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Post-Harvest Management in Onion: Deserve Concern

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ABSTRACT: Onion (*Allium cepa* L.) is one of the oldest known bulb plants and is widely used worldwide. It is one of the best-selling vegetable plants in India and is thought to have originated in Central Asia. It is known for its unique spicy taste and is an important part of many traditional dishes. Onions dominate the top of the kitchen. Postharvest losses are caused by improper postharvest handling procedures for crops, including inappropriate harvesting methods, sorting, curing, packaging, and inadequate storage facilities. Despite recent advances in production technology, post-harvest losses continue to be a major problem due to a lack of scientific knowledge. As a review conclusion, an effort was put forth in this paper to gather information about the essential components of harvesting, healing, sorting and storage of onions.

Keywords: Post harvest management, curing, grader, peeler and storage.

INTRODUCTION

Onions are one of the most valuable and ancient bulb crops consumed worldwide (Shigyo and Kik 2008; Singh, 2009). The crops are members of the Alliaceae family, which was introduced to India from Central Asia. India now ranks second in the world in terms of onion and garlic area and production, after China (Bornhofen *et al*., 2019; Hanci, 2018). Only harvested once or twice a year. However, it is in great supply in every Indian kitchen. Losses are estimated that 40 to 50% of stored onions do not reach consumers due to various types of losses. According to Steppe (1976), post-harvest spoiling accounts for 16 to 35 percent of onion losses. Such losses may be larger than estimated in tropical nations (Salunkhe and Desai 1984). These losses include physiological weight loss (PLW), which includes moisture loss and weight loss (30-40%), decay (10-12%), and germination (8-10%). Significant loss of storage is the result of weight loss during the dry months, when temperatures are high and humidity is low. Despite advances in production technology, post-harvest damages during storage continue to cause significant damage in tropical countries according to Tripathi and Lawande (2019).

POST-HARVEST TECHNOLOGY

In underdeveloped nations, manually harvesting is perhaps the most popular method. This is usually done by loosening the bulbs with a fork and then plucking the tops off by hand. Mechanical harvesting is widely utilized in industrialized countries, particularly on large-scale farms. The weather conditions at harvest time influence the harvesting procedures used.

Khura *et al.* (2011) reported that the main components of the harvester were digging, transporting, and separating the parts. The drilling efficiency of the six different drilling rigs was assessed. The V-shaped reversed blade has a very low resolution of 625.6 N. Suitable design parameters for factors such as elevator length, speed, and slope were obtained 1.2 m, 1.25: 1 and 15° respectively. During field inspection, the test digger with design specifications performed as expected, with 97.7% excavation efficiency, 79.1% separation index, 3.5 percent bulb damage, 4.1 liters of fuel per acre (12.81 liters per hectare) and a frame of 10.78 kN. Compared to hand harvesting, a digger designed to save 1170 Rs / ha on harvest costs.

Mahesh (2014) created and tested digger performance at a field capacity of 0.46 ha/h while travelling at 4 km/h during first high gear with minimal losses. A depth control wheel was effective in controlling the blade's cut depth. The created digger's normal operating depth of 7.62 cm was sufficient, with virtually little damages to the onion bulbs. The lift percentage, mean digger efficiency and damage percentage, respectively, were 94.9, 89.8 and 5.1 percent.

1. Curing. Curing removes extra water from the bulb's outer layers before storage. The dried skin acts as a barrier against loss of moisture and microbial contamination, helping to keep the primary edible tissue fresh (Gorreapti *et al*., 2017; Gubb and Tavis 2002; Maw and Mullinix 2005). Drying also lowers shrinkage during subsequent processing, prevents sprouting, and enables the crop to ripen before being consumed fresh or stored for long periods of time. Curing and sorting bulb onions reduced the incidence of postharvest losses, according to Kitinoja *et al*. (2012). Curing bulb onions after harvest hardens the outer scales, reduces skin fissures, and narrows the neck, reducing pathogenic deterioration as found by Downes *et al*. (2009); Petropoulos *et al.* (2017).

The most important post-harvest control measures are needed for long-term storage of onion cones (up to 6 months in cool and dry areas) while minimizing losses (Naqash *et al*., 2021). It also helps to reduce wrinkles due to moisture loss in the inner part of the bulbs (Shankar *et al.*, 2017).

2. Grader. Hand-operated and motorized onion graders designed by NRCOG, Pune have decreased the burden of human labour required in onion grading. Machine grading costs roughly Rs. 26/t, but manual grading costs around Rs. 80/t. The grader attained a precision of 98 percent, compared to 50 percent for hand grading.

Gunathilakea *et al*. (2016) investigated onion size grading machines. At a 3° inclination angle of the graded cylinder against the horizontal axis and a rotating speed of 15 rpm, machine performance was at its peak. For small, medium, and large sizes, maximal grading qualities/efficiencies under optimum machine adjustments were reported as 84.47 percent, 93.46 percent and 90.14 percent, respectively. Under optimal operating circumstances, the grading machine's capacity was 630 kg/hour.

