

Onions - Post-Harvest Handling and Storage

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SUMMARY

Most of the onions (*Allium cepa* cv. Orlando) grown in southern Israel are treated with maleic hydrazide before storage, and are cold-stored for up to 8 months with minimal losses to rots or sprouting. Nevertheless, in most cases the complete dry outer skin (tunic) cracks and loosens, and tends to fall off during storage. To improve onion postharvest quality, bulbs were harvested at 80–100% green leaf drop (top-down), leaving about 10 cm of neck above the bulb. The early harvest reduced skin cracks in 93% of the bulbs, resulting in a sturdy tunic beneath the muddy outer skin. We applied fast curing (FC) at 30 °C and 98% RH for up to 9 days postharvest: the onion neck became 52% narrower after 6 days, similar to the effect of 5 months of cold storage. FC also changed the color of the treated onion bulbs' outer skin to a darker reddish brown. FC of onions harvested with a long neck and stored for 290 days reduced weight loss and rot by 30% and 80%, respectively, as compared to non-FC onions. The better onion quality induced by FC was accompanied by an increased number of onion skin layers (from an average of 1.8 to 4) and a higher force needed to tear the tunic (average 4.8 N as compared to 3.5 N in the control). FC compressed the effects of 5 months of cold storage into a few days, since most of the bulb neck and tunic changes measured during FC occurred only after long cold storage without FC. Although emission of the lachrymatory factor was not affected by FC, it markedly increased after 5 months of storage. Histological observation showed that FC keeps the onion tunic and inner fleshy scales intact and ensures postharvest quality, even after 8 months of cold storage. The high temperature used for FC can be reached in hot-climate storage areas with minimal energy investment.

INTRODUCTION

The onion (*Allium cepa*) (Latin 'cepa' = onion), also known as the bulb onion or common onion, is used as a vegetable and is the most widely cultivated species of the genus *Allium*. This genus also contains several other species variously referred to as onions and cultivated for food, such as the Japanese bunching onion (*A. fistulosum*), Egyptian onion (*A. proliferum*), and Canada onion (*A. canadense*). Onion is an important vegetable crop grown and consumed widely across the world. As a culinary ingredient it adds to the taste and flavour in a wide range of food preparations and it is also used as a salad. Thus there is a steady increase in the demand for onion across the world. China is the leading producer of onion constituting about 27 per cent of the world total production. Due to lower yields, though India has the highest area under onion, it stands second in the production of onion in the world. Hence, there is a lot of potential for increasing the production of onion by improving the yields. India is also the largest exporter of onion and hence, it is crucial to improve the yields for enhancing the export level, so that it helps in earning foreign exchange for the exchequer of the country.



Curing

The only post-harvest treatment required for the long storage of bulb onions is a thorough curing of the bulbs. Curing is a drying process intended to dry off the necks and outer scale leaves of the

bulbs to prevent the loss of moisture and the attack by decay during storage. The essentials for curing are heat and good ventilation, preferably with low humidity. This dries out the neck and the two or three outer layers of the bulb. The outermost layer, which may be contaminated with soil, usually falls away easily when the bulbs are cured, exposing the dry under-layer, which should have an attractive appearance. Onions are considered cured when neck is tight and the outer scales are dried until they rustle. This condition is reached when onions have lost 3 to 5% of their weight. If onions cannot be dried in the field, they can be collected in trays, which are then stacked in a warm, covered area with good ventilation. In cool, damp climates, onions in bulk ventilated stores are dried with artificial heat blown through the bulk at a duct temperature of 30 degrees Celsius. Onions can also be cured by tying the tops of the bulbs in bunches and hanging them on a horizontal pole in a well-ventilated shades. Curing in shade improves bulb colour and reduces losses significantly during storage.

Grading

Onions after curing are graded manually before they go in to storage or for marketing. The thick neck, bolted, doubles, injured and decayed bulbs are picked out so also misshapen small bulbs. Sorting and grading is done after storage also to fetch better price. The outer dry scales usually rub off during the grading process, giving the onions a better appearance for market. It has been experienced that if storage is arranged after proper sorting and grading losses in storage are reduced. For local market the onions are graded based on their size.

Extra large onion (>6 cm dia.)

