Study on the Effects of Lime and Cellophane on Postharvest Quality and Storage Life of Cabbage

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ABSTRACT

The postharvest study of cabbage was carried out at vegetable science laboratory of the Vegetables and Fruits Research Development Centre (VFRDC) at Yemon, Hlegu Township, Yangon Region from December 2017 to February 2018. There were six treatments in this experiment. They were T_1 (control), T_2 (cellophane), T_3 (cellophane+1g lime powder), T_4 (cellophane+2g lime powder), T_5 (1 g lime powder), T_6 (2 g lime powder).Among these treatments the application the combination of cellophane plastic films and 1 g of lime powder (T_3) showed the best performance of fresh cabbage heads for 42 days during storage at room temperature: such as minimum weight loss, least occurrence of incidence and severity of defects, minimum change in total soluble solids (TSS), greatest firmness and maintain the pH level.

Keywords: lime, cellophane, incidence and severity

INTRODUCTION

Cabbage is an economically important plant and is cultivated throughout the world for oil and medicinal products and its importance as an economical and medicinal plant is becoming increasingly apparent (Fu C, Shi H, Li Q 2006).It is one of the most important vegetable crops of the world, being grown by market gardeners, general farmers in many regions of the world.(Salunkhe and Desai). It is grown for the early market should be harvested as soon as it attains sufficient size and quality (Thompson *et al*., 2002). Penetrate of microorganisms from the cut ends of fresh cabbage after harvest and during storage period. (Pantastico *et al*., 1975). Suitable amount of lime, wax have been used to control many diseases in postharvest losses of fruit and vegetable crops (D.K Salunkhe and B.B Desai).In this study, cabbage were harvested from the vermicompost or organic fields, then six treatments of cabbage were set up the postharvest experiment and determined by packaged with cellophane and lime for prolong their shelf-life. There are two points of objectives in this paper, the first is to investigate the effects of lime and cellophane on fresh harvested cabbage for prolong their shelf – life or marketable and the second is, to determine the quality of cabbage heads were harvested from organic fields (vermicompost) during the storage period .

MATERIALS AND METHODS

Time and place of study

The postharvest experiments of cabbage were carried out at vegetable science laboratory of the Vegetables and Fruits Research Development Centre (VFRDC) at Yemon, Hlegu Township, Yangon Region from December 2017 to February 2018.

Preparation of Materials

Commercially sale fresh green cabbage head with wrapper leaves (outer leaves) were harvested from the best result of organic (vermicompost) field. Fresh cabbage is characterized by full compact cluster, freshly, full firmness, uniform weigh and disease free outer leaves, Before starting the experiment, some selected fresh heads were removed all wrapper leaves for the studies of all treatments. Then 1g and

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2g of lime powder were cement on the end of cut stalk of cabbage heads for treatments T_3 ,T_5 and T_4 , T_6 (Except the T_1 (Control)T_2, T_3 and T_4 were packaged with cellophane plastic films were prepared for storage at the room temperature was 25.2 - 26˚C and relative humidity (RH) was 62 to 70%.

Data collection

Data were collected as weekly until the unacceptable occurrence of defects on (un marketable) cabbages. Cumulative weight loss, Total soluble solid (TSS), Total acidity (TA%), firmness, Incidence of defects, Severity of defects, pH Level, storage room temperature and relative humidity (RH) were determined in this study.

Method Used

1. Weight loss (%) $= \frac{W_0 - Wt}{W_0} \times 100$

Where, W_0 = initial weight

Wt = Weight at time t.