At I.I.H.R., Bangalore, Gayathri *et al*. (2016) conceived, developed, and tested onion machine Rose onion verities commonly grown in Bangalore into three distances based on the geometric size of the selected varieties. The set parameters, according to statistical analysis, were 4° slope, intelligent direction of long swing, and feed gate when fully opened. A producer can achieve a speed of 1105 kg/h with a 75% grading efficiency and a required 75% grading efficiency. The operation of the machine was 6 times more expensive than the actual operation.

Dabhi and Patel (2016) to maximize impact and reduce labor time, an onion-powered bulb grilling machine was designed and built. At a volume of 598.58 kg/h, the correct combination of roller speed and roller inclination was determined to be 13 rpm and 8°, respectively, giving an efficiency of 79.95 percent. The measuring machine costs Rs. 40680/- (Except for electric car).

3. Peeler. For multiplier onions, a batch kind peeling equipment suited for farming activities was devised and tested. The built-in aluminum drum sat on a rotating disk on the machine. A sheet metal sheet is used to cover the inside of the drum and the top of the lower disc, which facilitates the peeling process. The ends of the recurring onions should be cut with a sharp knife and immersed in clean water for 10 minutes to help loosen the peel, followed by drying in the air for 1-2 minutes to separate the excess water.

Major performance features: Slide performance, bulb damage, and other performance parameters were adjusted by adjusting the operating speed and the slope of the drum. The peeler capacity was 50-60 kg/h. Effective peeling efficiency was approximately 92 percent, including 6% and 2% non-peeled and injured, respectively. The device saves about 68 percent and 69 percent in labor and cost, respectively, according to cost-effective economic research, and a payment period of 1.40 years (Naik *et al*., 2013).

To accommodate the small and medium-sized processing units, an onion peel was conceived, built, developed, and tested. The onion peel is made up of seven parts: the main frame, the sliced drum, the suction holes and exhaust, the collector, the water and air supply systems, and the power transmission. Different sizes of onion bulbs were used to test equipment (small, medium and large). A mixed sample of various sizes was also tested. Three different drum rotation speeds (30, 40 and 50 rpm), 3 different rotation times (1, 2 and 3 minutes), and 3 different load loads used in the test (18, 24 and 30 kg). For small (74.9 percent), medium (65.24 percent), mixed (80.08 percent) and large sizes (85.45 percent), peeling efficiency was at a mass load of 24 pounds (0.36 ton/h), duration of 2 minutes and -40 rpm. To increase peeling efficiency, a water pump and air compressor were added to the peeler, and tested under the same conditions as before. The efficiency of the pump water pump at 400 kPa was small (76.73 percent), medium (83.06 percent), large (99.20 percent) and mixed (87.49 percent), respectively. By pumping air at a pressure of 500 kPa, they were small, medium, large and mixed 76.33, 72.87, 87.530 and 88.37 percent, respectively. Only equipment, water pump, and air compressor machine, expected costs were 28.47, 29.56 and 33.75 LE/ton, respectively.

4. Storage structures. Farmers in India use a variety of storage methods. The onions are stored in bulk in customized homes with thatched roofs and bamboo poles or wire mesh side walls for adequate ventilation. The edges are also wrapped with gunny fabric in North India. In these shelters, onions are stored by spreading in a dry, waterproof area or racks. Replacement of bulbs or replacement of rotten, damaged or germinated lumps should definitely be done regularly. For proper storage, improved ventilated storage facilities with

racks or tiers with two or three levels of bulbs would be ideal. The storage damage of rabies-harvested onions varies from 30 to 60 percent. The most important loss in body preservation is weight loss of 25-30%, followed by 10-15 percent germination of bulbs and finally by 10-15 percent rot or bacterial decay. Rot, mold, and shrinking have been reported as major post-harvest bulb loss at farm level in India and Ethiopia, according to a similar study by Gorrepati *et al*. (2018); Kasso and Bekele (2018).

Despite the development of production methods, post-harvest losses are still a major problem. Several studies have attempted to find a way to prevent the loss of onions after harvest. Several studies attempted to find a way to prevent onion losses after harvest. With the cv. Staltgart Giant, Iordachescu and Nihailescu (1983) investigated six techniques of onion storage. The storage length was five months in the natural ventilation variations, with storage losses ranging from 4.18 to 4.71 percent and eight months in the forced ventilation variants, with losses ranging from 2.21 to 2.25 percent.

Maleic hydrazide @ 800 ppm sprayed bulbs maintained in plastic bags showed lesser rotting (15.8%) than untreated bulbs (17.6 percent), according to Mahadevswamy (1984). When compared to the control, the same treatment showed fewer sprouting and sprouts length. The best technique of keeping onions under ambient conditions was the curing method, following by the hanging method.

Thomas *et al.* (1986) conducted storage experiments on rabi onions in a traditional storage area known as chawl and model stores in Pimpalgaon, Maharashtra, and found that after the last five months, the loss of storage in a chawl without fresh air was 70% compared to 50% spicy air. Indian farmers use a variety of storage methods. The detached bamboo structure with center hallow was found to be the best, with the least amount of deterioration and germination during storage according to Krishnamurthy *et al*. (1987).

