UNIVERSITI PUTRA MALAYSIA

EFFECTS OF PRODUCTION SYSTEMS AND OZONE TREATMENT ON NITRATE CONTENT AND E. coli O157:H7 CONTAMINATIONS OF BUTTERHEAD LETTUCE

SITI FAIRUZ BINTI YUSOFF

FP 2013 40

EFFECTS OF PRODUCTION SYSTEMS AND OZONE TREATMENT ON NITRATE CONTENT AND *E. coli* O157:H7 CONTAMINATIONS OF BUTTERHEAD LETTUCE

SITI FAIRUZ BINTI YUSOFF

MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA

2013

EFFECTS OF PRODUCTION SYSTEMS AND OZONE TREATMENT ON NITRATE CONTENT AND *E. coli* O157:H7 CONTAMINATIONS OF BUTTERHEAD LETTUCE

By

SITI FAIRUZ BINTI YUSOFF

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

August 2013

COPYRIGHT

This thesis is especially
dedicated to my beloved:

Husband Zulkefli Abdullah,……
Hjh Remlah, Hj Yusoff and family

For love, sacrifices and support

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science

EFFECTS OF PRODUCTION SYSTEMS AND OZONE TREATMENT ON NITRATE CONTENT AND *E. coli* O157:H7 CONTAMINATIONS OF BUTTERHEAD LETTUCE

By

SITI FAIRUZ BINTI YUSOFF

August 2013

Chairman : Professor Mahmud Tengku Muda Mohamed, Ph.D

Faculty : Agriculture

Butterhead lettuce, a salad crop pose to food safety risk issues because it is normally consume raw. The information regarding nitrate and *Escherichia coli* O157:H7 contaminations status on Butterhead lettuce in Malaysia is still scanty. Not much work of this nature is carried out locally. Recently, an outbreak of *E. coli* was happened in Germany, which one of the most stringent countries in term of food safety on fresh produce. Hence, this study seemed inevitable to be carried out. The first experiment, a market study, to determine the level of nitrate and *E. coli* O157:H7 contaminations of Butterhead lettuce. The result showed that nitrate levels exceeded the maximum limit but the bacteria contaminations were still under safe limit.

The second experiment was to determine the effect of harvesting stage on the nitrate content, quality and nitrate reductase activity (NRA) of Butterhead lettuce, grown by hydroponic and organic systems. After 35, 38, 41 and 44 days of transplanting (DAT), the lettuce harvested and the studied effects were determined. Nitrate content in

hydroponic lettuce was higher compared to organic lettuce. The accumulation varies with leaf parts, the highest being in midribs, followed by outer adult leaf blades and young leaves. For hydroponic lettuce, extended harvesting stage was found to reduce nitrate content. Fourty one DAT was the optimum stage to harvest with significantly higher reduction of nitrate content. At this stage, the fresh weight, firmness and color were still acceptable. However, harvesting stage had no effect on nitrate content in organic lettuce. NRA was found to be higher in young leaves compared with outer adult leaf blades and midribs.

The third experiment was to determine effect of different aqueous ozone concentrations on *E. coli* O157:H7, nitrate and nitrite contents, and postharvest quality of Butterhead lettuce. The lettuce was treated with aqueous ozone at concentrations of 0, 3 and 5 $mg.L^{-1}$ and stored at 10 °C for 12 days. The quality was assessed on day 0, 4, 8 and 12 of storage by comparing the changes. The number of *E. coli* in organic lettuce was found to be higher than hydroponic lettuce. The aqueous ozone at 5 $mg.L^{-1}$ treatments was effective in reducing *E. coli* colonies but with quality compromised and the effectiveness decreased as the storage period progressed. Ozone at 3 $mg.L^{-1}$ was a potential concentration on reducing *E. coli* without giving in to quality.

In conclusion, the consumers and producers should apply hygienic practices to ensure safe consumption. The optimum harvest stage of Butterhead lettuce is at 41 DAT. A potential concentration of aqueous ozone was 3 $mg.L^{-1}$ on reducing *E. coli* O157:H7 contamination without detrimental effects on lettuce quality. Lettuce can be stored in cool storage for up to eight days.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN-KESAN SISTEM PENGELUARAN DAN RAWATAN OZON KE ATAS KANDUNGAN NITRAT DAN PEMCEMARAN *E. coli* O157:H7 BAGI SALAD *BUTTERHEAD*

Oleh

SITI FAIRUZ BINTI YUSOFF

Ogos 2013

Pengerusi : Profesor Mahmud Tengku Muda Mohamed, PhD

Fakulti : Pertanian

Salad *Butterhead* adalah sejenis tanaman salad yang terdedah kepada isu risiko keselamatan makanan kerana ia biasanya dimakan segar. Maklumat tentang status pencemaran nitrat dan *Escherichia coli* O157:H7 ke atas salad *Butterhead* di Malaysia masih lagi kurang. Tidak banyak kajian tempatan dibuat dalam bidang ini. Baru-baru ini berlaku wabak *E. coli* di Jerman, yang merupakan salah sebuah negara yang ketat dari segi keselamatan makanan ke atas hasil segar. Oleh itu, kajian ini tidak dapat dielakkan. Eksperimen pertama, kajian pasaran untuk menentukan tahap pencemaran nitrat dan *E. coli* O157:H7 pada salad *Butterhead*. Keputusan menunjukkan tahap nitrat melebihi paras had maksimum tetapi pencemaran bakteria masih di bawah paras had yang selamat.

Eksperimen kedua adalah untuk menentukan kesan peringkat penuaian terhadap kandungan nitrat, kualiti dan aktiviti penurunan nitrat (NRA) salad *Butterhead* yang ditanam secara sistem hidroponik dan organik. Selepas 35, 38, 41 dan 44 hari selepas

pemindahan (DAT), salad dituai dan kesan-kesan kajian ditentukan. Kandungan nitrat dalam salad hidroponik adalah lebih tinggi berbanding dengan salad organik. Pengumpulannya berbeza mengikut bahagian daun, yang tertinggi adalah dalam midrib, diikuti oleh bilah daun luar dewasa dan daun muda. Bagi salad hidroponik, pelanjutan peringkat penuaian boleh mengurangkan kandungan nitrat. Empat puluh satu hari DAT adalah peringkat optimum untuk dituai kerana pengurangan nitrat yang ketara. Pada peringkat ini, berat segar, kerapuhan dan warna masih boleh diterima. Walaubagaimanapun, peringkat penuaian tidak mempengaruhi kandungan nitrat dalam salad organik. NRA ditemui lebih tinggi dalam daun muda berbanding bilah daun luar dewasa dan midrib.

