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LIST OF ABBRIVIATIONS

µl	Microliter
ATM	Package atmosphere
B.O.P.P.	Bi-axial-oriented polypropylene
CAS	Controlled atmosphere storage
cc.	Cubic centimeter
CFU/g	Cell forming unit per gram sample (microbiological counts)
$cc/m^2/day$	The unit for measuring gas permeability of package film.
CO_2	Carbon dioxide
cv.	Cultivar
DAY	Storage time (days)
FAO	Food and Agriculture Organization
FILM	Package material
FTRI	Food Technology Research Institute
GC	Gas liquid chromatography
hr.	Hour
IU	International unit for vitamin A (retinol equivalents)
kg.	Kilogram
$KMnO_4$	Potassium Permanganate
LDPE	Low density polyethylene, a polymeric plastic material for packaging
m bar	A pressure unit
MAP	Modified atmosphere packaging.
µ	micron
Mil	1/100 of an inch
MP	Minimal (light) processing or minimally (or lightly) processed
MPV	Minimally, lightly processed, ready-to-use, or fresh cut vegetables
NaOCl	Sodium hypochlorite
N_2	Nitrogen
O_2	Oxygen
PE	Polyethylene, a polymeric plastic film used for making packaging bags
pH	Concentration of Hydrogen ion
PP	Polypropylene, a polymeric plastic film used for making packaging bags
ppm	Part per million
PVC	Polyvinyl chloride, a polymeric plastic film used for making over-wrap
r H	Relative humidity
RTU	Ready-to-use, fresh cut, lightly or minimally processed vegetables
TEMP	Storage temperature (°C)
THICK	Package thickness (µ)
TRT	Pre-packaging treatment
TSS	Total soluble solids
ul/ kg. hr	the unit for fresh produce ethylene production rates
USDA	United States Department of Agriculture.
UV	Ultraviolet light for sterilization
V. C	Vitamin C; ascorbic acid and dehydro ascorbic acid forms.

SUMMARY AND CONCLUSION

This work was carried to evaluate the effect of using prepackaging treatments, packaging material, thickness, and atmosphere and storage temperature on the quality attributes of some minimally processed vegetables. Four vegetables; okra, green peppers, green beans, and yellow carrots were selected and minimally processed, then pre-packaging treated by dipping in tape water (The control), ascorbic acid (0.2%), and potassium permanganate (0.2%) solutions for 3 min. Samples were left from solutions, let to drain, and air-dried gently using a fan.

Samples were packed in polypropylene (PP) or polyethylene (PE) of 22 μ or 34 μ thickness (100-125 g/bag). Bags containing the samples were sealed using a sealing machine capable for gas injection. Half of the samples were injected regular air before sealing, whereas the other half were injected a premixed gas mixture (N_2: O_2 : CO_2 of 90:5:5 ratio). Half of those packed under air or modified atmosphere (MAP) was stored at 5 °C and the other half was stored at 7 °C. On regular bases, samples were withdrawn and evaluated for their chemical, physical, microbial, and sensory attributes. The obtained results can be summarized in the following:

A. Physical and Chemical Evaluation

A.1. Physical Evaluation Of The Four MP Vegetables

A.1.1. Weight loss

The obtained results indicated that percentage of weight loss of okra pods during storage was significantly affected by storage time, packaging atmosphere (ATM), and packaging type. The effects of the other studied factors; storage temperature, package thickness, and pre-packaging treatment were not significant at $P \leq 0.05$. It should be noted that

the two-factor interactions (ATM x film type), and film type x thickness) were significant. These significant interactions indicate that the effect one the two factors depends on the levels or categories of the other factor and vise versa.
Weight loss was found to increase by increasing duration of storage. Okra pods treated with ascorbic acid and packed under modified atmosphere in PE of 22 μ thickness and stored at 5 °C for 11 days showed weight loss percentage of 3.09% followed by the control okra sample packed in PE bags of 34 μ under modified atmosphere at 7°C which showed weight loss of 2.61%. The next okra sample in weight loss was that pretreated with potassium permanganate and packed in PP of 22 μ under modified and stored at 7 °C.

