

EFFECT OF ENVIRONMENTAL FACTORS ON SHELF LIFE OF BIG ONION

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ABSTRACT

An experiment was conducted to identify the effect of environmental temperature and relative humidity on the shelf life of b'onion. Different geographical locations were used for the experiment to test storability under different temperature and relative humidity conditions. Results revealed that the shelf life of onion in low temperature locations Sita Eliya, Rahangala and Bandarawela where minimum average temperature is less than 15°C was comparatively lower than that at Maha Illuppallama and Homagama where minimum average temperature is between 23 - 28°C. While the level of relative humidity recorded in any of the locations (60 - 90%) has not been favourable in reducing sprouting losses effectively, spraying of sprouting inhibitor before maturity has helped to reduce losses due to sprouting by 65%. However, the comparative advantage of using sprouting inhibitor was low in low temperature locations where minimum average temperature was below 15°C. Overall results indicated that minimum average temperature (23 - 28°C) and relative humidity (< 80%) conditions at low-country locations, Homagama and Maha Illuppallama are more suitable than those of mid and up-country locations for long-term storage of b'onion.

KEY WORDS: Onion, Storage, Temperature, Humidity, Sprouting.

INTRODUCTION

B'onion, internationally known as common onion or bulb onion (*Allium cepa* L.) is an essential item in the Sri Lankan diet. The total annual requirement is around 90,000 metric tons of which about 50% are imported every year despite the good potential to produce them locally. Seasonality of production and short shelf life of the produce are major hindrances restricting the availability of locally produced onions within the country. Therefore, it is important to identify means of increasing the shelf life of local onion in order to extend its availability.

Among many factors that are affecting the storability of onion, relative humidity (RH) and the temperature of the storage

environment are very important because they affect three major causes of storage losses of onion: rotting, sprouting and drying (Tanaka *et al.*, 1985; Van den Berg and Lentz, 1973; Brice *et al.*, 1997). However, adequate information on the effects of environmental temperature and relative humidity on the shelf life of B' onion under local conditions is not available. Therefore, an investigation was undertaken to determine the effect of environmental temperature and relative humidity on the shelf life of B' onion and thereby to identify suitable locations for long-term storage of onions in Sri Lanka.

MATERIALS AND METHODS

Medium-size bulbs (60-80 g bulbs) of cultivar "pusa red" grown under similar

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management practices during Yala 1991, 1992 and 1993 at the RARC, Maha Illuppallama were used for the study. Bulbs were cured for 10 days before the experiment. Six locations Maha Illuppallama (MI), Homagama (HO), Gannoruwa (GA), Bandarawela (BW), Rahangala (RA) and Sita Eliya (SE) were identified mainly by considering their geographical location and also availability of a research station or an adaptive research centre to facilitate the study. Onions were stored in 1 m x 1 m x 15 cm structures with a wire meshed interior and they were placed 20 cm above ground in well-ventilated rooms in each location. All possible precautions were taken to provide similar conditions for the storage structures in different locations except environmental temperature and relative humidity which were recorded twice daily. There were four replications in each location and locations were considered as treatments.

In the first year study only untreated bulbs were used but in the second and final years, bulbs treated with a sprouting inhibitor, malic hydrazide (Potassium salt of 1, 2 dihydro 3, 6 pyridazinedione - 80%) at the rate of 15 l/ha two weeks before harvesting were used in addition to normal untreated bulbs. Storage losses due to sprouting, rotting and drying were recorded at monthly intervals. Sprouted and rotted bulbs were removed after recording the results.

RESULTS AND DISCUSSION

Storage losses due to sprouting, rotting, and drying in each location during the first year study are presented in Figs. 1 and 2. Even though there is no continuity between data points, relative humidity and temperature data in each location were plotted as line graphs within the same axis with percentage weight loss for comparison. Similarly, data for year 2 and 3 of the study are presented in Figs. 3, 4, 5 and 6.

