

Effect of Thin Paper Polythene Wrapping and Chlorine Water Treatments in Post-harvest Life of Cucumber at Gandaki Province, Nepal

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Abstract

Qualitative and quantitative loss of cucumber at storage is a matter of great economic concern in Nepalese farmer condition. The experiments were conducted to find out the best method and available materials of storage at room condition to minimize the post-harvest loss of cucumber at Gandaki Province of Baradi, Tanahu from 27th April to 3rd September; Hemja, Kaski from 10th June to 25th June and 27th June to 11th July and at DoAR, Lumle from 20th August to 03rd September 2021. There were 10 treatments in RCBD with three replications. Every treatment had 5 no. of cucumber. Average length of one cucumber had 20-25 cm. The treatments were: Thin plastic packaging with no holes; with 4 punch holes; with 8 punch holes; cling wrap; Plastic crate only and treated water with 50 ppm chlorine, washed all cucumbers and arranged treatment 1 to 5 simultaneously. The treated cucumbers stored in normal room condition at, Baradi, Tanahu 25.90C average temp. and 62% RH; Hemja, Kaski was 25.00C average temp. and RH 84.5% and DoAR, Lumle was 21.90C and 82% RH during the trial period. The results revealed that the treatment cling wrap with or without 50 ppm chlorine water was appropriate to extend post-harvest shelf life of cucumber under ambient room temperatures of all tested sites. Therefore, the use of cling wrap should be recommended for wide dissemination in similar conditions.

Keywords: Cling wrap, chlorine water, 50 ppm, post-harvest loss, storage

Introduction

A considerable proportion of post-harvest loss of cucumber is a matter of great economic concern in Nepalese agriculture. It becomes the most preferred and cash-generating vegetables throughout the year. Some commercial farmers near the roads and markets started for the growing of this crop to get remunerative price (MoALD, 2019). Post-harvest loss could be rightly stated as the qualitative and quantitative loss of horticultural produce at any moment

along the post-harvest chain which includes the change in the edibility and wholesomeness i.e. quality of the produce finally preventing its consumption (Adeoye, 2009; Buyukbay et. al., 2010). Between the harvest location and the retail market, produce undergoes storage under various environmental conditions. Turan (2008) reported that improper harvesting practices and improper post-harvest practices result in loss due to spoilage of produce before reaching the market along with loss in quality of the product

Such as, deterioration in appearance, taste and nutritional value. Vegetables have diverse adaptive mechanisms to control moisture loss (Cameron, et.al., 2006). Cuticular wax is a major barrier restricting moisture transfer. It has been reported that a high content of the cuticles was correlated with moisture retention capacity of plant tissue (Mamrutha, et.al. 2010). Immature fruits typically have a relatively thin cuticle and the cuticle is often at least partially removed during washing.

The high moisture content in vegetables like cucumber makes them highly susceptible to being spoiled by microorganisms (Erukainure et. al., 2010) at normal temperature, even when appropriately packaged. Moreover, physiochemical changes affect the safety and quality. All of these offensive changes may be prevented by application of sealed plastic films, application of chlorine water maintain the nutrition value of cucumber, extend its lifetime, and keep in safe.

The weight loss, firmness, TSS, pH and cucumber fruit color were all highly affected by the packaging materials. As a feature of proper packaging in a sealed package, a fresh product will create a modified atmosphere by respiration and gas permeation through the packaging material. Packaging has been reported to significantly reduce fruit weight loss and that cucumbers sealed in plastic films have an extended marketable life.

Materials and Methods

Four different experiments were conducted at three different locations i.e. NARC Technical Village, Baradi, Tanahu; two trials on OR site Hemja Kaski and DoAR, Lumle Kaski to study the post-harvest life of cucumber from 27th April 2021 to 3rd September 2021. Fresh immature cucumber which had 20-25 cm length (i.e. marketable size) was selected for the treatments. Every treatment has 5 no. of cucumber. The harvested cucumbers after treatments were put in the same place of ordinary room temperature. The treatments details were as follows

Treatment 1 (T1) = Thin plastic packaging with no holes.

Treatment 2 (T2) = Thin plastic packaging with 4 punch holes.

Treatment 3 (T3) = Thin plastic packaging with 8 punch holes.

Treatment 4 (T4) = wrap with Cling wrap

Treatment 5 (T5) = Put in plastic crate only

Treatment 6 (T6) = Washing with 50 ppm chlorine water + Thin plastic packaging with no holes.