Medium (4-6 cm dia.)

Small (2-4 cm dia.)

The extra large onions have great demand and fetches very good price.

General Characteristics

The bulbs shall:

- Be reasonably uniform in shape, size colour and pungency of the variety /type
- Be mature, solid in feel, reasonably firm with tough clinging skins.
- Be throughout cured and dried.
- Be free from dust and other foreign material.
- Be free from defective, diseased, decayed and damaged bulbs caused by seed stems, tops
- Oots, moisture, dry sun scald burn, sprouting, mechanical or other injuries and staining.
- Be free from moulds, soft rot and insect attack.
- % of seed stem or bolted bulbs shall not exceed 20% in nasik kharif onions.

Grade designations and definitions of quality for export of onions:

Type of onion	Colour	Grade	Diameter (mm)	Defective Bulbs
Nasik,Saurashtra Bellary,Poona & Nasik	Light Red	Extra big Big Medium Small General N.S.grade #	60 20 Mixed 20 -	10 10 10
B) Dindigul or "Kar" Podisu or Red onions	Light Purple- Pink	Special Good	10	
Bangalore onions	Light Purple to Purple	Big Medium Small Mixed	30 20 15 Different size but not	

	Big 30	Medium 20	below 15 Small 15	
Krishnapuram onions	Light rosy to dark	Big Medium Small Mixed	30 25 15 Different size but not below 15	

Different size but not below 15

1. Tolerance for size in big onions: For accidental errors in sizing, not more than 5 % by weight of the bulbs in any lot may be of next lower grade than the minimum diameter prescribed in Nasik, Saurashtra, Bellary or Poona onions. In case of Podisu, this error in sizing not more than 10 % by weight. In this case, smallest onion in bunch would be taken for measuring the diameter.

2. Defective, diseased and damaged shall mean malformed bulbs and the bulbs internally or externally damaged, diseased or discoloured material affecting the quality. The decayed onions shall not exceed 2% in any lot.

General: The grade shall be allowed to be packed only against irrevocable letter of credit.

NS grade: This is not a grade in its strict sense but has been provided for the onions not covered under regular grade. Onions under this grade shall be exported only against a specific order from foreign buyer inducting the quality.

Packaging

Packing should be small for easy handling during transit and may vary according to market demand. Onions are packed in jute (hessian) bags for transporting to yard or brought as loose. For safe handling, 40 kg open mesh jute bags having 200-300 g weight should be used in domestic market. For export, common big onions are packed in 5-25 kg size open mesh jute bags. Bangalore Rose and multiplier onions are packed for export in 14-15 kg wooden baskets. Nylon net bags, when used for packing have resulted in less storage loss because of good ventilation.

Handling

Bulbs intended for storage must be free from cuts and handled with extreme care. Onions should not be dropped on to non-resilient surface from more than 6 feet height. If onions are to be stacked after packing in store or trucks, the better height is 2-2.5 metres. Losses due to rot is reported to be more if onions are stored in gunny bags than in loose or wooden crates.

Storage

Proper storage of bulbs is necessary both for consumption and also for seed production. Onions should not be stored unless adequately dried either in the field or by artificial means. It is necessary to dry the neck tissue and outer scales until they rustle when handled otherwise the bulbs will rot in storage. Sprouting in onion is controlled by temperature. The temperature between 10-25°C increases sprouting. Rooting is influenced by relative humidity (RH). More the relative humidity, more is rooting. Weight loss is more when temperature is above 35°C. Under ambient conditions the onions are stored at a temperature of 30-35°C with RH of 65-70%. In cold storage, temperature is maintained at 0-2°C while the RH is kept at 60-75%. Sprouting is checked effectively if Maleic Hydrazide at 2500 ppm is sprayed at 75-90 days after transplanting. Effect is, however, more pronounced in kharif season than in rabi season. The storage rots could be checked if proper cleanliness is maintained in store and crop is sprayed with 0.1% Carbendazim after 90 days of transplanting and just before

harvest. In India, the farmers practice different storage methods. The onions are bulk stored in special houses with thatched roof and side walls are made up with bamboo sticks or wire mesh for good air circulation. In North India, the sides are also covered with gunny cloth. Onions are stored in these sheds by spreading them on dry and damp proof floor or racks. Periodical turning of bulbs or removal of rotten, damaged and sprouted bulbs should be done. Well-ventilated improved storage structures with racks or tiers having two or three layers of bulbs would be desirable for proper storage.

