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National Academy of Agricultural Science (NAAS) Rating : 3. 03

Development of A Suitable Household Storage Technique for Enhancing Shelf Life of Selected Tropical Vegetables

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Abstract: *The efficiency of different packaging methods and storage conditions on enhancing the shelf life of selected solanaceous, leguminous, green leafy vegetables, lady's finger, ivy gourd and carrot were explored. Of the different packaging and storage conditions tried vented LDPE (Low Density Polyethylene) under low temperature storage conditions recorded least physiological loss in weight (PLW) and speed of decay for tomato (3.40% & 0.43% respectively), cowpea (6.33% and 0.79% respectively) and lady's finger (10.67% and 1.33% respectively). PLW and speed of decay were very low for brinjal (3.77% and 0.47% respectively), chilly (5.17% and 0.65% respectively), french beans (6.10% and 0.76% respectively), ivy gourd (7.73% and 0.96 % respectively) and carrot (6.67% and 0.83% respectively) when packaged in LDPE pouches without vents under low temperature storage. Curry leaves and coriander leaves wrapped with newspaper and packaged in vented LDPE pouches stored in low temperature conditions recorded least PLW (9.3% and 18.2% respectively) and speed of decay (1.16% and 2.27% respectively).*

Keywords: *Low temperature, packaging, paper wrap, vents, weight loss.*

Vegetables play an important role in healthy nutrition and stands top in the list of consumer priorities. Leguminous vegetables, solanaceous vegetables, cucurbits etc. are the different groups of vegetables prefer by Indians in their daily life. However the major obstacle on storing purchased vegetables is their short shelf life. Microorganisms pose a serious threat to them [5] and temperature is the most important environmental factor favouring it. They might have encountered with several other spoilage factors by the time lag between harvest and consumption. Temperature has a crucial effect on spore germination and pathogenesis. For every 10^0 C rise in temperature the rate of deterioration of perishables increases two to three-fold times.

Thus, temperature and microbial control is essential from the farm to the table. The economy and infrastructure of a nation if supports a cool chain it is well and good and when it reaches the consumer it's our duty to retain its quality till consumption. Packaging and improved storage conditions can be adopted as a tool for tackling this issue in home [1]. For house hold storage flexible packaging materials like polymeric films which are cheap and easily available can be chosen.

Polymeric films especially, polyethylene (PE) is most commonly used which has antifogging ability, pealability and sealability [2]. Polymeric films, tissue paper wraps or a combination of these may perform well. Sometimes PE films are perforated to control water vapour transmission due to its low water vapour transmission rate [6]. According to World Resources Institute [4] better storage conditions can be ensured by using secured storage rooms, zero energy cool chambers and low temperature storage systems like refrigerator.

So an experiment was conducted in Department of Processing Technology, College of Agriculture, Vellayani, Trivandrum with the objective of finding out a suitable packaging and storage conditions for selected tropical vegetables for enhancing their shelf life in households.

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MATERIALS AND METHODS

Solanaceous vegetables like, Tomato (*Lycopersicon esculentum*), Brinjal (*Solanum melongena*) and Green chilly (*Capsicum annuum*), leguminous vegetables like, Cowpea (*Vigna unguiculata* var. *sesquipedalis*) and French beans (*Phaseolus vulgaris* L.), leafy vegetables like, Curry leaves (*Murraya koenigii*) and Coriander leaves (*Coriandrum sativum*), Lady's finger (*Abelmoschus esculentus* (L.) Moench.), Ivy gourd (*Coccinia indica* L.) and Carrot (*Daucus carota* L.), are the vegetables selected for the study. Fresh vegetables were collected from local market, Thiruvananthapuram, washed thoroughly in running water, subsequently air dried, packed in polyethylene packets and stored in refrigerator (4^0 C) until using for experiments.

The study was conducted by wrapping 100g of each type of vegetables in newspaper or without wrapping packaged in ventilated (5% vents) or non-ventilated LDPE (Low Density Polyethylene) pouches of 100 gauge thickness and stored under ambient or low temperature storage (20 ± 2^0 C) conditions. Physiological loss in weight (PLW) and speed of decay were recorded by a milligram weighing balance (ED623S model of Sartorius Extend) at eighth day of storage. Percentage PLW [3] as estimated using the formula, %PLW = [(Initial weight-Final weight) ÷ Final weight] x 100. Speed of decay is estimated as the ratio of % PLW to number of days the produce got stored.