Eksperimen ketiga menentukan kesan kepekatan akueus ozon yang berbeza ke atas *E. coli* O157:H7, kandungan nitrat dan nitrit, dan kualiti lepas tuai bagi salad *Butterhead*. Salad yang telah dirawat dengan akueus ozon pada kepekatan 0, 3 dan 5 $mg.L^{-1}$ disimpan pada suhu 10 °C selama 12 hari. Kualiti dinilai pada hari 0, 4, 8 dan 12 penyimpanan dengan membandingkan perubahan. Bilangan *E. coli* dalam salad organik ditemui lebih tinggi berbanding dengan salad hidroponik. Rawatan akueus ozon pada 5 $mg.L^{-1}$ berkesan bagi mengurangkan koloni *E. coli* tetapi dengan kualiti telah dikompromi dan keberkesanannya berkurangan semasa tempoh penyimpanan. Kepekatan ozon pada 3 $mg.L^{-1}$ berpotensi bagi mengurangkan *E. coli* tanpa menjejaskan kualiti.

Kesimpulannya, pengguna dan pengeluar perlu menerapkan amalan kebersihan bagi memastikan hasil yang selamat. Peringkat optimum penuaian bagi salad *Butterhead*

adalah 41 DAT. Kepekatan ozon pada 3 $mg.L^{-1}$ berpotensi bagi mengurangkan pencemaran *E. coli* O157:H7 tanpa memberi kesan buruk pada kualiti salad. Salad boleh disimpan dalam penyimpanan sejuk sehingga lapan hari.

ACKNOWLEDGEMENTS

Alhamdulillah wa hasbiallahu wa nikmal wakil. First of all I would like to express my outmost thanks and gratitudes to the Almighty Allah, the most Gracious and the most Merciful; without Whose will no one can achieve anything. My salawat and salam to His righteous messenger, prophet Muhammad SAW.

I am indebted and grateful to Prof Dr Mahmud Tengku Muda Mohamed, Associate Professor Dr Siti Hajar Ahmad and Associate Professor Dr Farinazleen Mohamad Ghazali for their unlimited support, invaluable guidance, tireless advices, constructive comments, and patience throughout my study. All of you are really inspired me to be a successful lecturer one day.

I would like to acknowledge and thank to SLAB, Kementerian Pengajian Tinggi (KPT) Malaysia, for awarding me a scholarship during my study. My sincere gratitude is also extended to the Human Resource, UPSI and Faculty of Technical and Vocational Education (FPTV), UPSI to give me a study leave and full time study. My sincere gratitude is also extended to the Postharvest Laboratory, especially Mr Azhar, and Taman Pertanian Universiti, for their kindness, guidance and helpful.

It is upmost pleasure in thanking my colleagues in the Posharvest Laboratory (Harizul, Shariah, Hamizah, Aisyah, Hazwani, Elliza, Bunga, Azimah, Munirah, Farah, Rubel, Humam, Fakhrul and Shiva) for their friendship, encouragement, birthday party, and

sharing various interests from food to movies. I am really glad and grateful to know all of you.

Last but not least, my deepest appreciation to my beloved husband (Zulkefli Abdullah) for helping me in lab, a lot of sacrifice, care, love and ongoing support. This work would not be realized without continuous encouragement from my parents (Hajah Remlah Derahman and Hj Yusoff Yaakub), siblings and caring in-laws (Abdullah and Jeriah).

I certify that a Thesis Examination Committee has met on (01 August 2013) to conduct the final examination of Siti Fairuz Binti Yusoff on her thesis entitled "Effects of Production Systems and Ozone Treatment on Nitrate and *E. coli* O157:H7 Contaminations of Butterhead Lettuce" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded Master of Science.

Members of the Thesis Examination Committee were as follows:

Yahya Awang, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Phebe Ding, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Internal examiner)

Fatimah Abu Bakar, PhD
Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Internal examiner)

Aminah Abdullah, PhD
Professor
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
(External examiner)

NORITAH OMAR, PhD
Associate Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Mahmud Tengku Muda Mohamed, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Siti Hajar Ahmad, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Farinazleen Mohamad Ghazali, PhD
Associate Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institutions.

SITI FAIRUZ BINTI YUSOFF

Date:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Acetyl-CoA	: Acetyl-Coenzyme A
ADI	: Acceptable daily intake
ANOVA	: Analysis of variance
AOAC	: Association of Official Analytical Chemists
C*	: Chroma
BfR	: Federal Institute for Risk Assessment
BOD	: Biological oxygen demand
$Ca(OH)_2$	: Calcium hydroxide
CD	: Corona discharge
$CFUg^{-1}$	: Colony-forming units per gram
$CFUml^{-1}$	: Colony-forming units per milliliter
CH_3COOH	: Acetic Acid
cm	: Centimeter
COD	: Chemical oxygen demand
CQS	: Color quality scale
CRD	: Completely randomized designs
DAT	: Days after transplanting
DOA	: Department of Agriculture
DPPH	: 2,2-diphenyl-1-picrylhydrazyl
DW	: Dry weight
EC	: European commission
EFSA	: European Food Safety Authority
EU	: European Union
FAO	: Food Agriculture Organization
FCR	: Folin-Ciocalteu's phenol reagent
FW	: Fresh weight
g	: Gram
g/L	: Gram per liter

GAE : Gallic acid equivalents

h : Hour

h^o : Hue angle

H_2O : Water

ha : Hectar

HCl : Hydrochloric acid

HPO_3 : Metaphosphoric acid

HUS : Hemolytic-uremic syndrome

IFT : Institute of Food Technologists

kg : Kilogram

K_2HPO_4 : Dipotassium phosphate

KH_2PO_4 : Potassium dihydrogen phosphate

KNO_3 : Potassium nitrate

L* : Lightness

L : Liter

LSD : Least significant difference

min : minutes

mg/cm^2 : Milligram per centimeter square

$MgCO_3$: Magnesium carbonate

$mg.kg^{-1}$: Miligram per kilogram

$mg.L^{-1}$: Miligram per liter

$mg.mL^{-1}$: Miligram per mililiter

mL : Mililiter

MNL : Maximum nitrate limits

MRL : Maximum recommended limits

MT : Metric tons

N : Newton

NAAS : National Academy of Agricultural Sciences

$NaCO_3$: Sodium carbonate

NADPH : Nicotinamide adenine dinucleotiden phosphate

$NaNO_2$: Sodium nitrite

NaOH	: Sodium hydroxide
NED	: N-(1-Naphthyl) ethylenediamine dihydrochloride
NH_4^+	: Ammonium
NiR	: Nitrite reductase
NIST	: National Institute of Standards and Technology
nm	: Nanometer
nmol	: Nanomoles
NO_2^-	: Nitrite
NO_3	: Nitrate
NO_3-N	: Nitrate-nitrogen
NR	: Nitrate reductase
NRA	: Nirate reductase activity
O_2	: Oxygen
O_3	: Ozone
OH	: Hydroxide
PAL	: Phenylalanine ammonia-lyase
ppm	: Part per million
PPO	: Polyphenoloxidase
PVC	: Polyvinyl chloride
QTLs	: Quantitative trait loci
R^2	: R-squared
RCBD	: Randomized complete block design
RMK-10	: Rancangan Malaysia ke-10
rpm	: Revolutions per minute
SA	: Sulfanilamide
SCF	: Scientific Committee on Food
SSC	: Soluble solids content
TA	: Titratable acidity
TCA	: Tricarboxylic acid cycle
TFTC	: Too few too count
TPC	: Total phenolic content