Treatment 7 (T7) = Washing with 50 ppm chlorine water + Thin plastic packaging with 4 punch holes.

Treatment 8 (T8) = Washing with 50 ppm chlorine water + Thin plastic packaging with 8 punch holes.

Treatment 9 (T9) = Washing with 50 ppm chlorine water + wrap with Cling wrap

Treatment 10 (T10) = Washing with 50 ppm chlorine water + Put in plastic crate

Treatment allocation The treatments (thin paper polythene wrapping and washing with 50 ppm chlorine water) were imposed to the harvested cucumbers randomly (Gomez and Gomez, 1984).

Observations

In all three locations, the observations were recorded within the following parameters.

Weight after wrapping (kg.)

Fruit length (cm)

Fruit Diameter (mm)

Weight of fruit at 2nd day, 4th day, 6th day, 8th day, 10th day, 12th day & 14th day.

Total soluble solid

Titrateable acidity

In the trial of Hemja, Kaski from 27th June to 11th July 2021 after 14th day of weight observation, the fruits were collected to post

harvest laboratory. TSS & TA was analyzed and finally sensory evaluation was done among 14 respondents within the following parameters ('0' for lowest and '10' for highest marking unit).

- (1) Color of the fruit
- (2) Taste of the fruit
- (3) Freshness of the fruit
- (4) Smell of the fruit
- (5) Juiciness of the fruit
- (6) Off-taste (if any) of the sample of the fruit
- (7) Overall quality of the fruit.

Result

It was evident from the data of table No.1 that the treatments had significant impact on the tenth days of storage at Baradi, Tanahu. It was noticed that significant weight was obtained from the treatment of 50 ppm chlorine water and thin plastic packaging with 4 punch holes. It was followed by 50 ppm chlorine water and thin plastic packaging with 8 punch holes. In contrast, the lowest weight (2.377 kg) was recorded from thin plastic packaging with 4 punch holes without chlorine water treatment. In this experiment, treatment of 50 ppm chlorine water and thin plastic packaging with 4 punch holes was found to be superior to all the tested treatments.

Table 1: Weight of cucumber fruit as influenced by different treatments at Baradi, Tanahu.

Treatment	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day	14 th day
Thin plastic packaging with no holes	3.063	3.062	3.058	3.055	2.935bc	1.527	1.525
Thin plastic packaging with 4 punch holes	2.632	2.63	2.627	2.625	2.377e	1.343	1.343
Thin plastic packaging with 8 punch holes	2.565	2.562	2.557	2.557	2.618cde	2.615	2.612
Cling wrap	2.948	2.943	2.943	2.938	2.723bcde	2.25	2.25
Plastic crate only	2.665	2.615	2.583	2.555	2.545de	1.815	1.805
Chlorine water+ Thin plastic packaging with no holes	2.833	2.833	2.832	2.827	2.862bcd	2.86	2.86
Chlorine water+ Thin plastic packaging with 4 punch holes	3.278	3.273	3.272	3.267	3.52a	1.62	1.62
Chlorine water+ Thin plastic packaging with 8 punch holes	3.27	3.265	3.262	3.258	3.072b	3.07	3.065
Treat with chlorine water and wrap with cling-wrap	3.127	3.12	3.117	3.112	2.993bc	2.217	2.215
Treat with chlorine water and put in plastic crate	2.863	2.808	2.77	2.727	2.873bcd	2.728	2.697
Mean	2.925	2.911	2.902	2.892	2.852	2.205	2.199
CV (%)	11.7	11.7	11.7	11.8	7	39.2	39.2
P-Value	0.155	0.132	0.113	0.101	<.001	0.221	0.224
LSD (0.05)	0.5843	0.5821	0.5799	0.5799	0.3376	1.4703	1.4686

It was evident from the data of table no. 2 that the treatments had significant impact on the 14th days of storage at Hemja, Kaski. It was noticed that significant weight was obtained from the treatment with chlorine water and put in plastic crate. It was followed by Treat with chlorine water and wrap with cling-wrap. In contrast,

the lowest weight (0.4 kg) was recorded from thin plastic packaging with no punch holes with chlorine water treatment. In this experiment, treatment of 50 ppm chlorine water and put in plastic crate was found to be superior to all the tested treatments.

Table 2: Fruit weight of cucumber as influenced by different treatments at Hemja, Kaski.