2. Incidence of defects (%)

$$\text{Incidence of defects} = \frac{\text{Total numbers of defected leaves}}{\text{Total numbers of leaves}} \times 100$$

3. Severity of defects (grade)

1-all leaves of head are white and fully turgid

2-10% of head browning or slightly wilting leaves

3- 20%of head browning or slightly decayed leaves

4 -30% of head browning or moderately decayed leaves (marketable)

5- 50% of head browning or severely decayed leaves (unmarketable)

4. Firmness

$$\text{Firmness} = \frac{\text{Force in Kg} + 1}{\text{Area in cm}^2} \times 100$$

$$\text{Area} = \pi \times d^2/4$$

5. pH meter, used in measuring pH.
6. TSS (Brix)

TSS (Brix) = refractometer reading x DF

$$\text{Dilution factor (DF)} = \frac{\text{V } H_2O \text{ in ml}}{\text{Weight of sample}} + 1$$

7. $$\text{TA (\%)} = \frac{VN \times \text{Measuring weight predominant}}{\text{Weight of equivalent aliquot (g)}} \times 100$$

$$\text{Wt - of equivalent aliquot (g)} = \frac{\text{Wt in sample in (g)}}{\text{Juice volume + distilled water}} \times \text{v ol of aliquot}$$

Experimental Design and Loyout

The experiment was conducted on different sized of cabbage heads using CRD (Completely Randomized Design). Treatments were as follow; T_1- control, T_2-cellophane,T_3- cellophane+1 g lime, T_4- cellophane+2 g lime, T_5- 1 g lime and T_6-2 g lime.

Statistical Analysis

The results were analyzed using IRRISTAT Program .Total of a treatments for the study were carried out by using CRD (Completely Randomized Design) .Each treatment consisted of 5 replicates. All treatments means were compared using LSD (Least Significant Different) at 5% level of significance.

RESULTS

Weight Loss (g/head)

Table (1) Mean values of weight loss(g/head) of cabbage during storage period.

Treatment	Weight Loss (g/head)						
	Storage Period (Days)						
	1	7	14	21	28	35	42
T_1- control	1223.0	963.2	734.9	665.7	-	-	-
T_2- cellophane	1055.3	1016.7	940.5	906.5	892.5	878.8	863.4
T_3- cellophane+1 g lime	1108.3	1071.9	1036.6	1020.0	986.7	976.7	966.7
T_4- cellophane+2 g lime	1098.3	1063.7	1006.0	995.7	962.7	895.5	865.0
T_5- 1 g lime	1295.7	1003.3	810.0	767.3	-	-	-
T_6- 2 g lime	1053.3	869.3	608.0	565.3	-	-	-
Differences in LSD at 5%	71.4	104.4	109.53	188.64	137.4	130.9	108.71
CV%	3.6*	5.9*	6.9*	9.7ns	16.9ns	17.0ns	18ns

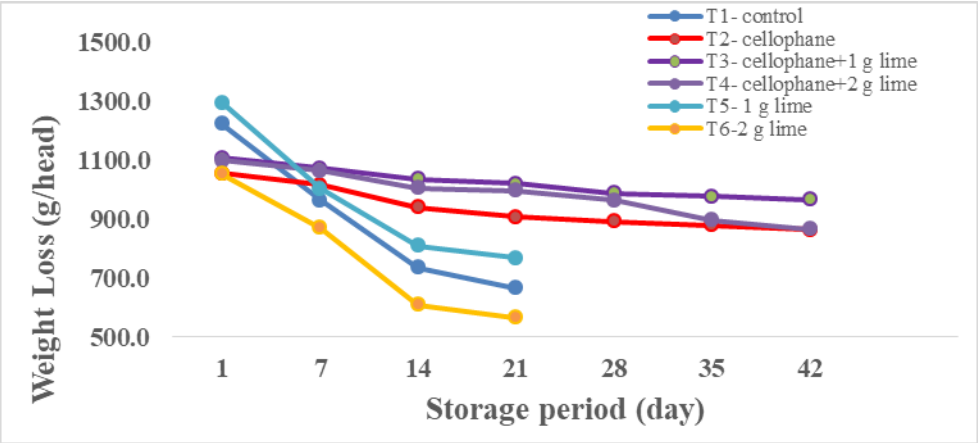

Figure (1) Weight loss of fresh cabbage heads during storage period.