TPU	: Taman Pertanian Universiti
UPM	: Universiti Putra Malaysia
USA	: United States of America
UV	: Ultraviolet
v/v	: Volume per volume
WHO	: World Health Organization
w/v	: Weight per volume
^{o}C	: Degree celsius
%	: Percent
µL	: Microliter
$\mu L.L^{-1}$	: Microliters per liter
µmol	: Micromoles
$\mu mol\ mol^{-1}$	: Micromoles per moles

CHAPTER 1

GENERAL INTRODUCTION

Lettuce is a major leafy vegetable and commonly used as salad. There are five major types of lettuce; Butterhead, Crisphead (Iceberg), Romaine, Leaf, and Stem. In China and Egypt, stems rather than leaves of lettuce are consumed, mainly as a cooked vegetable. Humans have had a long history of domestication and cultivation of lettuce. The existence of many primitive forms of lettuce in the Middle East suggested that lettuce probably originated in the eastern Mediterranean basin. Lettuce-like plants were found in Egyptian tomb paintings dated from the Middle Kingdom, about 4, 500 years ago (Harlan, 1986). Human selection and later breeding efforts have led to changes in size, shape, color, texture, and taste of leaves and plants, resulting in modern-day lettuce. In Malaysia, lettuce is produce through hydroponic and organic systems. However, traditional planting on soil is also common. According to Nazaryuk et al. (2002), the production system has bearing on nitrate content in plant due to different types, amount, and frequency of fertilizer application.

The harvesting stage is one of the factors that affect lettuce quality. Lettuce maturity is reached when the heads are well formed and solid (Ryall et al., 1982). Maturity is also based on head compactness and firmness that is also related to its susceptibility to certain postharvest disorders (ZongQi, 2009). Delaying in harvest when the lettuce

reaches its maximum yield decreases their quality as mentioned by Kader (2008) but in contrast, it reduced the nitrate content in lettuce (Santamaria et al., 2001).

In term of microbial food safety, the potential sources of preharvest contamination on fresh produce were recently reviewed and include the use of manure fertilizer, the presence of animals in fields and the use of poor quality water for irrigation (Beuchat and Ryu, 1997; Brackett, 1999; Beuchat, 2002; Steele and Odumeru, 2004; Brandl, 2006). The organic lettuce which contained ruminant manure and sewage were considered the main sources of *E. coli* O157:H7 (Olaimat and Holley, 2012) and they were able to survive in soils for months or years (Doyle and Erickson, 2008). Postharvest contamination might also occur in the packaging house due to cross-contamination with raw produce, during washing steps or poor sanitation. Thus, human pathogens might contaminate the fresh produce at any stage from farm-to-fork.

Ozone is one of the alternative sanitizing treatments tested for inactivation of microorganisms, removing toxic substances and extending the shelf life of fruits and vegetables. Ozone revealed promising results in solving problems of food industry like mycotoxin contamination and chemical or pesticide residues. In Oztekin et al. (2005) studies, a significant reduction in total bacteria, coliform and yeast counts on figs were observed after 3 hours treatment at 5 ppm. The decreased in total aerobic mesophyllic bacteria and yeast counts was 38 and 72%, respectively. All coliforms were inactivated. Nadas et al. (2003) stored strawberries for 3 days at 2 ^{o}C with or without 1.5 ppm ozone and then transferred to room temperature. Ozone treated fruits showed less weight loss than the non-treated fruits after cold storage. They stated that Ozone treatment reduced

water loss through transpiration of the fruit, but this effect disappeared when the fruit returned to ambient air.

Ozonated water treatment resulted in no significant difference in total sugar content of celery (Zhang et al., 2005). Beltran et al. (2005) also reported that ozonated water maintained the initial visual appearance of fresh-cut lettuce and controlled browning during storage. However, some detrimental effects of ozone on certain products, such as bananas and leafy vegetables were also reported (Smilanick, 2003). Perez et al. (1999) stored strawberries for three days at 2 ^{o}C in an atmosphere containing 0.35 ppm ozone and found low contents of sugars at the third day of storage. They concluded, this could be due to an activation of sucrose degradation pathways in response to oxidative stress caused by ozone. Ozone is expected to cause the loss of antioxidant constituents, because of its strong oxidizing activity. However, ozone washing treatment was reported to have no effect on the final phenolic content of fresh-cut iceberg lettuce (Beltran et al., 2005). Vitamin C (ascorbic acid), present in fruits and vegetables gives an added value due to its important nutritional implications. It was reported that ozone decreases ascorbic acid in broccoli florets (Lewis et al., 1996). On the contrary, Zhang et al. (2005) reported that there was no significant difference between vitamin C contents of celery samples treated and non-treated with ozonated water.

Nitrate and *E. coli* O157:H7 are known to contaminate the fresh produce including lettuce. These contaminations could be harmful to human health if exceeded maximum limits. One of the major contamination sources is through production system. However, harvesting stage and storage duration also influenced the level of contamination. Ozone

is an alternative sanitizer with no safety concerns with residual or by-products. Nevertheless, if not properly used, ozone can cause some deleterious effects on physiology and quality of produce. However, these kinds of studies are still scarce in Malaysia. Thus, this study carried out with the general objective of to evaluate the level of nitrate and *E. coli* O157:H7 contaminations in lettuce found in the market and interventions that can reduce the contaminations.

The specific objectives of this study were (i) to determine the nitrate and *E. coli* O157:H7 contaminations in Butterhead lettuce available in the market, (ii) to determine the effect of hydroponic and organic production systems and harvesting stage on nitrate accumulation, quality and nitrate reductase activity (NRA) of Butterhead lettuce, and (iii) to determine the effect of production system and different aqueous ozone concentrations on *E. coli* O157:H7, nitrate and nitrite contents and subsequently, postharvest quality of Butterhead lettuce.

BIBLIOGRAPHY

Abdul-Raouf, U.M., Beuchat, L.R., and Ammar, M.S. 1993. Survival and growth of *Escherichia coli* O157:H7 on salad vegetables. *Applied and Environmental Microbiology.* 59: 1999-2006.

Abu Rayyan, A., Kharawish, B. H., and Al Ismail, K. 2004. Nitrate content in lettuce (*Lactuca sativa* L) heads in relation to plant spacing, nitrogen form and irrigation level. *Journal of the Science of Food and Agriculture.* 84(9): 931-936.

Achen, M. and Yousef, A. E. 2001. Efficacy of ozone against *Escherichia coli* O157: H7 on apples. *Journal Food Science.* 66: 1380–1384.

Ackers, M.L., Mahon, B.E., Leahy, E., Goode, B., Damrow, T., Hayes, P.S., Bibb, W.F., Rice, D.H., Barrett, T.J., Hutwagner, L., Griffin, P.M. and Slutsker, L. 1998. An outbreak of *Escherichia coli* O157:H7 infections associated with leaf lettuce consumption. *Journal of Infectious Diseases.* 177: 1588-1593.