Treatment	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day	14 th day
Thin plastic packaging with no holes	2.48	2.48	2.48	2.47	2.45	1.49	1.1bc
Thin plastic packaging with 4 punch holes	3.19	3.19	3.18	3.18	3.17	3.17	3.17a
Thin plastic packaging with 8 punch holes	2.96	2.96	2.96	2.96	2.96	2.95	2.95a
Cling wrap	2.98	2.98	2.98	2.97	2.97	2.97	2.91a
Plastic crate only	2.67	2.59	2.38	2.36	2.34	2.29	2.3ab
Chlorine water+ Thin plastic packaging with no holes	2.62	2.62	2.62	2.62	2.62	2.12	0.4c
Chlorine water+ Thin plastic packaging with 4 punch holes	2.87	2.87	2.87	2.87	2.87	2.87	2.86a
Chlorine water+ Thin plastic packaging with 8 punch holes	3.58	3.58	3.57	3.57	3.54	3.56	3.27a
Treat with chlorine water and wrap with cling-wrap	3.09	3.09	3.09	3.09	3.09	3.09	3.08a
Treat with chlorine water and put in plastic crate	3.54	3.52	2.31	3.46	3.45	3.32	3.38a
Mean	3	2.99	2.84	2.95	2.95	2.78	2.54
CV (%)	25.1	25.1	34.6	25.5	25.5	31	30.8
P-Value	0.692	0.672	0.866	0.601	0.598	0.181	0.001
LSD (0.05)	1.284	1.279	1.678	1.284	1.28	1.468	1.332

Note: 14th day data is transferred by square root transformation

Table 3: Effect on TSS & TA by polythene wrapping and chlorine water treatment of cucumber after 14 days of storage at Hemja, Kaski (25.00C, 84.5% RH).

Treatments	TSS	TA
Thin plastic packaging with no holes	2.027	0.20
Thin plastic packaging with 4 punch holes	2.01	0.16
Thin plastic packaging with 8 punch holes	2.4	0.04
Cling wrap	2.52	0.03

Treatments	TSS	TA
Plastic crate only	2.23	0.03
Chlorine water+ Thin plastic packaging with no holes	0	0
Chlorine water+ Thin plastic packaging with 4 punch holes	2.36	0.03
Chlorine water+ Thin plastic packaging with 8 punch holes	1.72	0.03
Treat with chlorine water and wrap with cling-wrap	2.16	0.03
Treat with chlorine water and put in plastic crate	2.15	0.03

It was evident from the data of table No. 4 that the treatments had significant impact on 12th and 14th days of storage at Hemja, Kaski. It was noticed that significant weight was obtained from the treatment with cling wrap at both data recording date. It was followed by Treat with chlorine water and wrap with thin plastic packaging with no holes at 12th days of data

recording. But at 14th days of data recording, this no holes treatment heavy loss of cucumber due to decay and cling wrap becomes superior to all the treatment. In this experiment, treatment of cling wrap becomes superior with and without 50 ppm chlorine water among all the tested treatments.

Table 4: Weight of fruit of cucumber as influenced by different treatments at Hemja, Kaski.

Treatment	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day	14 th day
Thin plastic packaging with no holes	2.48	2.48	2.48	2.43	2.06	0.601b	0.224c
Thin plastic packaging with 4 punch holes	2.78	2.78	2.78	2.78	2.78	1.672a	1.683ab
Thin plastic packaging with 8 punch holes	2.83	2.77	2.76	2.76	2.76	1.674a	1.672ab
Cling wrap	3.73	3.74	3.7	3.73	3.73	1.935a	1.934a
Plastic crate only	2.78	2.76	2.73	2.7	2.67	1.631a	1.617ab
Chlorine water+ Thin plastic packaging with no holes	3.3	3.31	3.3	3.3	3.29	1.788a	1.145b
Chlorine water+ Thin plastic packaging with 4 punch holes	2.97	2.91	2.91	2.91	2.91	1.704a	1.703ab
Chlorine water+ Thin plastic packaging with 8 punch holes	2.82	2.82	2.82	2.81	2.62	1.560a	1.492ab
Treat with chlorine water and wrap with cling-wrap	2.93	2.93	2.93	2.92	2.92	1.710a	1.709ab
Treat with chlorine water and put in plastic crate	2.93	2.91	2.89	2.86	2.83	1.689a	1.682ab
Mean	2.96	2.94	2.93	2.92	2.86	1.5965	1.486
CV (%)	27.6	27.7	27.8	27.7	28.9	19.5	25.6
P-Value	0.838	0.823	0.839	0.79	0.595	0.004	0.001
LSD (0.05)	1.388	1.385	1.386	1.377	1.406	0.53108	0.6478

Note: 12th and 14th day data are transferred by square root transformation method

Table 5: Effect on TSS & TA by polythene wrapping and chlorine water treatment of cucumber after 14 days of storage at Hemja, Kaski (25.00C, 84.5% RH).