Storage duration had a significant effect on minimally processed pepper samples. Also, the two-factor interactions; temp x ATM, film x TRT, film x thick, thick x TRT were significant. This indicated that the effects of these factors are interrelated. The largest weight loss (4.64%) was observed after 11 days of storage for potassium permanganate pretreated pepper samples packed in PP of 22 μ under modified atmosphere and stored at 7 °C. Also, the control pepper samples packed in PE of 34 μ and stored at 7 °C showed 4.52% weight loss after 11 days of storage.

Storage duration, storage temperature and prepackaging treatment had significant effect on weight loss percentage of MP green bean samples. Also, the two factor interactions; prepackage treatment x bag thickness, and film type x thickness showed significant effect on weight loss. The largest weight loss as associated with green bean sample pretreated with potassium permanganate and packed in PP of 34 μ thickness under atmospheric air and stored at 5°C, followed by that pretreated also with potassium permanganate packed in PE of 34 μ under air or of 22 μ under modified atmosphere and stored at 5 °C.

Carrot samples showed weight losses that were significantly affected by storage duration, storage temperature, and prepackaging treatments. The effect of storage temperature on weight loss of MP carrots was dependent on package material and thickness and the prepackage treatment as well. The later factor depended in its effect on package material and thickness as was shown by the results of the analysis of variance .The largest weight loss (2.70%) for carrot samples was associated with the control sample packed in PP of 34 μ and stored at 7°C regardless of the package atmosphere. This was followed by another sample of 2.37% weight loss which was pretreated with ascorbic acid and packed in PP of o34 μ under air and stored at 7μ on the 11th day of storage.

Weight loss is considered a quick simple good indicator that can reflect the quality attributes of packed vegetables. It is also economical in that it reflect the drop in the price of the vegetable where weight is of concern. For this study, only few samples whose weight loss percentage exceeded 2%.

A.1.2. Total soluble solids (TSS)

Storage temperature, storage duration had significant effects on TSS of MP vegetables. Package atmosphere has a significant effect on TSS of okra and pepper samples whereas the TSS of carrots was affected by the prepackage treatment. It was notice that the TSS of stored vegetables to decrease consistently with storage duration. In general, okra samples stored at 7 °C showed lower TSS values than those stored at 5 °C. Pepper samples stored at 5°C were discarded after the 11th day of storage because of their unacceptability for sensory attributes.

For green beans, a large number of samples showed lower TSS values at 5°C than their counterparts stored at 7°C. It was observed that the effect of storage temperature on TSS of carrot samples was dependent on package material and the prepackage treatment as well. Carrot sample packed in packages of 34 μ thickness maintained their original TSS more than did those packed in 22 μ packages.

A.1.3. Color values

A.1.3.1. "L" value

Bright clear, or white objects will have a value of 100 for '**L**' value, whereas the dark, dull, black object will show '**L**' value near zero. In this study, it was observed that **L** value for okra and pepper samples to be affected significantly by duration of storage and by storage duration and temperature for carrot samples. Green bean samples showed no significant effect of the studied factor on their **L** values.

The **L** value of okra samples increased as with increase duration of storage. This indicated that the color become lighter. The fact was confirmed also for green pepper and yellow carrots. However, for green beans there was no particular trend.

A.1.3.2. "a" value

Large positive **a** values indicate red color of the object, whereas large negative **a** values indicate green color of such object. The **a** values of okra samples increased with increasing duration of storage i.e. samples become more radish in color. This was also true for pepper sample, however, the potassium permanganate pretreated samples or storage at 5°C maintained more on the negative values of **a** i.e. on the green color more than did the other treatments or storage at 7°C .

With regard to the minimally processed carrots, the modified atmosphere as well as the potassium permanganate treatment increased the value of **a** i.e. samples became more red in color as well as the red color intensity increased with the increase in duration of storage. The was shown by the analysis of variance which indicated the significant effect of storage duration on **a** value of okra, pepper and carrot samples as well as prepackage treatment for pepper and storage temperature for the green beans, and package atmosphere for the carrot sample.

A.1.3.3. "b" value

The analysis of variance showed the significant effect of storage duration on b values of okra samples, and storage temperature on b values of pepper and green beans and storage period and package atmosphere on b value of studied samples. It was observed that all b values (large positive values) imply a yellow color and the degree of yellowness increases with increase duration of storage.

It can be mentioned that the deep green color of okra sample on the day of packaging turned lighter and more yellowish and radish with the 11th day of storage.