Agrawal, M., Krizek, D.T., Argawal, S.B., Kramer, G.F., Lee, E.H., Mirecki, R.M., and Rowland, R.A., 1993. In¯uence of inverse day/night temperature on ozone sensitivity and selected morphological and physiological responses of cucumber. *Journal American Society Horticulture Science.* 118: 649-654.

Agri-Facts, 1991. Nitrate poisoning and feeding nitrate feeds to livestock. Alberta Agric. Food Rural Dev., Alberta, Canada. Agdex 400/60-1:1–5. http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex851. Retrieved 12 September 2012.

Aguayo, E., Escalona, V.H., and Artés, F. 2006. Effect of cyclic exposure to ozone gas on physicochemical, sensorial and microbial quality of whole and sliced tomatoes. *Postharvest Biology and Technology*. 39(2): 169-177.

Ahmed A.H.H., Khalil M.K., and Farrag A.M. 2000. Nitrate accumulation, growth, yield and chemical composition of Rocket (*Eruca vesicaria* subsp. *sativa*) plant as affected by NPK fertilization, kinetin and salicylic acid, in: Proceedings of ICEHM 2000, pp. 495–508. Egypt: Cairo University.

Ahvenainen, R. 1996. New approaches in improving the shelf life of minimally processed fruit and vegetables. *Trends Food Science Technology*. 7: 179–187.

Akbas, M.Y. and Ozdemir, M. 2006. Effectiveness of ozone for inactivation of *Escherichia coli* and *Bacillus cereus* in pistachios. *International Journal Food Science Technology* 41:513-519.

Alma, M.H., A. Mavi, A. Yildirim, M. Digrak and T. Hirata, 2003. Screening chemical composition and *in vitro* antioxidant and antimicrobial activities of the essential oils from *Origanum syriacum* L. growing in Turkey. *Biological and Pharmaceutical Bulletin*. 26: 1725-1729.

Alothman, M., Kaur, B., Fazilah, A., Bhat, R., and Karim, A.A. 2010. Ozone-induced changes of antioxidant capacity of fresh-cut tropical fruits. *Innovative Food Science and Emerging Technologies.* 11(4): 666-671.

Alvarez, P.M., Garcia-Araya, J.F., Beltran, F.J., Giraldez, I., Jaramillo, J., and Gómez-Serrano, V. 2006. The influence of various factors on aqueous ozone decomposition by granular activated carbons and the development of a mechanistic approach. *Carbon*. 44(14): 3102-3112.

Amr, A., and Hadidi, N. 2001. Effect of Cultivar and Harvest Date on Nitrate (NO_3) and Nitrite (NO_2) Content of Selected Vegetables Grown Under Open Field and Greenhouse Conditions in Jordan. *Journal of food composition and analysis.* 14(1): 59-67.

Anjana, S., Umar, M., Iqbal, Y., and Abrol, P. 2006. Are nitrate concentrations in leafy vegetables within safe limits?. Proceedings of the Workshop on Nitrogen in Environment, Industry and Agriculture, pp. 81–84. New Delhi, India.

Anjana, S.U., and Iqbal, M. 2007. Nitrate accumulation in plants, factors affecting the process, and human health implications. A review. *Agronomy for Sustainable Development.* 27(1): 45-57.

Arifin, B. and Bono, A.J.J. 2006. The transformation of chicken manure into mineralized organic fertilizer. *Journal of Sustainability Science and Management.* 1(1): 58-63.

Arkus, K.A.J., Cahoon, E.B. and Jez, J.M. 2005. Mechanistic analysis of wheat chlorophyllase. Arch. *Biochemistry Biophysic.* 438: 146–155.

Arte´s-Herna´ndez, F., Aguayo, E. and Arte´ s, F. 2004. Alternative atmosphere treatments for keeping quality of 'Autumn seedless' table grapes during long-term cold storage. *Postharvest Biology and Technology.* 31: 59–67.

Aruscavage, D., Lee, K., Miller, S., LeJeune, J.T. 2006. Interactions affecting the proliferation and control of human pathogens on edible plants. *Journal of Food Science*.71: R89–R99.

Atress, A.S.H. 2006. Physiological studies on lettuce production in sandy soil and storage ability of its fresh cut heads. PhD. Faculty of Agriculture. Cairo University.

Augustin, J., Mc Dole, R.E. and Painter G.C. 1977. Influence of fertilizer, irrigation and storage treatments on nitrate-N content of potato tubers. *American Potato Journal.* 54: 125-136.

Aworh, O.C., Hicks, J.R. Minotti, P.L and Lee, C.Y. 1980. Effects of plant age and nitrogen fertilization on nitrate accumulation and postharvest nitrite accumulation in fresh spinach. *Journal of American Society for Horticultural Science.* 105(1): 18 – 20.

Ayala-Zavala, J.F., and González-Aguilar, G.A. 2009. Use of Additives to Preserve the Quality of Fresh-Cut Fruits and Vegetables. *Advances in Fresh-Cut Fruits and Vegetables Processing* (pp. 231-254). United States of America: CRC Press.

Ayaz, A., Topcu, A., and Yurttagul, M. 2007. Survey of nitrate and nitrite levels of fresh vegetables in Turkey. *Journal of Food Technology.* 5(2): 177-179.

Babic, I., Roy, S., Watada, A.E. and Wergin, W.P. 1996. Changes in microbial populations on fresh cut spinach. *International Journal of Food Microbiology.* 31: 107–119.

Bablon, G., Bellamy, W.D., Bourbigot, M.M., Daniel, F.B., Dore, M., Erb, F., Gordon, G., Langlais, B., Laplanche, A., Legube, B., Martin, G., Masschelein, W.J., Pacey, G., Reckhow, D.A., and Ventresqur, C. Langlais, B., Reckhow, D.A., and Brink, D.R. (Eds).1991. Fundamental aspects. In *Ozone in Water Treatment*: *Application and Engineering* (pp.11-132). Chelsea MI: Lewis Publishers, Inc.

Barrett, D.M., Beaulieu, J.C., and Shewfelt, R., 2010. Color, flavor, texture, and nutritional quality of fresh-cut fruits and vegetables: desirable levels, instrumental and sensory measurement, and the effects of processing. *Critical Reviews Food Science.* 50: 369-389.

Barth, M.M, Zhou, C., Mercier, M., Payne, F.A. 1995. Ozone storage effects on anthocyanin content and fungal growth in blackberries. *Journal of Food Science.* 60: 1286-1287.

Bazarova, V.I. 1992. Use of ozone in storage of apples. *Food Science Technology Abstract.* 14: J1653.

Beis, G.H., Simons, A.S., and Dogras, C.C. 2002. Spinach composition as affected by leaf age and plant part. *Acta Horticulture.* 579: 653.

Beltran, D., Selma, M.V., Marin, A., Gil, M.I. 2005. Ozonated Water Extends the Shelf Life of Fresh-cut Lettuce. *Journal of Agricultural and Food Chemistry.* 53(14), 5654–5663.