Relative humidity in locations used for the study varied from 63% to 93% during the study period. Average minimum environmental temperature varied from 10 to 28°C (Figs. 1 - 6). Average minimum air temperature was used in interpreting results by considering the findings of previous workers (Abdulla and Mann, 1963; Karmarkar and Joshi, 1941; Tanaka *et al.*, 1985) who have reported that the optimum temperature for sprouting is around 15°C.

Storage losses during the first two months at Maha Illuppallama, Homagama and Gannoruwa have been mainly due to drying and rotting. In the low-temperature locations Bandarawela, Rahangala and Sita Eliya, high percentage of sprouting losses has been recorded from early stages.

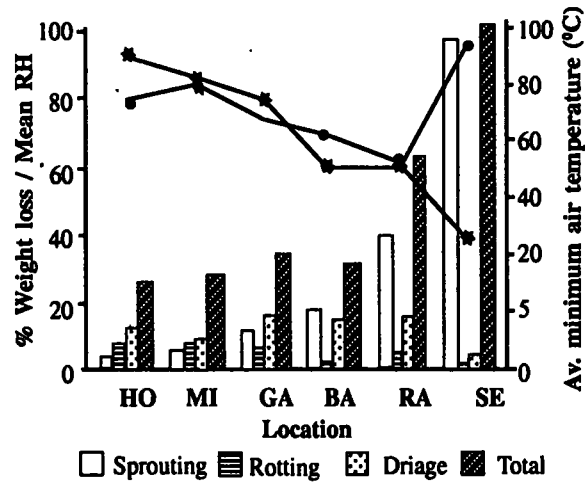


Fig. 1. Effect of relative humidity (●) and air temperature (*) on weight loss during first two months in the 1991 study.

(HO - Homagama, MI - Maha Illuppallama, GA - Gannoruwa, BA - Bandarawela, RA - Rahangala, and SE - Sita Eliya)

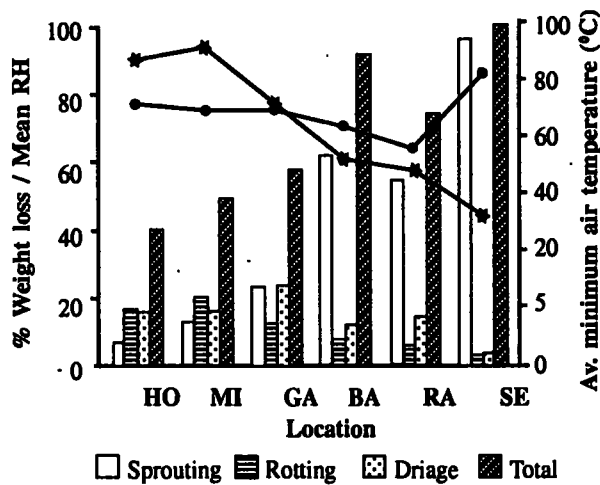


Fig. 2. Effect of relative humidity (●) and air temperature (*) on weight loss during first four months in the 1991 study. Locations are same as in Fig. 1.

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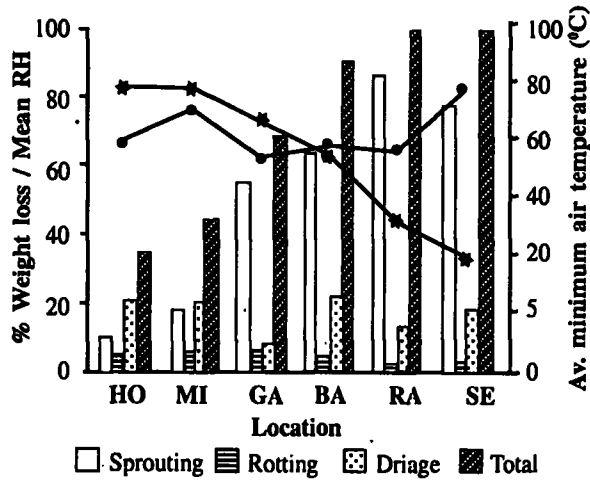


Fig. 3. Effect of relative humidity (●) and air temperature (*) on weight loss during first two months in the 1992 study. Locations are same as in Fig. 1.