Experimental data was analysed using analysis of variance (ANOVA) and significant differences among means from triplicate analyses at p (<0.05) were determined by Duncan's Multiple range test.

RESULT AND DISCUSSION

Physiological Loss of Weight During Storage

On eight day of storage (Table 1), tomatoes packed in vented LDPE pouches and stored in low temperature conditions recorded least physiological loss in weight (PLW) of 3.40% (96.6g) whereas those stored in ambient condition without packaging recorded 28.93% loss in weight (71.07g). Vented LDPE pouches under low temperature storage was found to be good for cowpea (93.67g) and lady's finger (89.33g) also, with a PLW of 6.33% and 10.67% respectively.

LDPE pouches without vents under low temperature storage conditions was found to be good for storing brinjal (96.23g), chilly (94.83g), french beans (93.90g), ivy gourd (92.27g) and carrot (93.33g) with PLW of 3.77%, 5.17%, 6.10%, 7.73% and 6.67% respectively. Chilly can be stored in ambient conditions for eight days by packaging them in LDPE pouches without vents (7.20% PLW), wrapping in news paper and packaging in vented (7.40% PLW) or unvented (7.90% PLW) LDPE pouches. Chillies are safe for eight or more days in low temperature storage conditions in vented LDPE pouches (7.43% PLW) also.

Green leafy vegetables like curry leaf and coriander leaves can be wrapped in newspaper and packaged in vented LDPE pouches and can be stored under low temperature conditions for eight days or more with a minimum PLW of 9.3% and 18.2% respectively.

Table 1
Effect of packaging and storage conditions on weight loss of vegetables

Mode of storage	LDPE Ambient storage					LDPE Low temperature storage					CD (P=0.05)
Items	Vented	Without vents	Vent+Paper wrap	Without vents+Paper wrap	Control	Vented	Without vents	Vent+Paper wrap	Without vents+Paper wrap	Control	
Tomato	74.77^{de}	72.97^{ef}	78.77^{c}	84.43^{b}	71.07^{f}	96.6^{a}	84.9^{b}	84.27^{b}	83.27^{b}	76.47^{cd}	2.81
Brinjal	78.7^{cf}	85.73^{c}	85.83^{c}	87.2^{bc}	75.3^{f}	90.33^{b}	96.23^{a}	85.33^{cd}	90.6^{b}	81.23^{de}	4.2
Chilly	91.53^{bc}	92.8^{ab}	92.6^{ab}	92.1^{abc}	70.17^{e}	92.57^{ab}	94.83^{a}	89.2^{cd}	87.93^{d}	86.77^{d}	3.25
Cowpea	86.1^{cd}	85.53^{d}	89.2^{bc}	89.3^{bc}	74.23^{e}	93.67^{a}	88.23^{cd}	89.4^{bc}	92.33^{ab}	89.43^{bc}	3.64
French beans	83.23^{c}	84.1^{c}	83.1^{c}	85.3^{bc}	69.5^{e}	87.33^{b}	93.9^{a}	85.57^{bc}	85.87^{bc}	78.07^{d}	3.08
Curry leaf	80.33^{bc}	81.4^{bc}	84.1^{b}	84.53^{b}	45.3^{e}	77.33^{c}	78.8^{bc}	90.7^{a}	83.07^{bc}	64.43^{d}	6.1
Coriander leaves	65.6^{c}	62.87^{cd}	71.2^{b}	71.97^{b}	30.57^{e}	71.2^{b}	73.73^{b}	81.8^{a}	71.73^{b}	57.83^{d}	5.31
Okra	73.53^{bcd}	74.77^{bc}	75.33^{b}	71.8^{cd}	66.87^{e}	89.33^{a}	73.63^{bcd}	72.97^{bcd}	74.4^{bc}	70.8^{d}	3.52
Ivy gourd	76.4^{cd}	79.47^{bcd}	75.5^{de}	80.53^{bcd}	70.2^{e}	82.43^{b}	92.27^{a}	82.33^{bc}	82.83^{b}	75.2^{de}	6.03
Carrot	84.7^{bc}	86.03^{b}	86.17^{b}	83.73^{bc}	73.4^{d}	82.1^{c}	93.33^{a}	84.8^{bc}	92.37^{a}	83.7^{bc}	3.48

Speed of Decay

Speed of decay of all vegetables is found to be high in ambient conditions (Figure 1.) than in low temperature storage (Figure 2.) irrespective of the packaging material used. Even without any packaging low temperature conditions recorded a low speed of decay for all studied vegetables.