Treatments	TSS	TA
Thin plastic packaging with no holes	2.060	0.035
Thin plastic packaging with 4 punch holes	2.160	0.037
Thin plastic packaging with 8 punch holes	2.156	0.038
Cling wrap	2.333	0.033
Plastic crate only	2.107	0.036
Chlorine water+ Thin plastic packaging with no holes	2.320	0.030
Chlorine water+ Thin plastic packaging with 4 punch holes	2.147	0.028
Chlorine water+ Thin plastic packaging with 8 punch holes	2.140	0.028
Treat with chlorine water and wrap with cling-wrap	2.253	0.029
Treat with chlorine water and put in plastic crate	2.800	0.032

Sensory characteristics of cucumber post-harvest trial at DoAR, Lumle, Kaski.

The fruits for sensory evaluation were collected after 14 days of storage at ordinary room temperature (24.60C, 82.2% RH). That was treated with ten different wrapping method of thin plastic and 50 ppm chlorine water. Fruit length was 25-30 cm and the piece of fruit to taste the panelist was approximately 50

gm in weight. Fourteen panelists, trained in techniques of sensory evaluation, estimated the samples of cucumber fruits in three replications. The following attributes were evaluated: colour, Freshness, Taste, Smell, Juiciness, Off-test and the overall quality. Each panelist marked his subjective evaluation of the investigated sample converted to numerical values in the stipulated units from 0 to 10. The obtained results depicted in Table No. 6.

Table 6: Sensory characteristics of cucumber judged by 14 panelists at DoAR, Lumle, Kaski.

Treatments	color	Taste	Freshness	Smell	Juiciness	Off-Taste	Overall quality
Thin plastic packaging with no holes	4.50	5.04	4.96	5.39	6.04	4.39	5.79
Thin plastic packaging with 4 punch holes	4.86	4.79	5.00	5.33	6.07	4.19	5.76
Thin plastic packaging with 8 punch holes	5.07	5.50	5.39	5.86	6.43	4.14	5.93
Cling wrap	4.33	4.67	4.60	4.69	5.55	4.62	5.62
Plastic crate only	3.21	3.56	3.63	3.81	4.28	4.53	4.12
Chlorine water+ Thin plastic packaging with no holes	4.86	5.17	5.26	5.33	5.98	4.26	5.69
Chlorine water+ Thin plastic packaging with 4 punch holes	5.61	4.89	5.21	5.25	6.07	4.43	5.89

Treatments	color	Taste	Freshness	Smell	Juiciness	Off-Taste	Overall quality
Chlorine water+ Thin plastic packaging with 8 punch holes	5.45	4.60	5.21	4.90	5.86	4.14	5.52
Treat with chlorine water and wrap with cling-wrap	4.61	4.75	4.32	5.21	5.39	3.96	5.25
Treat with chlorine water and put in plastic crate	4.50	5.04	4.96	5.39	6.04	4.39	5.79

It was evident from the data of table No. 4 that the treatments had significant impact on 14th days of storage at DoAR, Lumle. It was noticed that significant weight was obtained from the treatment with cling wrap at the data recording date. It was followed by Treat with chlorine water and wrap with thin plastic packaging with no

holes at 12th days of data recording. But at 14th days of data recording, this no holes treatment heavy loss of cucumber due to decay and cling wrap becomes superior to all the treatment. In this experiment, treatment of cling wrap becomes superior with and without 50 ppm chlorine water among all the tested treatments.

Table 7: Fruit weight of cucumber as influenced by different treatments at DoAR, Lumle.