Incidence of defects (%)

Table (2) Mean values of incidence of defects (%) of cabbage during storage period

Treatment	Incidence of defects (%)						
	Storage Period (Days)						
	1	7	14	21	28	35	42
T_1- control	0.00	11.90	13.00	10.40	-	-	-
T_2- cellophane	0.00	10.66	6.90	2.02	2.19	4.70	4.90
T_3- cellophane+1 g lime	0.00	2.35	2.26	1.44	1.14	1.48	1.71
T_4- cellophane+2 g lime	0.00	8.10	3.21	1.23	3.53	1.63	1.44
T_5- 1 g lime	0.00	10.20	5.34	10.12	-	-	-
T_6- 2 g lime	0.00	10.51	8.23	12.70	-	-	-

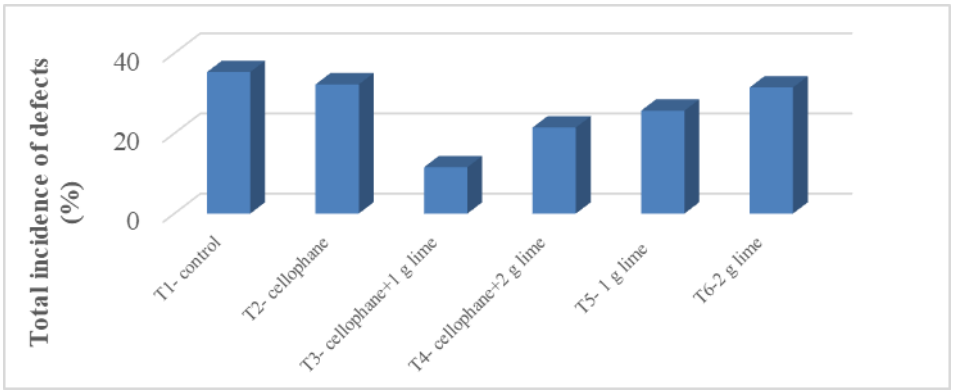

Figure (2) Total incidence of defects (%) of fresh cabbage heads during storage period

Severity of defects (grade)

Table (3) Mean values of severity of defects (grade) of cabbage during storage period

Treatment	Severity of defects(grade)						
	Storage Period (Days)						
	1	7	14	21	28	35	42
T_1- control	1.00	3.00	4.00	5.00	-	-	-
T_2- cellophane	1.00	1.35	1.45	1.50	1.55	1.70	1.90
T_3- cellophane+1 g lime	1.00	1.25	1.40	1.45	1.55	1.60	1.65
T_4- cellophane+2 g lime	1.00	1.35	1.45	1.50	1.55	1.65	1.85
T_5- 1 g lime	1.00	2.00	3.50	4.00	-	-	-
T_6- 2 g lime	1.00	2.50	3.50	4.50	-	-	-

Total Soluble solids (˚Brix)

Table (4) Mean values of total soluble solid (˚Brix) of cabbage during storage period

Treatment	Total Soluble Solid (˚Brix)						
	Storage Period (Days)						
	1	7	14	21	28	35	42
T_1- control	7.55	7.85	7.90	8.05	-	-	-
T_2- cellophane	7.25	7.45	7.60	7.65	7.70	7.85	7.95
T_3- cellophane+1 g lime	7.60	7.60	7.75	7.75	7.80	7.85	7.85
T_4- cellophane+2 g lime	7.55	7.60	7.70	7.75	7.75	7.80	8.00
T_5- 1 g lime	7.45	7.65	7.70	7.90	-	-	-
T_6- 2 g lime	7.55	7.75	7.95	8.00	-	-	-
Differences In LSD at 5%	0.49	0.52	0.68	0.44	0.9	0.65	1.84
CV%	6.6*	5.5*	6.0*	3.1*	4.1*	6.5ns	6.7ns