This can be explained by break down in chlorophyll pigments during storage. This fact was true for pepper, however, for the green bean, only few samples showed an increase in the red color during storage at 7°C. Carrots, on the other hand the yellow color increased with increasing duration of storage (b values become larger), whereas those carrot samples stored at 5°C showed increase in the intensity of the red color.

A.2. Chemical Evaluation Of The Four MP Vegetables

A.2.1. Vitamin C

The analysis of variance showed the significant effect of storage duration on the content of vitamin C of okra, pepper and green beans as well as the significant effect of storage temperature on vitamin C content of okra and pepper samples. In addition, the prepackage treatment had significant effect on vitamin C content of pepper samples. The effects of other studied factors on the content of vitamin C were not significant.

A.2.2. Total sugars

Total sugar content of okra and pepper samples were significantly affected by storage temperature, in addition to storage duration and packaging atmosphere in each of the green beans and carrots. The prepackage treatment had also significant effect on total sugar content of the green beans. The package type also had a significant effect on total sugar content of the yellow carrots during the refrigerated storage.

It was observed that the level of total sugar in okra was dependant on storage temperature and type of package and the type of prepackaging treatment. Okra samples pretreated with potassium permanganate showed less variation among samples with regard to total sugar content in comparison with the control and ascorbic acid pretreated samples.

A.2.3. Reducing sugars

The storage duration, storage temperature and package atmosphere showed significant effect on reducing sugar contents of the MP okra samples. The analysis of variance showed the significant effect of prepackage treatment and type of package material and storage duration on the level of reducing sugars in pepper.

The storage duration had a significant effect on reducing sugar content of green beans as well as the effect of packaging atmosphere, package type and storage temperature..

A.2.3. Non-reducing sugars

The storage duration, storage temperature and package atmosphere showed significant effect on non-reducing sugar contents of the MP okra samples. The analysis of variance showed the significant effect of prepackage treatment and type of package material and storage duration on the level of non-reducing sugars in pepper.

The storage duration had a significant effect on non-reducing sugar content of green beans as well as the effect of packaging atmosphere, package type and storage temperature..

B.Microbiological Evaluation of the four MP Vegetables

B.1. Total plate count

Package atmosphere had a significant effect on total plate count of okra samples during storage, and the effect of the two-factor interaction; (storage temperature x prepackaging treatment) was significant as was shown by the analysis of variance results. With regard to the MP green pepper, the effects of storage duration, package atmosphere, and (package atmosphere x prepackage treatment) were significant. With respect to MP green beans, storage duration and the two-factor interactions; (package atmosphere x temperature), (package atmosphere x package thickness), (package atmosphere x prepackage treatment), and (package type x prepackage treatment) showed significant effects on total count during storage.

Total count of MP carrot samples was significantly affected by storage duration, storage temperature, package atmosphere and the two-factor interactions between storage temperature, package atmosphere or prepackage treatments with either type or thickness of the package material.

B.2. Yeast and mold count

Yeast and mold counts of MP okra sample was significantly affected by storage duration, storage temperature, and package type and atmosphere. With regard to MP green pepper, the total count of sample was significantly affected by storage duration, package atmosphere, package type. Total count of the MP green beans was significantly affected by storage duration, package type and the prepackaging treatment. Also, package atmosphere and the two-factor interactions; (temperature x atmosphere), (package type x atmosphere) had significant effects on total count of MP carrot samples during the refrigerated storage.

B.3. Anaerobic bacterial count

The anaerobic bacterial counts of MP vegetables under investigation showed less variation among samples in comparison with that observed for total bacterial counts or for yeast and mold counts. This was indicated by the analysis of variance which insignificant effect of most studied factors on the anaerobic bacterial count.

For okra samples, the prepackage treatment significantly affected the anaerobic bacterial count. The analysis of variance also showed that the effect of prepackage treatment is dependant on package atmosphere and package thickness.

With respect to MP green pepper, the significant effect of storage duration on anaerobic bacterial count was accompanied by the significant two-factor interaction between storage temperature and the prepackaging treatments.

Anaerobic bacterial count of MP green beans was significantly affected by storage duration. In addition, the significant effect of prepackaging treatment depended on package atmosphere as well as package material. With respect to MP carrots, storage duration along with package atmosphere had significant effect on carrot anaerobic bacterial count.