Tomatoes packed in vented LDPE pouches and stored in low temperature conditions recorded least speed of decay (0.43%) whereas those packaged with the same material and stored in ambient condition recorded 3.15% speed of decay. Cowpea and Lady's finger also showed a least speed of decay (0.79% and 1.33% respectively) when they were packaged in vented LDPE pouches and stored under low temperature storage conditions.

Brinjal (0.47%), chilly (0.65%), french beans (0.76%), ivy gourd (0.96%) and carrot (0.83%) showed least speed of decay when they are stored in low temperature conditions by packing in LDPE pouches without vents. Chillies are found to decay slowly even in ambient conditions also. Under ambient conditions LDPE pouches without vents (0.90%), wrapping in news paper and packaging in vented (0.92%) or unvented (0.98%) LDPE pouches and in low temperature conditions packaging in vented LDPE pouches (0.93%) recorded least decay.

Among the vegetables studied leafy vegetables had a higher speed of decay of which coriander showed a higher speed of decay compared to curry leaves in both the storage conditions irrespective of the packaging material used. Both the leafy vegetables wrapped in newspaper and packaged in vented LDPE pouches under low temperature storage recorded least speed of decay (2.27% for coriander leaves & 1.16% for curry leaves).

CONCLUSION

The effect of different packaging materials like LDPE covers with and without vents, wrapping with newspaper and packaging in LDPE covers with or without vents and without any packaging in ambient storage conditions as well as low temperature storage conditions for enhancing the shelf life of Tomato, Brinjal, Green chillies, Cowpea, French beans, Curry leaf, Coriander leaves, Okra (Lady's finegr), Ivy gourd and Carrot were explored. Physiological loss in weight and speed of decay in terms of percentage for eight days of storage were recorded and found that low temperature conditions are better than ambient for all vegetables irrespective of the packaging. Tomato, Cowpea and Lady's finger can stored well in vented LDPE whereas LDPE covers without vents found to be good for Brinjal, Chillies,