Benbrook, C., Zhao, X., Davies, N., and Andrews, P. 2008. New Evidence Confirms the Nutritional Superiority of Plant-Based Organic Foods. http://www.organic-center.org/science.nutri.php?action= viewandreport id=126. Retrieved 9 November 2009.

Benitez, F.J., Acero, J.L., and Real, F.J. 2002. Degradation of carbofuran by using ozone, UV radiation and advanced oxidation process. *Journal of Hazardous Materials.* 89: 51–65.

Berger, C.N., Sodha, S.V., Shaw, R.K., Griffin, P.M., Pink, D., Hand, P., and Frankel, G. 2010. Fresh fruit and vegetables as vehicles for the transmission of human pathogens. *Environmental microbiology*. 12(9): 2385-2397.

Berlin B., Breedlove, D.E., Raven, P.H. 1974. Principles of Tzeltal plant classification: an introduction to the botanical ethnography of Mayan-speaking people of Highland Chiapas. London: Academic Press.

Bernalte, M.J., Sabio, E., Hernández, M.T., and Gervasini. C. 2003. Influence of storage delay on quality of 'Van' sweet cherry. *Postharvest Biology Technology*. 28: 303-312.

Bett-Garber, K.L., Lamikanra, O., Lester, G.E., Ingram, D.A., Watson, M.A., 2005. Influence of soil type and storage conditions on sensory qualities of fresh-cut cantaloupe (*Cucumis melo*). *Journal Science Food Agricultural*. 85: 825–830.

Beuchat, L.R. 1992. Surface disinfection of raw produce. *Dairy, Food and Environmental Sanitation.* 12(1): 6–9.

Beuchat, L.R. 1998. Surface decontamination of fruits and vegetables: A review. World Health Organization (FSF/FOS/98.2.).

Beuchat, L.R. 2002. Ecological factors influencing survival and growth of human pathogens on raw fruits and vegetables. *Microbes and Infection.* 4: 413–423.

Beuchat, L.R. and Ryu, J.H. 1997. Produce handling and processing practices. *Emerging Infectious Diseases.* 3(4): 459-464.

Bialka, K. L. and Demirci, A. 2007. Efficacy of aqueous ozone for the decontamination of Escherichia coli O157:H7 and Salmonella on raspberries and strawberries. *Journal Food Protection.* 70: 1088–1092.

Bialka, K.L. 2007. *Decontamination of berries with ozone and pulsed UV-light* (Doctoral dissertation, The Pennsylvania State University).

Black, B.L., Fuchigami, L.H., and Coleman, G.D. 2002. Partitioning of nitrate assimilation among leaves, stems and roots of poplar. *Tree Physiology*. 22(10): 717-724.

Boink, A. and Speijers, G. 2001. Health effects of nitrates and nitrites. *Acta Horticulturae.* 563: 29-36.

Booker, F.L., Fiscus, E.L. and Miller, J.E. 1991. Ozone-induced changes in soybean cell wall physiology. *Current Topics in Plant Physiology.* 6: 229-232.

Boonyakiat, D. 1999. Postharvest losses of highland vegetables in Thailand. *Acta Horticulturae.* 483: 251–254.

Bourn, D., and Prescott, J. 2002. A comparison of the nutritional value, sensory qualities, and food safety of organically and conventionally produced foods. *Critical Reviews Food Science Nutrition.* 42**:** 1–34.

Bourne, M. 2002. *Food texture and viscosity. Food Technology, International Series, (2nd ed.)*. San Diego, CA: Academic Press.

Brackett, R.E. 1998. Incidence, contributing factors, and control of bacterial pathogens in produce. *Postharvest Biology and Technology.* 15: 305-311.

Brackett, R.E. 1992. Shelf stability and safety of fresh produce as influenced by sanitation and disinfection. *Journal Food Protection.* 55: 804–814.

Brackett, R.E. 1999. Incidence, contributing factors, and control of bacterial pathogens in produce. *Postharvest Biology and Technology.* 15: 305–311.

Bradley, F. M., Ellis, B.W., and Martin, D.L. 2010. *The Organic Gardener's Handbook of Natural Pest and Disease Control: A Complete Guide to Maintaining a Healthy Garden and Yard the Earth-friendly Way*. New York: Rodale Books.

Brandl, M.T., and Mandrell, R.E. 2002. Fitness of Salmonella enterica serovar Thompson in the cilantro phyllosphere. *Journal Applied and Environmental Microbiology*. 68: 3614–3621.

Brandl, M.T. 2006. Fitness of human enteric pathogens on plants and implications for food safety. *Annual Review of Phytopathology.* 44: 367–392.

Brandl, M.T. and Amundson, R. 2008. Leaf age as a risk factor in contamination of lettuce with *Escherichia coli* O157:H7 and *Salmonella enterica*. *Application Environmental Microbiology.* 74: 2298–2306.

Brandt, K., Leifert, C., Sanderson, R., and Seal, C.J. 2011. Agroecosystem management and nutritional quality of plant foods: the case of organic fruits and vegetables. *Critical Reviews in Plant Sciences.* 30(1-2): 177-197.

Brown, S.B., Houghton, J.D. and Hendry G.A.F. 1991. Chlorophyll breakdown. In: Scheer, H. (Ed.), *Chlorophylls* (pp. 465–489). Boca Raton: Finland.

Bruning-Fann, C.S. and Kaneene J.B. 1993. The effects of nitrate, nitrite and N-nitroso compounds on human health: a review. *Veterinary and Human Toxicolog.* 35:521-538.

Burg, S.P. 2004. *Postharvest physiology and hypobaric storage of fresh produce*. USA: CABI Publishing.

Bussi, C., Gojon, A. and Passama, L. 1997. *In situ* nitrate reductase activity in leaves of adult peach trees. *Journal Horticultural Science.* 72: 347–353.

Caba, J.M., Lluch, C. and Ligero, F. 1995. Distribution of nitrate reductase activity in *Vicia faba*: effect of nitrate and plant genotype. *Physiology Plant.* 93: 667–672.

Cardenas-Navarro R., Adamowicz S., and Robin P. 1998. Diurnal nitrate uptake in young tomato (*Lycopersicon esculentum* Mill.) plants: test of a feedback based model, *Journal Experimental Botany.* 49: 721–730.

Cárdenas-Navarro, R., Adamowicz, S. and Robin P. 1999. Nitrate accumulation in plants: a role for water. *Journal of Experimental Botany*. 50: 613–624.

Carasso, B.S., Bakshi, V.P., and Geyer, M.A. 1998. Disruption in prepulse inhibition after alpha-1 adrenoceptor stimulation in rats. *Neuropharmacology*. 37(3): 401-404.

Carl, E.S. 1999. Preharvest factors affecting postharvest texture. *Postharvest Biology and Technology*. 15: 249-254.

Carlin, F., Nguyen-the, C., Cudennec, P. and Reich, M. 1989. Microbial spoilage of fresh ready-to-use grated carrots. *Science Aliments.* 9: 371–386.

Castaner, M., Gill, M.I., Artes, F., and Tomas-Barberan, F.A. 1996. Inhibition of browning of harvested head lettuce. *Journal of Food Science.* 61:314-316.