C. Sensory Evaluation Of The Four MP Vegetables

C.1. Color

Panelists' scores for color attribute of okra samples were not significantly affected by storage temperature at any of the three evaluation days (3d, 8^{th}, and 11 days of storage). The highest scores for color attribute of okra samples was reported for those okra samples packed in PP package.

The effect of storage temperature on color of MP green pepper was significant; the 7°C stored samples had higher scores for color On the 8^{th} day of storage than those stored at 5 °C. No significant difference in color scores of samples at the two storage temperatures was detected on the 3d, and 11^{th} days of storage of MP pepper. Similar to what was found for MP okra, pepper samples packed in PP received better scores for color than those packed in PE. These differences were found significant only on the 8^{th} and 11 days of storage.

MP green beans packed under modified atmosphere received lower scores for color attribute than those packed under atmospheric air. These differences were significant only on the 8^{th} and 11^{th} days of storage. On the 3d and 11^{th} days of storage, MP green beans packed in PP film received higher score for color than did those packed in PE film.

The effect of packed atmosphere on panelists' score of color of MP carrots was similar to that found for green beans. MP carrots packed under modified atmosphere received lower scores for color on the 8^{th} and 11^{th} days of storage than those packed under atmospheric air. MP carrots stored at 5°C received better scores for color than those stored at 7°C.

C.2. Texture

Prepackaging treatment, storage temperature, and package type and thickness had no significant effect on texture of MP okra samples during the refrigerated storage. Okra samples packed under modified atmosphere, however, received higher score for texture attribute than those packed under atmospheric air.

Texture of MP pepper samples stored at 7°C received significantly better scores on the 8^{th} and 11^{th} days of storage than those stored at 5°C. Panelists' scores for texture of MP green bean samples was affected by packaging atmosphere differently according to the period of evaluation. On the 3d day of storage, samples packed under modified atmosphere received better scores than did those packed under air. On the 11^{th} day of storage this trend for scores of texture of green beans was reversed. On the 11^{th} day of storage, panelists' scores for texture of green beans was higher for samples packed in 34 μ bags than those of samples packed in 22 μ bags, and the scores given to samples stored at 5°C were better than those stored at 7°C.

MP carrot samples stored at 5°C had better scores for texture on the 8^{th} day of storage than did those stored at 7°C. On the 8^{th} and 11^{th} days of storage, carrot samples that were packed under air received better scores for texture than did those packed under modified atmosphere.

C.3. Odor

MP okra samples packed in 34 μ bags received better scores for odor on the 3d day of storage than did those packed in 22 μ bags. On the 8^{th} and 11^{th} days of storage, MP okra samples packed in PP films had better scores for odor than those packed in PE bags. On the 8^{th} day of storage, okra samples packed under modified atmosphere received better scores than those packed under atmospheric air.

On the 3d and 8th days of storage, pepper samples packed under modified atmosphere received better panelists' scores for odor than those packed under air. On the 8th day of storage, pepper sample stored at 7°C received better scores than did those stored at 5°C.

MP green beans stored at 5°C received on the 11th day of storage better score for welt and dryness attribute than those stored at 7°C. ON the 3d and 11th days of storage, MP green beans packed under air received better scores for this attribute than those packed under atmospheric air.

Also, carrot samples packed in PP film received significantly better scores than those packed in PE films.

C.4. Welt and dryness

There was no significant difference among panelists scores for this attribute of okra samples with regard to the effects of prepackaging treatment, package type and storage temperature. Packaging atmosphere showed significant effect on panelists' scores of welt and dryness attribute of okra samples as those packed under modified atmosphere received better scores (i.e. less welt and dryness symptoms) on the 8th and 11th days of storage than did those packed under air.

MP green pepper samples packed in PP bags received on the 11th days of storage significantly higher scores for this attribute than did those packed in PE bags. Only on the 3d day of storage samples packed under modified atmosphere received higher scores for welt and dryness attribute than those packed under air.

This trend holds true also for MP green bean samples packed under modified atmosphere as they received better scores on the 3d day of storage, but on the 11th day, samples packed under atmospheric air received better scores than those packed under modified atmosphere.

The prepackaging treatment showed significant effect on panelist scores on the 11th day of storage for welt and dryness attribute of yellow carrots as those samples treated with ascorbic acid received better scores than those pretreated with potassium permanganate. The control samples received the least scores. Carrot samples stored at 5°C received higher scores for this attribute on the 3d and 11th days of storage than did those stored at 7°C.