Anbukkarasi *et al*. (2020) was tested for low weight loss (5.18%), growth (0.62%), decay (0.64%), weight loss (0.00%), total weight loss (6.78%) and quality parameters, such as TSS (17.22 Brix), ascorbic acid (10.24 mg 100 g^{-1}), pyruvic acid (2.53 mol g^{-1}), sulfur content (0.704%), total phenolics content (625.56 gg^{-1}), phenylalanine ammonia lipase activity (6.86 µg ml^{-1} min^{-1}), peroxidase activity (1.825 absorbance $g^{-1}min^{-1}$) and polyphenol oxidase activity (1.321 absorbance $g^{-1}min^{-1}$) were detected and bulbs in the pathway ventilated room temperature compared to harvested bulbs placed in a low air-conditioned storage facility. The building had the longest shelf (up to 6 months).

In cv. Ballary Red, the overall storage loss after five months in a Nasik type storage structure was 21%, which was regarded acceptable. The structure's entire cost was Rs. 5000 (Murthy *et al*., 1988).

Ranpise *et al*. (2001) used a traditional onion storage facility known as chawl, airless and onion can be stored up to 1.5 to 2.0 meters tall with extensive damage and rot, and he also mentioned stored onions in it. Refurbished storage structure with lower and middle aeration and elevated floor (60 cm) of above ground level reduced storage losses from 99.2 to 70.0 percent within five months of maintenance. Extending the shelf life of onion bulbs, a maximum temperature of 15 °C and a relative humidity of 50 to 70% may be helpful in reducing rot and desiccation release at the appropriate level.

Total losses in low-cost bottom ventilated structures are substantially lower (35.17 percent) than suggested bottom ventilated structures, according to Tripathi and Lawande (2003) (44.96 percent). Low-cost storage structures also had less sprouting and black mould infection.

HANGING ON STRING METHOD

A ROOF OVER 'PATTARAI'

LOW-COST STORAGE METHOD

FORCED AIR ONION STORAGE

Vengayapattarai is built in levelled fields with equal-sized rectangular stones placed at a distance of 2 feet between each stone to act as a load barrier. Over the stones, a custom-made neem timber board is mounted, with manually woven bamboo sheets covering all three sides. The frame is filled with onions, and the front side is covered with jute gunny bags or bamboo sheets, depending on how much the farmer likes. The upper section of the pattarai is wrapped using coconut thatches to protect it from rain and direct sunshine while still allowing the onions to breathe (Karthikeyan *et al*., 2009).

Two onion storage buildings were built by the Directorate of Onion and Garlic Research. The bottom and side are fitted with two sets of 25–50 tons of storage lines, and one low ventilation line and one less expensive side to store 5–10 tons capacity.

The key characteristics of these storage structures are listed below:

- To avoid moisture, contact and dampness, the construction was built on an elevated platform.
- To prevent overheating, use Mangalore tile roof or other suitable materials.
- Preventing mold - hot and moist packs between layers of onions, allow air to circulate freely and quickly.
- To avoid sunburn, color fading, and deterioration of quality, keep onion lumps away from direct sunlight.
- Reduce the width of the whole stack to 60-75 cm in hot and humid temperatures, 75-90 cm in soft and humid conditions, and 90-120 cm in soft and dry conditions.
- To avoid damaging the pressure, keep the length of 100 cm for small and frequent onions and hot weather, as well as 120 cm for cool weather and large onions.
- Provide cubicles instead of continuous accumulation, as well as proper ventilation on all sides. 750 kg onions can be stored in cubic meter of storage space. The construction of a godown of the required capacity and multiple units instead of one large structure and a flowing pattern when placed in additional rows to allow for improved ventilation.
- If room is limited, provide a two-stage plan.
- To prevent build-up and excessive temperatures inside, use Mangalore tiled roofs or other suitable materials.
- To prevent the build - up of hot and humid pockets between the onion layers, provide bottom aeration for free and faster air circulation.
- To avoid sunscald, colour fading, and quality degradation, keep onion bulbs out of direct sunlight.
- Limit the width of every stack to 60-75 cm in hot and humid temperatures, 75-90 cm in mild and humid conditions, and 90-120 cm in mild and dry conditions.
- To avoid pressure bruising, keep stacking heights at 100 cm for tiny and multiplying onions and hot weather, and 120 cm for mild weather and huge onions.
- Providing cubicles rather than a continuous stack, as well as proper ventilation from across all sides. 750 kg onions can be stored in a cubic meter of storage space. Construction of a godown for the desired capacity and many units instead of a single large structure and in a zigzag pattern when erected in more rows for improved aeration.
- If room is limited, provide a two-tier system.
- To prevent rotting, sanitize structures and premises on a regular basis.
- Structures' cost-effectiveness is determined by locally accessible materials and labour.

CONCLUSION

Along with the increase in production, the post-harvest management of onion and garlic is the need of the hour to fulfill the growing demand. We can save our produce from wastage by adopting proper management practices.

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