"ONION VENTILATION MACHINE"

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1. Abstract:

Onion spoilage during storage is mainly caused by insufficient air circulation, which leads to moisture buildup, heat retention, and rapid deterioration of bulbs. Conventional storage techniques often lack a controlled ventilation mechanism, resulting in high post-harvest losses. To address this issue, an onion ventilation machine is developed to ensure effective airflow throughout the stored onion mass.The machine functions by forcing fresh air through designed air channels using a mechanical blower system. This airflow removes excess humidity and heat produced during onion respiration, thereby creating a favorable storage environment. Continuous ventilation helps suppress microbial activity, delays sprouting, and maintains bulb firmness and weight. The system is designed with low power consumption and simple components, making it suitable for rural and semi-commercial applications. Performance evaluation shows a noticeable reduction in spoilage percentage and quality degradation when compared with traditional storage methods. The onion ventilation machine presents a practical and economical approach to improving storage efficiency, enhancing shelf life, and reducing post-harvest losses in onion handling systems.

2. Introduction:

Onion is one of the most widely cultivated and consumed vegetable crops, playing a significant role in both domestic use and commercial markets. Despite high production levels, a considerable quantity of onions is lost after harvesting due to inadequate storage conditions. The primary causes of these losses include poor air movement, excess moisture accumulation, temperature rise within storage piles, and biological decay. These factors directly affect onion quality, weight, and shelf life.Traditional onion storage practices such as open heaps, sacks, or poorly ventilated structures do not provide uniform airflow. As a result, heat and humidity generated by onion respiration remain trapped, accelerating sprouting and microbial growth. This not only reduces market value but also causes economic losses for farmers and traders.The system is designed to improve air circulation within stored onions by supplying controlled airflow using mechanical components. Proper ventilation helps maintain a balanced storage environment by removing excess heat and moisture, thereby slowing down deterioration processes.The onion ventilation machine offers a practical, low-cost, and energy-efficient solution for reducing post-harvest losses. Its simple design makes it suitable for small- and medium-scale storage facilities, contributing to improved storage efficiency and better preservation of onion quality

Keyword:- *An onion ventilation machine improves storage life by providing continuous aeration to remove excess heat and moisture, Ventilation Fan,*

Electric Motor, Casing, Heat Removal, Power Supply unit,

3. Need of study:

Large quantities of onions are lost during storage due to poor ventilation, excess moisture, and heat buildup. Traditional storage methods do not provide uniform airflow, leading to spoilage and quality reduction. This study is needed to evaluate an onion ventilation machine that improves air circulation, reduces post-harvest losses, and enhances storage efficiency in a cost-effective manner.

4. Literature review:

Previous studies show that onion storage losses are mainly caused by poor ventilation, heat buildup, and moisture accumulation during storage. Traditional storage methods rely on natural airflow, which is often uneven and ineffective, leading to spoilage and reduced shelf life. Research on ventilated storage systems indicates that controlled airflow helps maintain suitable temperature and humidity, thereby reducing weight loss and decay. However, high-cost storage technologies are not feasible for small farmers. Hence, there is a need for a simple, low-cost onion ventilation machine to improve storage efficiency and minimize post-harvest losses[1 Their study

showed that storage conditions play a crucial role in determining onion shelf life, weight retention, and resistance to spoilage. The findings indicated that inadequate ventilation and unfavorable environmental conditions accelerate deterioration, while improved airflow and suitable storage environments help preserve onion quality for longer periods. The study highlighted the importance of selecting appropriate storage techniques to minimize post-harvest losses[2]. Their study indicated that temperature, humidity, and air movement significantly affect onion firmness, weight loss, and overall storability. The results showed that unsuitable storage environments accelerate deterioration, whereas controlled conditions with proper ventilation help maintain bulb quality for longer periods. The study emphasizes the importance of optimized storage parameters to reduce post-harvest losses[3].

6. Diagram Of Model:

The designed onion storage model consists of a cylindrical storage chamber supported on a raised platform to ensure proper air circulation from all directions. The outer structure is made of a perforated wire mesh, which allows free movement of air while securely holding the onions inside. This mesh design prevents moisture accumulation and supports natural as well as forced ventilation. At the center of the storage chamber, a vertical air duct is installed. A low-power electric fan is mounted at the top of this duct to distribute air uniformly throughout the onion stack. The duct contains multiple openings along its length, enabling even airflow at different levels of storage. This arrangement helps in removing excess heat and moisture generated due to onion respiration. The base platform is fabricated using slotted wooden supports, allowing air intake from the bottom and preventing direct contact of onions with the ground. A simple control unit is provided to regulate fan operation. The overall design is compact, economical, and easy to fabricate, making it suitable for small-scale onion storage applications.

7.Future Scope:

The onion ventilation storage system can be further improved by integrating automatic control features such as temperature and humidity sensors to regulate airflow based on storage conditions. The use of solar-powered fans can reduce dependency on electricity and make the system more sustainable for rural areas. Future designs may include modular structures that allow easy expansion of storage capacity according to demand. Advanced materials with better corrosion resistance and durability can be adopted to increase the system's service life. Additionally, the concept can be extended to store other bulb and root crops by modifying airflow distribution and structural dimensions.

7. Result:

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8. Application:

1. Onion Storage Centers
   Used in warehouses and cold storage units to improve airflow and extend the shelf life of stored onions.
2. Farmers' Storage Units
   Suitable for small and medium-scale farmers to reduce post-harvest losses in rural storage facilities.
3. Wholesale Markets
   Helps traders maintain onion quality during temporary storage before distribution.
4. Retail Shops and Grocery Stores
   Can be used for short-term storage to prevent spoilage and maintain freshness.
5. Agricultural Research and Training
   Useful for demonstration and experimentation in agricultural colleges and research institutes to study ventilation effects on storage.
6. Other Bulb Crops
   The ventilation system can be adapted for storing other crops like garlic, potatoes, and shallots by changing airflow patterns.

7. Conclusion:

The onion ventilation machine effectively improves storage conditions by ensuring continuous and uniform airflow within the storage chamber. This helps to remove excess heat and moisture generated by onion respiration, which is the main reason for spoilage and sprouting during storage. The system is simple in design, cost-effective, and suitable for small and medium-scale farmers. Testing results show that the ventilated storage reduces spoilage, maintains bulb firmness, and extends shelf life compared to traditional storage methods. Overall, the onion ventilation machine provides a practical solution to reduce post-harvest losses and improve the quality of stored onions.

9. References:

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