The salient features of improved storage structures are as below-

- Construction of storage godown on raised platform helps in reduction of moisture and dampness
- Use of Mangalore tiles roof or other suitable material prevents built up of high temperature inside.
- Increased centre height and more slope is better for air circulation and preventing humid microclimate inside godown.
- Bottom ventilation provides free and faster air circulation to avoid formation of hot and humid pockets between the onion layers.
- Avoid direct sunlight on onion bulbs to reduce sunscald, fading of colour and quality deterioration.
- Restriction on width of each stack to 60-70 cm for cool humid weather, 75-90 cm for mild and humid weather and 90-120 cm for mild and dry weather conditions
- Restriction of stacking height to 100 cm for small and multiplier onion and hot weather and 120 cm for mild weather and for big onion to avoid pressure bruising.
- Cubicles should be made instead of continuous stack leaving sufficient space for ventilation from all the sides.
- One cubic metre area of store accommodates about 750 kg onions.

Storage Diseases

Onions are susceptible to Botrytis neck rot during storage. The disease is characterized by grey fungal growth, often watery in nature, at the neck area and on the outer scales. The infection usually spreads quickly through the whole onion. Bruising of onion bulbs during harvesting, storing under humid conditions, and exposing the inner tissues due to breakage of outer scales increase the incidence of Botrytis neck rot. Curing onions prior to storage will reduce the incidence of this disease. Black mould, caused by *Aspergillus niger*, is characterized by black discoloration at the necks of onions. The black discoloration can sometimes be found on the outer scales. Bruised onions are more susceptible to this fungus. Black mould causes the tissues to become water soaked which often induces bacterial soft rot. Although low temperature storage delays growth of the fungus, exposure of infected onions to temperatures above 15°C, as occurs during marketing, will accelerate its growth. Stored onions are also susceptible to blue mould, caused by *Penicillium*. *Penicillium* moulds induce watery soft rot of onion tissues and/or blue-green discoloration at the neck or other tissues. Minimizing mechanical damage and proper curing often reduces the incidence of this fungus. Bacterial soft rots caused by *Erwinia* often occur during storage of onions. Onions infected by bacterial soft rots often appear healthy on the outside but when cut open some of the inner scales are brown, water-soaked and have a cooked appearance. A characteristic foul smell often occurs and the centre core of the onion often slips out when pressure is applied at the base of the onion. Bacterial rots caused by *Pseudomonas* infects outer scales and are characterized by yellow slime which produce a sour odour.

Control of fungal and bacterial rots of onions can be achieved by:

- Pre-harvest application of a registered fungicide such as Rovral.
- Harvesting at proper maturity
- Minimizing bruising of bulbs
- Discarding defective onions
- Prompt and effective curing
- Storing as quickly as possible

Transport

Onion stocks are transported in bullock carts, tractor trolleys and trucks as also railway wagons are used for longer distance movement within the country. Onions are transported in ventilated ships as well as sailing vessels / motorboats for export to Gulf and South-East Asian countries. It is also shipped in 3.5m containers or 7m containers by loading on ships.

Export specification

Specifications

Color: Light and dark red color

Size: 30mm and 70mm

Packing: Packed in 5 Kg, 10 Kg, 20 kg, or 25 Kg mesh bag as per customer requirement

CONCLUSION

There are some important decisions to be made regarding the harvest and postharvest of onions. All the decisions will directly determine how much profit a farmer will make. Should store the onions after harvest? This will affect the variety planted and whether the onions are cured or not. Storing onions has a cost and this has to be taken into consideration. When to harvest? If done too soon, the onions will not have reached their full yield. What are the weather conditions like? If wet, then curing has to happen under a protected structure. How long will I store the onions for? The longer they are stored, the better chance of accessing high prices. Extended storage however, means greater costs and greater risks of disease and sprouting. As with the postharvest of all crops, careful grading and postharvest handling is a must if the farmer expects the best prices from the market.

REFERENCES

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