Chan, E.W.C., Lim, Y.Y. and Omar, M. 2007. Antioxidant and Antibacterial Activity of Leaves of Etlingera Species (Zingiberaceae) in Peninsular Malaysia. *Food Chemistry*. 104: 1586-1593.

Chelme-Ayala, P., El-Din, M.G., and Smith, D.W. 2009. Kinetics and mechanism of the degradation of two pesticides in aqueous solutions by ozonation. *Chemosphere. 78*: 557-562.

Chen, B. M., Wang, Z. H., Li, S. X., Wang, G. X., Song, H. X., and Wang, X. N. 2004. Effects of nitrate supply on plant growth, nitrate accumulation, metabolic nitrate concentration and nitrate reductase activity in three leafy vegetables. *Plant Science*. 167(3): 635-643.

Choi, W.J., Ro, H.M., Lee, S.M. 2003. Natural 15N abundances of inorganic nitrogen in soil treated with fertilizer and compost under changing soil moisture regimes. *Soil Biology and Biochemistry.* 35: 1289-1298.

Chung, S.Y., Kim, J.S., Kim, M., Hong, M.K., Lee, J.O., Kim, C.M. and Song, I.S. 2003. Survey of nitrate and nitrite contents of vegetables grown in Korea. *Food Additive and Contaminants.* 20 (7): 621-628.

Chung, W.Q., Ahmad, S.H., Zamri, M.Z., and Rosenani, A.B. 2012. Nitrate and Nitrite Contents and Postharvest Quality of Choy Sum (*Brassica rapa chinensis* Group) during Storage. In *VII International Postharvest Symposium 2012*, Kuala Lumpur, Malaysia, 25-29 June 2012. Belgium: ISHS Publication.

Ciccarese, F., Sasanelli, N., Ciccarese, A., Ziadi, T., Ambrico, A., and Mancini, L. 2007. Seed disinfestation by ozone treatments. In *Proceedings of the IOA Conference and Exhibition*.

Cieslik, E. and Sikora, E. 1998. Correlation between the levels of nitrates and nitrites and the contents of potassium, calcium and magnesium in potato tubers. *Food Chemistry*. 63: 525–528.

Codex Alimentarius Commission (CAC). 2003. Recommended International code of Practice General Principles of Food Hygiene. CAC/RCP1-1969.

Cole, J.A. and Wimpenny, J.W.T. 1969. Metabolic pathways for nitrate in *Escherichia coli*. *Biochimia and Biophisica Acta.* 131: 39-47.

Concellón, A., Añón, M.C., and Chaves, A.R. 2007. Effect of low temperature storage on physical and physiological characteristics of eggplant fruit (*Solanum melongena L.*). *LWT*. 40:389-396.

Cooley, M.B., Chao, D., and Mandrell, R.E. 2006. *Escherichia coli* O157:H7 survival and growth on lettuce is altered by the presence of ephiphytic bacteria. *Journal of Food Protection.* 69: 2329-2335.

Coombs, J., Hall, D.O., Long, S.P. and Scurlock, J.M.O. 1985. Chlorophyll determination. *In Techniques in Bioproductivity and Photosynthesis*. 2nd ed. Pergamon Press.

Cornelissen, J.H.C., Lavorel, S., Garnier, E., Diaz, S., Buchmann, N., Gurvich, D.E., and Poorter, H. 2003. A handbook of protocols for standardised and easy measurement of plant functional traits worldwide. *Australian Journal of Botany.* 51(4): 335-380.

Corre, W.J. and Breimer, I. 1979. *Nitrate and Nitrite in Vegetables*. Wagheningen: Centre for Agricultural Publishing and Documentation.

Coseteng, M.Y., and Lee, C.Y. 2006. Changes in apple polyphenoloxidase and polyphenol concentrations in relation to degree of browning. *Journal of Food Science*. 52(4): 985-989.

Custic M., Poljak M., Coga L., Cosic T., Toth N., and Pecina M. 2003. The influence of organic and mineral fertilization nutrient status, nitrate accumulation, and yield of head chicory. *Plant Soil Environment*. 49: 218–222.

Dadzie, B.K. and Orchad, J.E. 1997. Routine post-harvest screening of banana/plantation hybrids: criteria and method. In : *Inibap Technical Guidelines.* International Plant Genetic Resources Institute.

Dallaire, R., Vasseur, L., Leblanc, D.I., Tranchant, C.C., and Delaquis, P. 2006. A methodological approach for assessing the microbial contamination of fresh produce from harvest to retail. *Food Protection Trends*. 2: 218-225.

Dangour, A.D., Dodhia, S.K., Hayter, A., Allen, E., Lock, K., and Uauy, R. 2009. Nutritional quality of organic foods: a systematic review. *American Journal Clinical Nutrition.* 90**:** 680–685.

Dapoigny, L., Tourdonnet, S.D., Roger-Estrade, J., Jeuffroy, M.H., Fluery, A. 2000. Effect of nitrogen nutrition on growth and nitrate accumulation in lettuce (*Lactuca sativa* L.) under various conditions of radiation and temperature. *Agronomy*. 20: 843–855.

Das, E.G., Gurakan, C., and Bayindirh, A. 2006. Effect of controlled atmosphere storage, modified atmosphere packaging and gaseous ozone treatment on the survival of *Salmonella* Enteritidis on cherry tomatoes. *Food Microbiology.* 23: 430-438.

Davey, M. R., Anthony, P., Van Hooff, P., Power, J. B., & Lowe, K. C. (2007). Lettuce. In *Transgenic Crops IV* (pp. 221-249). Springer Berlin Heidelberg.

De Martin, S. and Restani, P. 2003. Determination of nitrates by a novel ion chromatographic method: Occurrence in leafy vegetables (organic and conventional) and exposure assessment for Italian consumers. *Food Additives and contaminants*. 20 (9): 787-792.

De Meulenaer, B. 2006. Chemical hazards. *Safety In The Agri-Food Chain* (pp. 145). Vancouver: Wageningen Academic Publishers.

Debevere, J. 1996. Criteria en praktischemethodenvoor de bepal-ing van de houdbaarheidsdatum in de etikettering. Etikettering, houdbaarheid en bewaring (voedingsmiddelen en recht 2) (pp. 37– 64). Die Keure: Brugge.

DeEll, J. R., Khanizadeh, S., Saad, F., and Ferree, D. C. 2001. Factors affecting apple fruit firmness-a review. *Journal-American Pomological Society. 55:* 8-26.

Delhon P., Gojon A., Tillard P., and Passama L. 1995a. Diurnal regulation of nitrate uptake in soybean plants. I. Changes in NO_3 influx, efflux, and N utilization in the plant during the day/night cycle. *Journal Experimental Botany*. 46: 1585–1594.

Dich, J., Järvinen, R., Knekt, P., and Penttilä, P.L. 1996. Dietary intakes of nitrate, nitrite and NDMA in the Finnish Mobile Clinic Health Examination Survey. *Food Additives and contaminants*. 13: 541-552.