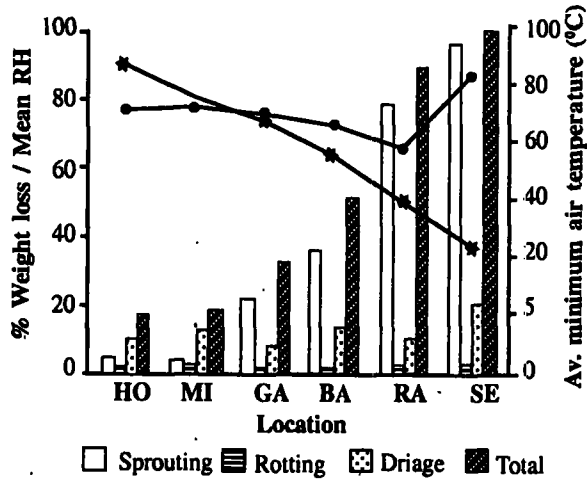


Fig. 4. Effect of relative humidity (●) and air temperature (*) on weight loss during first four months, in the 1992 study. Locations are same as in Fig. 1.

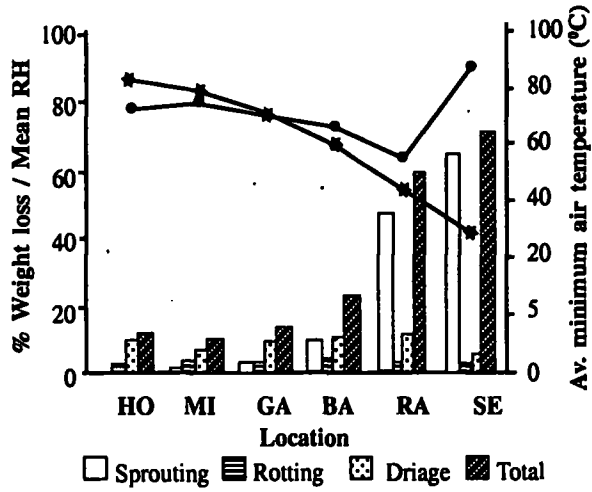


Fig. 5. Effect of relative humidity (●) and air temperature (*) on weight loss during first two months rotting and drying, in the 1993 study. Locations are same as in Fig. 1.

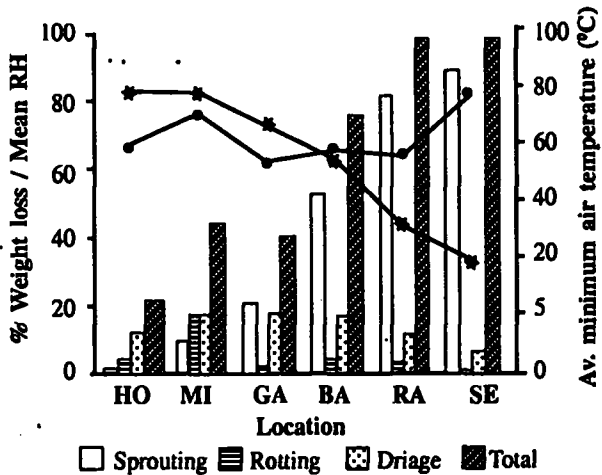


Fig. 6. Effect of relative humidity (●) and air temperature (*) on weight loss during first four months in the 1993 study. Locations are same as in Fig. 1.