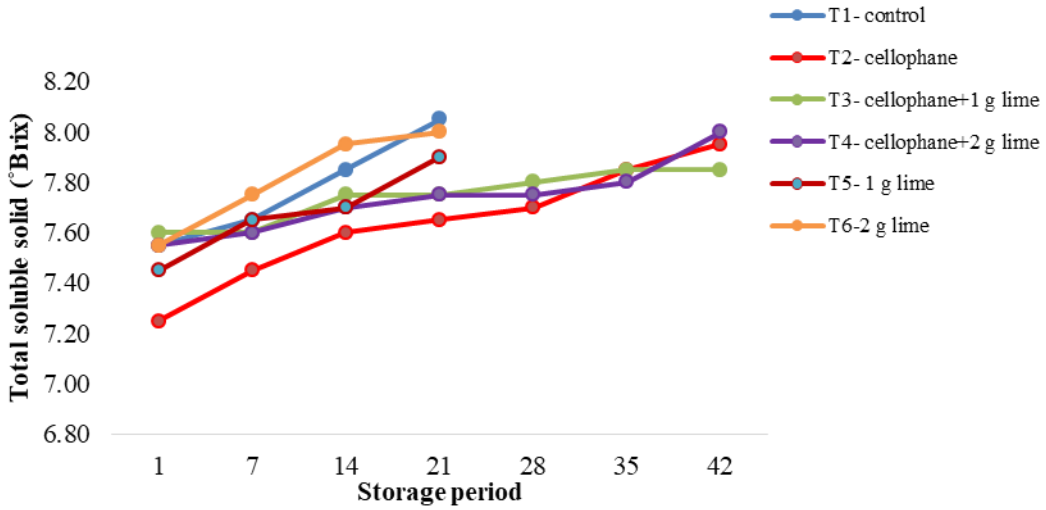

Figure (3) Total soluble solid of fresh cabbage heads during storage period

Total Acidity (%)

Table (5) Mean values of total acidity (%) of cabbage during storage period

Treatment	Total Acidity (%)						
	Storage Period (Days)						
	1	7	14	21	28	35	42
T_1- control	7.65	7.45	7.35	6.95	-	-	-
T_2- cellophane	7.80	7.65	7.50	7.50	7.45	7.45	7.35
T_3- cellophane+1 g lime	7.70	7.50	7.50	7.50	7.40	7.40	7.30
T_4- cellophane+2 g lime	7.75	7.65	7.50	7.45	7.45	7.35	7.25
T_5- 1 g lime	7.75	7.45	7.15	7.05	-	-	-
T_6- 2 g lime	7.70	7.50	7.35	7.00	-	-	-
Differences In LSD at 5%	0.18	0.19	0.28	0.44	1.08	1.27	1.19
CV%	14.6ns	9.1ns	9.4ns	10.5ns	14.1ns	15.5ns	14.0ns

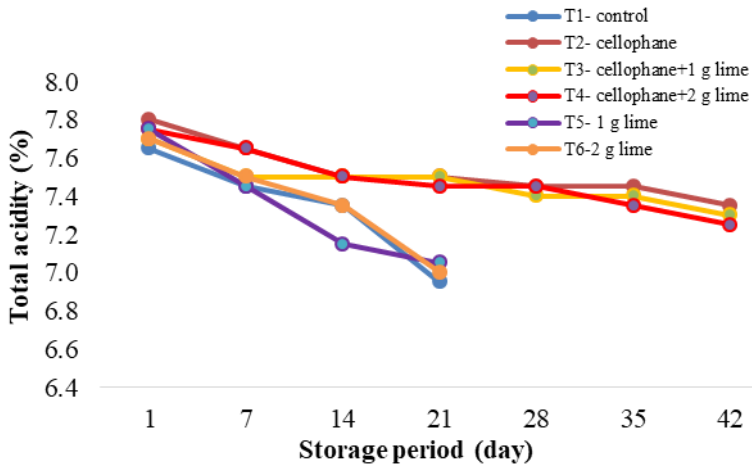

Figure (4) Total acitidy (%)of fresh cabbage heads during storage period.

