene bags helps suppress insects and moulds, although excessive CO_2 can reduce germination in high-moisture grains. CAP storage remains a valuable option, especially for large-scale agencies, but it requires careful management, regular inspection, and proper sealing to prevent damage. The integration of hermetic and triple-layer bag technologies represents a significant advancement, offering improved protection and longer safe storage durations. Continued adaptation of these technologies can enhance food security by reducing storage losses and making temporary storage more reliable and efficient.

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