C.5. Acceptability

The higher panelists' scores for this attribute was in the favor of okra samples packed under modified atmosphere, and of those packed in PP films. There was no significant effect of either prepackaging treatment or storage temperature on general acceptability attribute of okra samples.

With regard to MP pepper, on the 3d and 8th days of storage, those samples packed under modified atmosphere received significantly better scores for general acceptability than those packed under air. The samples packed in PP showed higher scores than those packed in PE. On the 8th day of storage, samples kept at 7°C received higher panelists scores for general acceptability than those stored at 5°C.

Green beans stored at 5°C received better score for general acceptability than those stored at 7°C. Also, samples packed under air received higher general acceptability than those packed under modified atmosphere. On day 8th of storage, samples pretreated with ascorbic acid received slightly higher scores for general acceptability than other samples.

MP carrot samples stored at 5°C received higher scores than those stored at 7°C on the 8th day of storage. On both the 8th and 11th days of storage, panelists gave higher scores for general acceptability for MP carrot samples that were packed under atmospheric air than those packed under modified atmosphere.

C.6. Discoloration

MP okra packed under modified atmosphere showed less discoloration than did those packed under air. In general, okra samples packed in PP films received better scores for this attribute than those packed in PE film and those packed in 34 μ showed less discoloration.

MP pepper packed in PP bags received better scores (less discoloration) on the 8th and 11th days of storage than did those packed in PE bags. Storage at 7°C of MP pepper delayed discoloration as was shown by panelists' scores on the 8th day of storage.

MP green beans received better panelists scores for discoloration attribute when packed under atmospheric air than under modified atmosphere and when packed in PP bags than in PE bags. Also, MP carrot samples packed in PP bags showed better scores on the 3d day of storage than did those packed in PE. On the 8th day of storage, carrot samples packed in 34 μ films received better scores than hose packed in 22 μ.

It can be concluded from the organoleptical evaluation of MP vegetables that their sensory attributes are so sensitive for the effects of storage temperature, package type and thickness, packaging atmosphere, and – to less extend – to the prepackaging treatments. Therefore, selecting the proper condition for treating, packaging and storage of minimally processed vegetables shoed be done carefully. Any change in the level of one of these factors may result in an opposite effect of another factor. However, proper selection of these conditions will result in preserving the quality attributes of MP vegetables for longer time.

D. Shelf Life Evaluation

D.1. Okra

The shelf life of minimally processed okra under refrigerated storage ranged from 14 to 23 days. The shortest shelf life was observed for the control okra samples packed in PE bags regardless of thickness and stored at 7°C. However, control okra samples packed in PP of 22 μ under modified atmosphere and stored at 7°C the longest shelf life period (23 days).

Okra samples pretreated with ascorbic acid showed the shortest shelf life period when packed in polyethylene bags of 34 μ under atmospheric air and stored at 7°C, and also when packed in PE of 22 μ under modified atmosphere and stored at 7°C. Samples pretreated with potassium permanganate showed similar trends.

D.2. Green pepper

MP green pepper showed a shelf life range of 12-18 days. There was less variation in shelf life of pepper samples except for those packed in PP bags of 34 μ under atmospheric air and stored at 5°C which showed the longest shelf life (18 days) for all the prepackaging treatments; control, ascorbic and potassium permanganate as well as for the potassium permanganate treated sample packed in PE of 22 μ under atmospheric air and stored at 5°C.

D.3. Green beans

The MP green beans showed also a shelf life of 11-18 days. Most samples showed shelf life around 13 days. The longest shelf life was observed for samples packed in PP of 34 μ under air and stored at 5°C. Also, those packed in PP of 22 μ under either air or modified atmosphere, as well as the control samples packed in PP of 22 μ under modified atmosphere and stored at 5°C. There were some variations among shelf life of samples with regard to the effect of prepackaging treatments. For example, green bean samples packed in PP of 22 μ under air and stored at 7 °C which showed a shelf life of 16 days when was pretreated with potassium permanganate and a shelf life of 11-12 days for the control and ascorbic acid pretreated samples.

D.4. Yellow carrots.