Firmness (kg/cm^2)

Table (6) Mean values of firmness (kg/cm^2) of cabbage during storage period

Treatment	Firmness (kg/cm^2)						
	Storage Period (Days)						
	1	7	14	21	28	35	42
T_1- control	3.80	3.68	3.60	3.50	-	-	-
T_2- cellophane	3.67	3.67	3.60	3.60	3.45	3.45	3.45
T_3- cellophane+1 g lime	3.75	3.75	3.70	3.55	3.45	3.45	3.40
T_4- cellophane+2 g lime	3.68	3.68	3.64	3.60	3.55	3.50	3.50
T_5- 1 g lime	3.75	3.65	3.58	3.55	-	-	-
T_6- 2 g lime	3.76	3.68	3.50	3.45	-	-	-
Differences In LSD at 5% CV%	0.57 * 9.2	0.60 * 9.0	0.88 ns 11.6	1.03 ns 10.4	2.17 ns 13.1	1.74 ns 10.1	1.46 ns 8.3

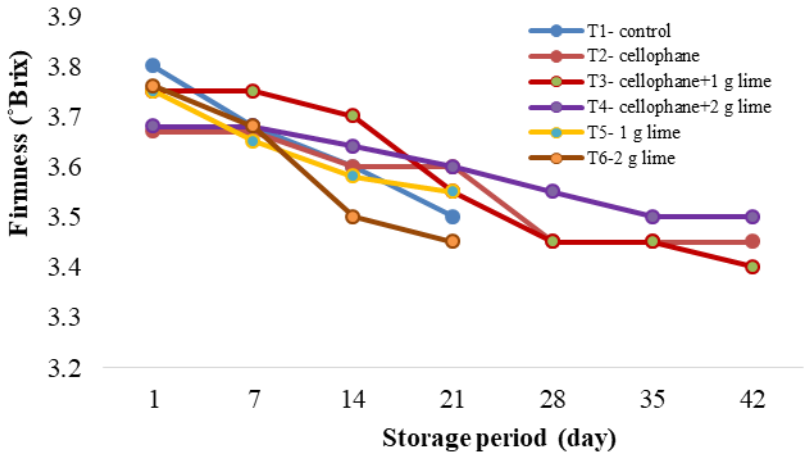

Figure (5) Firmness of fresh cabbage heads during storage period.