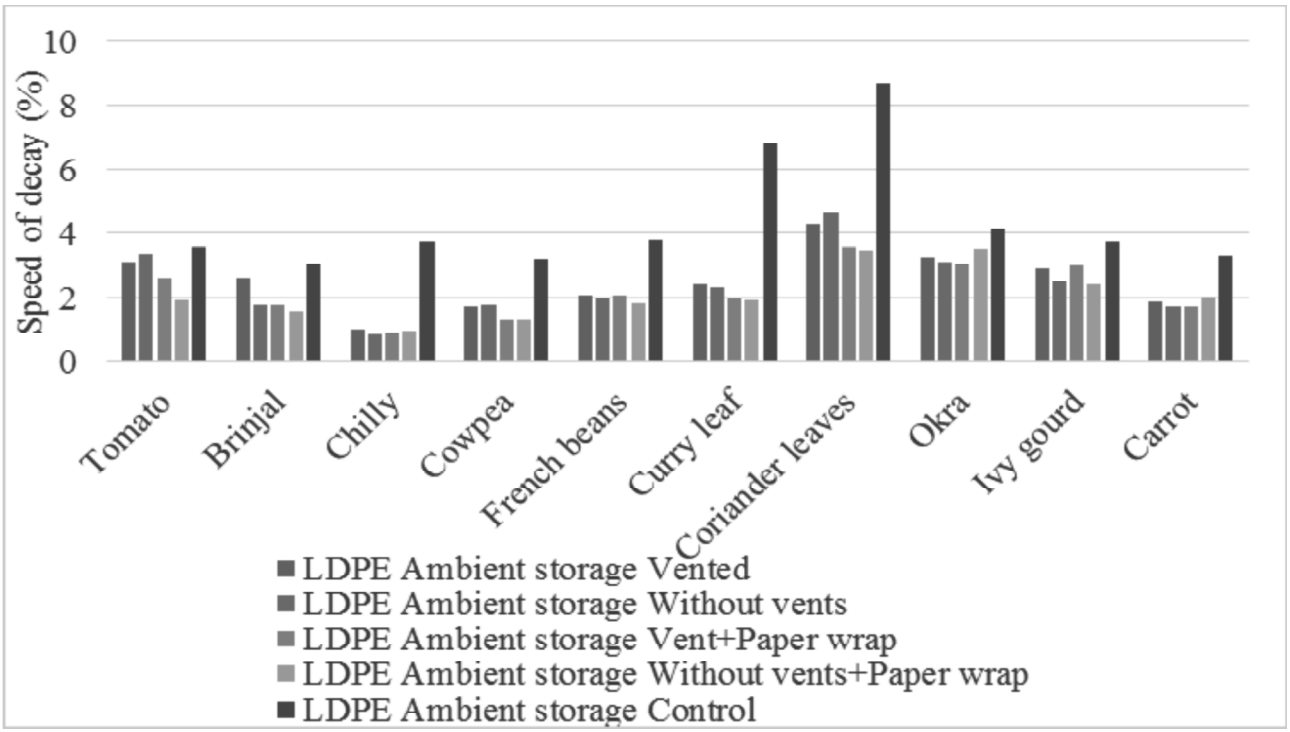

Figure 1: Speed of decay of vegetables during storage at ambient conditions

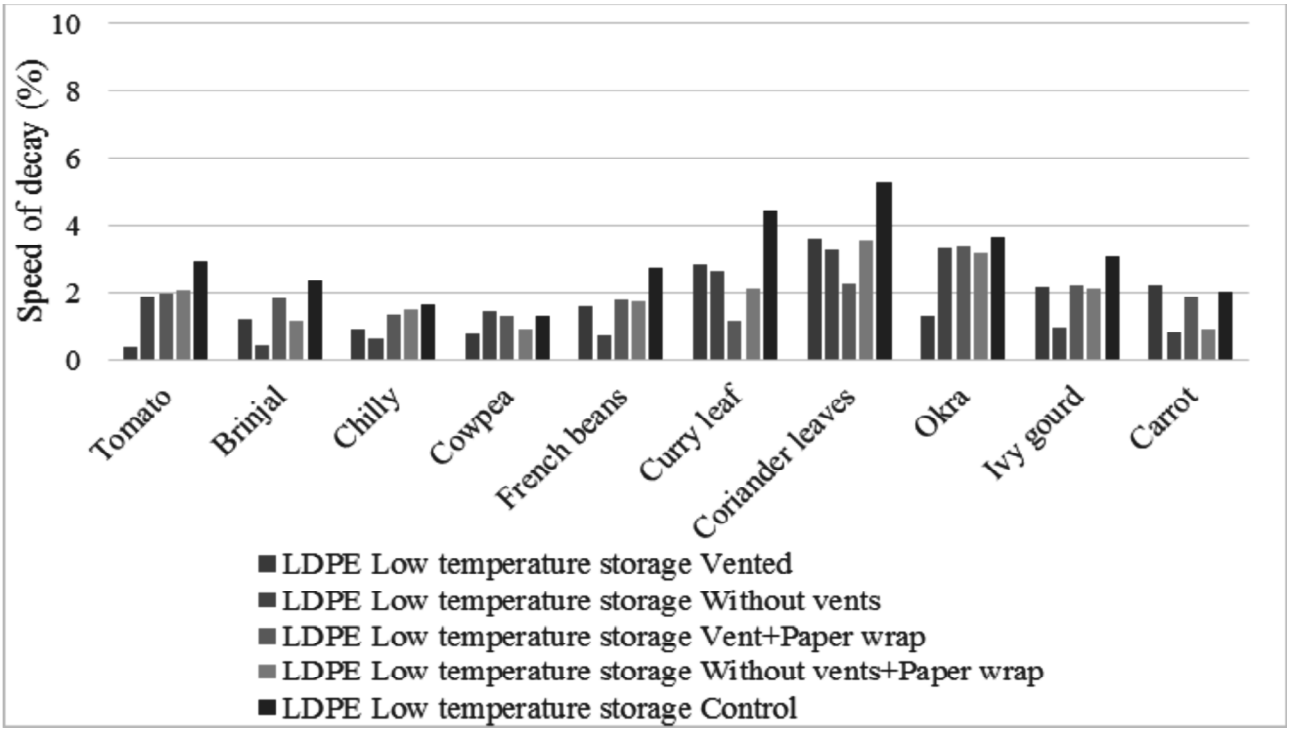

Figure 2: Speed of vegetables during storage at low temperature conditions

French beans, Ivy gourd and Carrots. For green leafy vegetables like curry leaves and coriander leaves, wrapping with newspaper and packaging in vented LDPE pouches help in enhancing their shelf life.

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