DOA. 2010. Keluasan dan pengeluaran sayur-sayuran Malaysia mengikut jenis, 2006-2010.http://www.doa.gov.my/c/document_library/get_file?uuid=79345201-5f7e-4a4d-a1af-638f8d01a0f5&groupId=455778. Retrieved 13 December 2012.

Dontorou, C., Papadopoulou, C., Filioussis, G., Economou, V., Apostolou, I., Zakkas, G., Salamoura, A., Kansouzidou, A. and Levidiotou, S. 2003. Isolation of *Escherichia coli* O157:H7 form foods in Greece. *International Journal of Food Microbiology*. 82: 273-279.

Dosti, B. 1998. *Effectiveness of ozone, heat and chlorine for destroying common food spoilage bacteria in synthetic media and biofilms*. Clemson Universtiy: Clemson.

Doyle, M.P., Erickson, M.C., 2008. Summer meeting 2007. The problems with fresh produce: an overview. *Journal Application Microbiology*. 105: 317-330.

Dröge, W. 2002. Free radicals in the physiological control of cell function. *Physiological reviews*. 82(1): 47-95.

Duthie, G.G., Duthie S.J., and Kyle J.A.M. 2000. Plant polyphenols in cancer and heart disease: implications as nutritional antioxidants. *Nutrition Research Reviews*. 13: 79–106.

EFSA. 2008. Opinion of the Scientific Panel on Contaminants in Food Chain on a request from the European Commission to perform a scientific risk assessment on nitrate in vegetables. *The EFSA Journal 2008*. 69: 1-79.

Eichholzer, M., and Gutzwiller, F. 2003. *Dietary nitrates, nitrites, and N-nitroso compounds and cancer risk with special emphasis on the epidemiological evidence*. In: D'Mello JPF, editor. Food Safety. Contaminants and Toxins (pp. 271). UK: CABI Publishing.

Elia, A., Conversa, G. and Gonnella, M. 2000. *Dosi di azoto, produzione e accumulo di nitrati di lattuga allevata in idrocoltura* (pp. 229–230). Atti V Giornate Scientifiche SOI: Sirmione.

Elzebroek, A.T.G., and Wind, K. 2008. *Guide to cultivated plants* (pp 368-371). UK: CABI publishing.

Erickson, M.C., Webb, C.C., Diaz-Perez, J.C., Phatak, S.C., Silvoy, J.J., Davey, L., Payton, A.S., Liao, J., Ma, L., and Doyle, M.P. 2010. Infrequent internalization of *Escherichia coli* O157:H7 into field-grown leafy greens. *Journal Food Protection*. 73: 500-506.

Ernst, D., Schraudner, M., Langebartels, C., and Sandermann, H. Jr. 1992. Ozone-induced changes of mRNA levels of b-1.3-glucannase, chitinase and phatogenesis-related protein 1 b in tobacco plants. *Plant Molecular Biology*. 20: 673-682.

Escobar-Gutierrez, A.J., Burns, I.G., Lee, A., and Edmondson, R.N. 2002. Screening lettuce cultivars for low nitrate content during summer and winter production. *Journal of horticultural science and biotechnology*. 77(2): 232-237.

Escriche, I., Serra, J.A., Go´ mez, M. and Galotto, M.J. 2001. Effect of ozone treatment and storage temperature on physicochemical properties of mushrooms (*Agaris bisporus*). *Food Science and Technology International*. 7: 251–258.

EU Scientific Committee for Food. 1995. Opinion on nitrate and nitrite. Expressed on 22 September 1995. European Commission DG III, Brussels. Annex 4 to document III/56/95, CS/CNTM/NO3/20-FINAL. Brussels: European Commission DG III.

Everaarts, A.P., and Blom-Zandstra, M. 2001. Internal tipburn of cabbage (*Brassica oleracea* var. *capitata*) Review Article. *Journal Horticulture Science Biotechnology*. 76(5):515–521.

FAO. 2010. Food and Agriculture Organization of the United Nations. http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor. Retrieved 24 March 2012.

FAO/WHO. 1997. Codex Alimentarius Food Hygiene Basic Texts. Joint FAO/WHO Food Standards Programme. Codex Alimentarius Commission Publication.

FAO/WHO. 1998. Surface decontamination of fruits and vegetables eaten raw: a review. World Health Organisation WHO/FSF/FOS/98.2. Prepared by L. Beuchat. http://www.who.int/foodsafety/publications/fs_management/surfac_decon/en/. Retrieved 6 September 2012.

FAO/WHO. 2001. *Codex Alimentarius: General requirements (Food hygiene). Volume 1B* (Vol. 1). FAO.

Ferrante, A., and Maggiore, T., 2007. Chlorophyll a fluorescence measurements to evaluate storage time and temperature of Valeriana leafy vegetables. *Postharvest Biology Technology*. 45: 73–80.

Ferrante, A., Incrocci, L., Maggini, R., Serra, G., and Tognoni, F. 2004. Colour changes of freshly-cut leafy vegetables during storage. *Journal Food Agriculture Environment*. 2: 40-44.

Ferrari, T.E., Yoder, O.C. and Filner, D. 1973. Anaerobic nitrite production by plant cells and tissues: evidence for two nitrate pools. *Plant Physiology*. 51: 423–431.

Fett, W.E. 2000. Naturally occurring biofilms on alfalfa and other types of sprouts. *Journal of Food Protection*. 63: 625–632.

Fillion, L. and Kilcast, D. 2002. Consumer perception of crispiness and crunchiness in fruits and vegetables. *Food Quality and Preference*. 13: 23-29.

Florkowski, W.J., Prussia, S.E., Shewfelt, R.L., and Brueckner, B. (Eds.). 2009. *Postharvest handling: A systems approach*. UK: Academic Press.

Food, U.S. 2006. Drug Administration (1998) Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables. *Center for Food Safety and Applied Nutrition. Washington, DC.*

Forney, C.F., Song, J., Fan, L., Hildebrand, P.D., and Jordan, M.A. 2003. Ozone and 1-methylcyclopropene alter the postharvest quality of broccoli. *Journal of the American Society for Horticultural Science*. 128(3): 403-408.

Foyer, C.H., and Noctor, G. 2005. Oxidant and antioxidant signalling in plants: a re-evaluation of the concept of oxidative stress in a physiological context. *Plant, Cell and Environment*. 28(8): 1056-1071.

Francis, G.A, and O'Beirne, O. 2001. Effects of vegetable type, package atmosphere and storage temperature on growth and survival of *Escherichia* coli O157:H7 and *Listeria monocytogenes*. *Journal Industry Microbiology Biotechnology*. 27:111–6.

Francis, G.A., and O'Beirne, D. 1999. Effects of gas atmosphere, antimicrobial dip and temperature on the fate of *Listeria innocua* and *Listeria monocytogenes* on minimally processed lettuce. *International Journal Food Science Technology.* 32:141–51.

Frantz, J.M., Ritchie, G., Cometti, N.N., Robinson, J., and Bugbee, B. 2004. Exploring the limits of crop productivity. Beyond the limits of tipburn in lettuce. *Journal American Society Horticulture Science.* 129(3): 331–338.