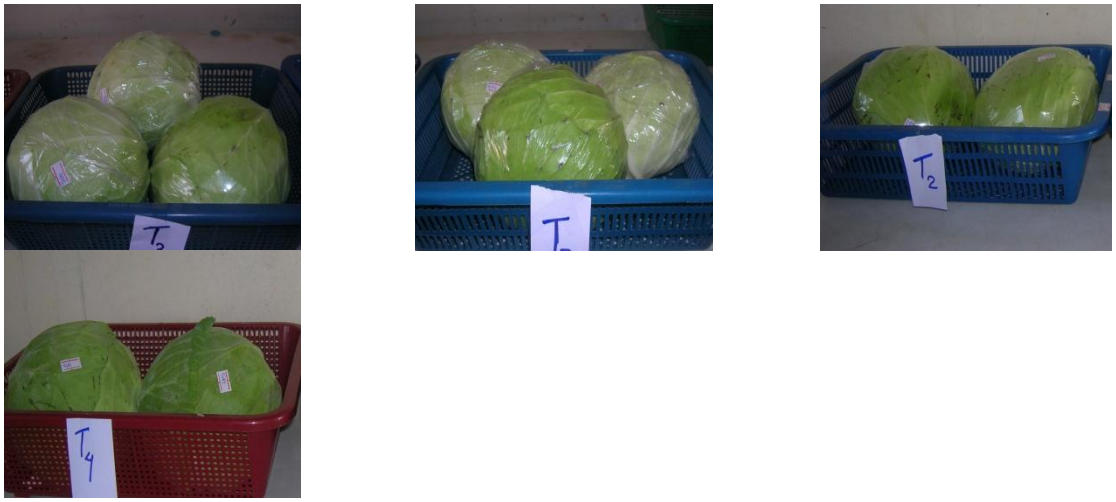

Figure (6) The fresh cabbage at Final day (42 days)

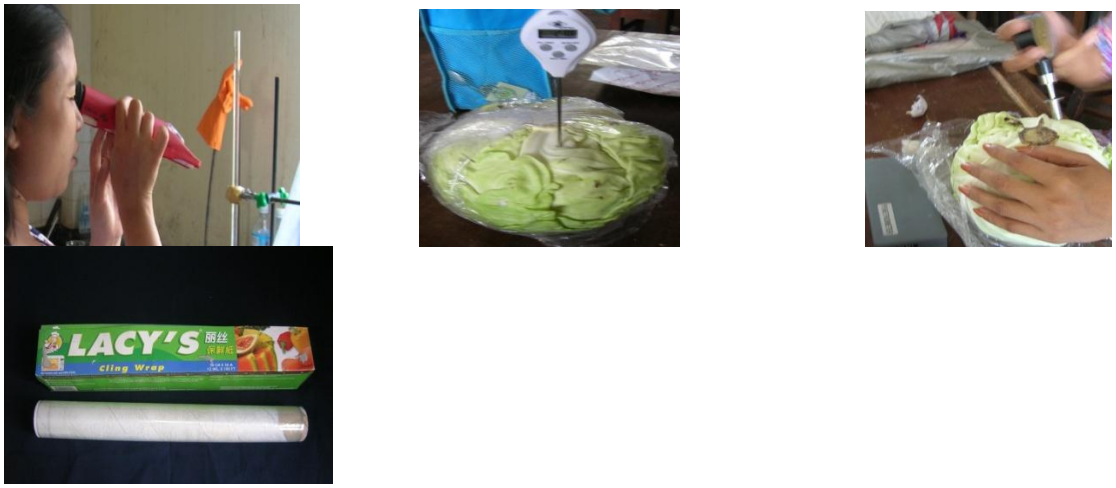

Figure (7) Data Collection

DISCUSSION AND CONCLUSION

Among all treatments, cellophane packaged treatments showed more durable of their storage life (42 days) than the other treatments. Correct packaging effectively controls losses of vegetables from the moisture, temperature and microorganisms, But packaging materials such as thick plastic that was high temperatures accelerate microbial growth and degradation of many nutrients (B.D Ezell and Wilcox). Only lime cement treatments (T_5 and T_6) showed equal shelf-life with control (T_1), cellophane plus lime cement (T_3 and T_4) best prolong their shelf-life and follow the good in only the cellophane package treatment (T_2). In lime cement treatments of cabbage stalks were not obtained both infections and soft rot of diseases. Chemicals (such as, lime, wax) have been used to control many diseases and losses of fruit and vegetable crops (D.K Salunkhe and B.B Desai). The results showed that weight loss can signification control in all cellophane treated with 1 g Lime of green cabbage heads for 42 days(6 Weeks)of storage period at ambient temperature because of the lowest percentage in cumulative weight loss, 12.93% were attained. However in all treatments, the contents of total soluble solid (TSS) increased and total acidity (TA) percentage decreased. The value firmness and pH level not change in all treatments.

In conclusion, that the proper way of Modified Atmosphere (MA) and cement with lime is better to control post-harvest soft rot and weight than untreated cabbage heads (control) during storage period. In fact, cellophane treated with lime powder attained the best result to control the weight loss, long storage life and control the quality of cabbage.

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