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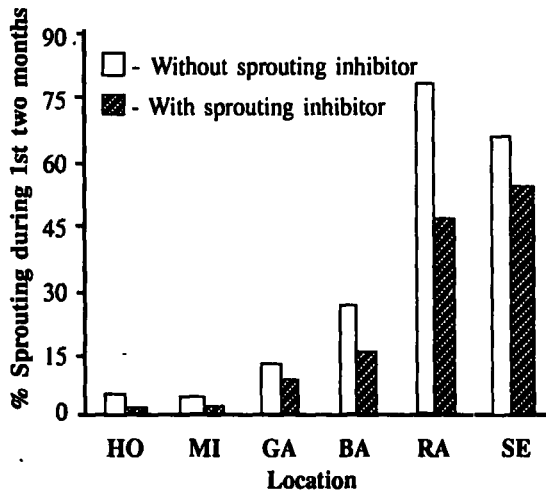


Fig. 7. Effect of sprouting inhibitor on storage losses due to sprouting of onion during first two months in storage. Locations are same as in Fig. 1.

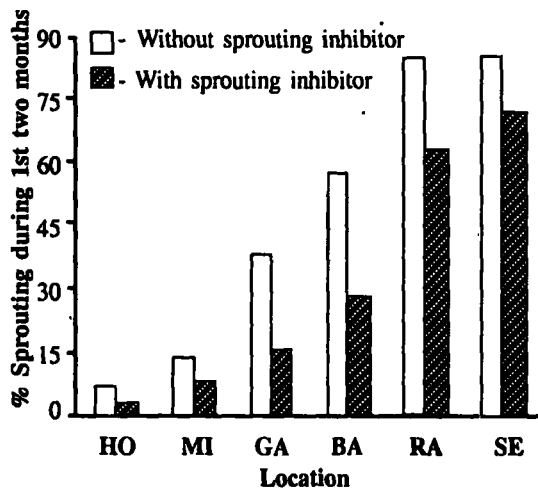


Fig. 8. Effect of sprouting inhibitor on storage losses due to sprouting of onion during first four months in storage. Locations are same as in Fig. 1.

The comparatively low temperature and more than sixty- percent relative humidity at Sita Eliya, Rahangala and Bandarawela may have contributed to the high percentage of sprouting losses in those locations. Similar observations have been made by previous workers who have worked with different cultivars of onion in other countries (Abdulla and Mann, 1963; Karmarkar and Joshi, 1941; Tanaka and Komochi, 1985). However, if the relative humidity was much lower losses due to sprouting could have been expected to be lower even under low temperature conditions. As shown by Ogata (1956), the respiration and sprouting are suppressed by low RH (40 - 50%). Low percentage of rotting in Rahangala, Bandarawela, and Sita Eliya could be due to reduced rate of fungal activity under low temperature conditions prevailing in those locations during the period of study. Tanaka *et al.* (1991) showed that the activity of one of the major storage fungi, *Aspergillus niger* was lower when the storage temperature was below 17°C. Increase in storage losses during four months storage has been due mainly to sprouting and drying irrespective of the storage environment.

Bulbs treated with a sprouting inhibitor before harvesting have shown less sprouting in all the locations when compared to untreated bulbs (Figs. 7 and 8). This is in agreement with Writer *et al.* (1950), who observed no sprouting even after five months of storage of onion bulbs that were harvested from plants sprayed with malic hydrazide at the rate of 2500 ppm (1.8 kg/ha). However, in low temperature environments, high percentages of sprouting losses have been recorded irrespective of the sprouting inhibitor treatment (Figs. 7 and 8).

The total storage losses for two months and four months storage periods have been low in Homagama and Maha Illuppallama due to reduced sprouting losses when compared

to the low temperature locations tested. Findings of Tanaka *et al.* (1985) agree with this finding. They proved that the storage life of onion was longer at 25°C than at 15 - 20°C.

CONCLUSIONS

Storage losses due to rotting could be reduced by selecting low temperature (<15°C) locations for b'onion storage. However, the losses will increase due to sprouting if the relative humidity is high (> 60%). Application of a sprouting inhibitor before harvesting could reduce the losses due to sprouting in storage depending on the condition of the storage environment. In view of the above, low country locations such as Homagama and Maha Illuppallama, with environmental temperature of 25 - 30°C and upto 80% relative humidity, could be considered more suitable for both short-term and long-term storage of b'onion.

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