Treatment	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day	14 th day
Thin plastic packaging with no holes	3.86	3.84	3.89	3.83	3.64	2.81	0.23b
Thin plastic packaging with 4 punch holes	3.95	3.95	3.77	3.73	3.74	3.53	3.29a
Thin plastic packaging with 8 punch holes	4.57	4.62	4.66	4.63	4.63	4.41	4.6a
Cling wrap	5.56	5.56	5.59	5.55	5.13	5.09	4.9a
Plastic crate only	3.77	3.74	3.75	3.71	3.62	3.44	3.27a
Chlorine water+ Thin plastic packaging with no holes	5.6	5.39	5.02	4.37	2.91	2.33	0.32b
Chlorine water+ Thin plastic packaging with 4 punch holes	5.51	5.5	5.54	5.52	5.45	3.88	3.15a
Chlorine water+ Thin plastic packaging with 8 punch holes	5.06	4.99	5.03	4.98	5.01	4.38	4.35a
Treat with chlorine water and wrap with cling-wrap	5.02	5.01	5.05	4.68	4.37	4.67	4.65a
Treat with chlorine water and put in plastic crate	4.29	4.25	4.27	4.21	4.22	4.16	4.14a
Mean	4.72	4.69	4.66	4.52	4.27	3.87	3.29
CV(%)	23	22.2	22.3	23.2	31.2	37.3	43.6
P-value	0.277	0.265	0.266	0.311	0.413	0.441	0.003
LSD	1.845	1.775	1.772	1.787	2.272	2.46	2.444

Table 8: Effect on TSS & TA by polythene wrapping and chlorine water treatment of cucumber after 14 days of storage at DoAR, Lumle (21.90C, 82% RH).

Treatments	TSS	TA
Thin plastic packaging with no holes	2.000	0.040
Thin plastic packaging with 4 punch holes	1.815	0.027
Thin plastic packaging with 8 punch holes	1.680	0.029
Cling wrap	1.708	0.026
Plastic crate only	1.553	0.029
Chlorine water+ Thin plastic packaging with no holes	1.400	0.027
Chlorine water+ Thin plastic packaging with 4 punch holes	1.750	0.024
Chlorine water+ Thin plastic packaging with 8 punch holes	1.292	0.027
Treat with chlorine water and wrap with cling-wrap	2.012	0.030
Treat with chlorine water and put in plastic crate	1.813	0.032

Discussion

In all three locations & four different trials, Thin plastic packaging with no holes, with 4 punch holes, with 8 punch holes & wrap with cling wrap. Other treatments were put in plastic crate only, washing of the fruit with 50 ppm chlorine water and wrap with thin plastic with no holes, with 4 punch holes, with 8 punch holes, washing & wrap with cling wrap & finally washing & put in plastic crate.

CaCl₂ dipped cucumber fruits were very firm. This could have been due to the calcium chloride which strengthened the cell walls, cell structure and membrane system of fruits and thereby retaining fruit firmness. This result is in line with the work of Harker et al. (1997) who reported that, calcium chloride treatment of apple fruits increases cell morphology, turgor, structure, and middle lamella structure and membrane system resulting in firm fruits.

A particularly low decay incidence was recorded in fruits treated with CaCl₂. This may be due to the presence of calcium which is capable of strengthening the cell wall and also enhancing tissues to develop resistance to fungal infection. This is also in agreement with the findings of Conway et al. (1994) who reported that calcium enhanced tissues to develop resistance to fungal infection by stabilizing or strengthening cell wall by making them more resistant to harmful

enzymes produced by fungi which could cause decay.

The postharvest treatments effect on weight loss of cucumber fruits during storage was also significant. Tap water washed fruits suffered the highest weight loss as compared to hot water dip ones which recorded the lowest weight loss. Hot water dip probably inactivated enzymes responsible for tissue breakdown leading to weight loss, as reported by Fallik (2004). CaCl₂ dipped fruits also recorded low weight loss during storage, which was similar to the results of Schirra and D'hallewin (1997), Zuzunaga et al. (2004), who also reported that fruit dip in hot water or calcium chloride reduced weight loss. Suslow et al. (2002) reported that the quality of cucumber fruit is based on shape, firmness and colour as well as freedom from growth or handling defects and freedom from decay

Conclusion

DoAR Lumle is a prone station of post-harvest trials in different vegetable crops. There appear the various problems identified while cucumber production. Of the problems identified in Gandaki Province condition, considerable proportion of post-harvest loss of cucumber was a great matter of economic concern faced by farmers, researchers & scientists.

Based on the results of three places and four

times ordinary room condition experiment in Baradi Tanahu; Hemja Kaski & DoAR Lumle, the use of cling wrap should be recommended for wide dissemination in similar conditions.

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