MP yellow carrots showed a shelf life range of 12-24 days. There was a pronounced effect for storage temperature on carrot shelf life. Samples stored at 5°C showed a shelf life period of 14 days in comparison with 12-16 days for those stored at 7°C. Samples packed in PE of 22 μ under modified atmosphere or in PE of 34 μ under atmospheric air and stored at 7°C showed similar shelf life periods of 12 days regardless the prepackaging treatment. The MP carrot sample pretreated with potassium permanganate packed in PP of 22 μ under modified atmosphere and stored at the same temperature (7°C) showed also12 days of shelf life.

The shelf life of the MP fresh produce depends – among other factors - on the proper combination of the post-packaging conditions; the temperature, package atmosphere, package material and package thickness (i.e. package permeability to gases and water vapor). Because each fresh MP produce requires particular combination of those factors, monitoring produce activities during storage, transportation and marketing using the proper tools will aid in selection the less expensive and still effective conditions in order to prolong the shelf life and keep the good quality of the product for longer periods. It can be concluded from this study that proper selection of the packaging material (i.e. that of effective gas permeability), pre-package treatments and storage temperature showed good results when package atmosphere was ordinary air comparable to those samples packaged under modified atmosphere. Optimization of packaging and handling conditions for fresh produce is a must for extending shelf life and minimizing waste, as well as to assure its safety and quality.

RECOMMENDATIONS

It has been shown throughout the current investigation that it was possible to extend the shelf life of four minimally processed vegetables (okra, bell pepper, green bean, and yellow carrot) along with preserving the quality attributes and nutritional value. However, this could not be achieve unless by controlling the main factors involving in determining shelf life of minimally processed vegetables. These factors are: the pre-packaging treatment, package material and thickness, packaging atmosphere, and storage temperature. It was possible by using the proper combination of these factors that a shelf life range of 14-23 days for okra, 11-18 days for green beans and pepper, and 11-24 days for yellow carrots. Accordingly it is recommended:

1- Production of minimally processed (MP) vegetables should be encouraged. This will reduced the large amount of loses in fresh vegetables, increase the marketing period, increase the money value of bought vegetables for the family by reducing the non-eatable portions and will save time of meal preparation.

2- Production of MP vegetables should be monitored closely in order to reduce the initial microbiological load of the product. Good manufacturing practice (GMP) along with utilizing the proper prepackaging treatments such as dipping in potassium permanganate or ascorbic acid solutions will help in reduce the possibility for microbial contamination and any risk for health hazard.

3- Selection of the proper package material and thickness (i.e. proper gas permeability) is of great importance in successful extension of shelf life and preservation of quality attributes and nutritional value of MP vegetables.

4- Packaging atmosphere may play a part in shelf life extension, however, from an economical stand point, package under atmospheric air showed good results providing that other involved factors were properly selected.

5- Storage temperature should be monitored closely because it is the key for successful marketing of MP vegetables. Maintaining the storage temperature without any fluctuation is important.

6- By applying the proper selection of the factors mentioned above, this growing "industry" can flourish and utilize a lot of youth as worker as well as will provide great opportunity for export and gain foreign currency.

7- Because of the differences among vegetables and within varieties in their responses to different treatments, packaging and storage temperature, it is highly recommended that other minimally processed vegetables should receive more attention from researchers and food processing industry.

8- In order to achieve the maximum possible shelf life for MP vegetables under investigation:

MP okra should be packed in PP bags of 22-34 μ under air and stored at 7°C when the prepackaging treatment was 0.2% ascorbic acid or under modified atmosphere and stored at 5°C when the prepackaging treatment was 0.2% potassium permanganate. This will assure 21-23 days of storage.

MP green pepper should be stored at 5°C. It should be packed under air in PP bags of 34 μ after soaking in either tap water or 0.2% ascorbic acid for 3 min on order to assure 15-18 days of storage. If the pretreatment is soaking in 0.2% potassium permanganate, MP pepper should be packed in PE bags of 22μ under air to assure 12-15 days of storage.

The MP green beans also should be stored at 5°C under air in either PP bags of 34μ when soaked in water or 0.2% ascorbic acid solution, or packed in PE bags of 22 μ when treated with 0.2% potassium permanganate solution before packaging. This conditions will assure 15-18 days of storage.

The MP carrots, pretreated with 0.2% solution of either ascorbic acid or potassium permanganate, should be packed in PE bags of either 22 or 34 μ under air and stored at 5°C in order to assure shelf life of 21-24 days.