Funn Bruning, S., 1991. The effects of nitrate, nitrite and nitros compounds on human health: are views. *Veterinary and Human Toxicology.* 35: 521-538.

Fytianos, K., and Zarogiannis, P. 1999. Nitrate and nitrite accumulation in fresh vegetables from Greece. *Bulletin of environmental contamination and toxicology*. 62(2): 187-192.

Gabler, F.M., Smilanick, J. L., Mansour, M.F., and Karaca, H. 2010. Influence of fumigation with high concentrations of ozone gas on postharvest gray mold and fungicide residues on table grapes. *Postharvest biology and technology. 55*(2): 85-90.

Garcia, A., Mount, J.R., and Davidson. P.M. 2003. Ozone and chlorine treatment of minimally processed lettuce. *Journal Food Science.* 68: 2747-2751.

García, J.M., Castellano, J.M., Nadas, A., and Olías, J.M. 1998. Effect of ozone on citrus storage. Pages 237-241 in: Proc. COST 914-COST 915. Workshop: Non-Conventional Methods for the Control of Postharvest Disease and Microbial Spoilage. October 9-11, Bologna, Italy.

García-Viguera, C., and Bridle, P. 1999. Influence of structure on colour stability of anthocyanins and flavylium salts with ascorbic acid. *Food Chemistry.* 64(1): 21-26.

Gennaro, L., and Quaglia, G.B. 2002. Food safety and nutritional quality of organic vegetables. In**:** *6th International Symposium on Protected Cultivation in Mild Winter Climate,* pp. 675–680.

Gent, M.P. 2003. Solution electrical conductivity and ratio of nitrate to other nutrients affect accumulation of nitrate in hydroponic lettuce. *Horticulture Science.* 38(2): 222-227.

Geransayeh, M., Mostofi, Y., Abdossi, V., and Ali Nejatian, M. 2011. Effects of Ozonated Water on Storage Life and Postharvest Quality of Iranian Table Grape (cv. Bidaneh Qermez). *Journal Of Agricultural Science.* 4(2): 31.

Gianquinto, G.P., Borin, M. and Scaife, A. 1992. Nitrate content in vegetable crops as affected by soil characteristics, rate and type of fertilization. In: *Proceedings of the 2nd Congress of the European Society for Agronomy*, pp. 256–257.

Gonzalez-Aguilar, G., Wang, C.Y. and Buta, G.J. 2004. UV-C irradiation reduces breakdown and chilling injury of peaches during cold storage. *Journal of Science and Food Agric*ulture. 84(5): 415-422.

Gorny, J.R. 2006. Microbial contamination of fresh fruits and vegetables. In : Sapers, G.M., Gorny, J.R. and Yousef A.E. (Eds). *Microbiology of Fruits and Vegetables* (pp. 3-32). USA: CRC Press.

Greenwood, D.J. and Hunt, J. 1986. Effect of nitrogen fertilizer on the nitrate contents of field vegetables grown in Britain. *Journal of the Science of Food and Agriculture.* 37: 373-383.

Griffin, P.M., and Tauxe, R.V. 1991. The epidemiology of infections caused by *Escherichia coli* O157: H7, other enterohemorrhagic *E. coli*, and the associated hemolytic uremic syndrome. *Epidemiologic reviews*. 13(1): 60-98.

Gross, K.C., Wang, C.Y., and Saltveit, M., 2002. The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Crops. Agriculture Handbook: USDA.

Gruda, N. 2005. Impact of environmental factors on product quality of greenhouse vegetables for fresh consumption. *Critical reviews in plant sciences*. 24(3): 227-247.

D. and Baranski R. 2001. Identification of accessions showing low nitrate accumulation in a germplasm collection of garden beet. *Acta Horticulturae.* 563: 253–255.

Gunes, A., Post, W.H.K. and Aktas, M. 1995. Effect of partial replacement of nitrate by NH4-N, urea-N and amino acid-N in nutrient solution on nitrate accumulation in lettuce (*Lactuca sativa L.*). *Agrochimica*. 39: 326–333.

Guo, X., Chen, J., Brackett, R.E., and Beuchat, L.R. 2002. Survival of Salmonella on tomatoes stored at high relative humidity, in soil, and on tomatoes in contact with soil. *Journal Food Protection*. 65: 274-279.

Guzel-Seydim, Z.B. 1996. *The use of ozonated water as a cleaning agent in dairy processing equipment*. Unpublished doctoral dissertation, Clemson University, USA.

Halliwell, B., Murcia, M.A., Chirico, S., and Aruoma O.I. 1995. Free radicals and antioxidants in food and in vivo: what they do and how they work. *Critical Reviews in Food Science and Nutrition*. 35: 7–120.

Hammoudi, A., Hoffmann, R., and Surry, Y. 2009. Food safety standards and agri-food supply chains: an introductory overview. *European Review of Agricultural Economics*. 36(4): 469-478.

Harada H., Yoshimura Y., Sunaga Y., Hatanaka T., and Sugita S. 2003. Breeding of Italian ryegrass (*Lolium multiflorum* Lam.) for a low nitrate concentration by seedling test. *Euphytica*. 129: 201–209.

Harborne, J.B. 1999. The comparative biochemistry of phytoalexin induction in plants. *Biochemical Systematics Ecology*. 27: 335–367.

Harker, F.R., Redgwell, R.J., Hallett, I.C., Murray, S.H., and Carter, G., 1997. Texture of fresh fruit. *Horticulture Review*. 20: 121–224.

Harlan, J.R. 1986. Lettuce and the sycomore: sex and romance in ancient Egypt. *Economic Botany*. 40(1): 4-15.

Harris, J.R. 1996. *Ascorbic Acid: Biochemistry and Biochemical Cell Biology* (Vol. 25). Springer.

Harrison J., Hirel B., and Limani A.M. 2004. Variation in nitrate uptake and assimilation between two ecotypes of *Lotus japonicas* and their recombinant inbred lines, *Physiology Plant*. 120: 124–131.

Hassenberg, K., Idler, C., Molloy, E., Geyer, M., Plochl, M., and Barnes, J. 2007. Use of ozone in a lettuce-washing process: an industrial trial. *Journal of the Science of Food and Agriculture*. 87: 914–919.

Heaton, J.W., and Marangoni, A.G. 1996. Chlorophyll degradation in processed foods and senescent plant tissues. *Trends Food Science Technology*. 7: 8–15.

Heaton, S. 2001. *Organic farming, food quality and human health: A review of the evidence*. United Kingdom: Soil Association.

Hewett, E.W. 2006. An overview of preharvest factors influencing postharvest quality of horticultural products. *International Journal Postharvest Technology Innovation*: 1(1): 4–15.

Hill, A.G., and Rice R.G. 1982. Historical background, properties and applications. In R. G. Rice (Ed.), Ozone treatment of water for cooling application, pp. 1–37. Ann Arbor, MI: Ann Arbor Science Publishers.

Hillborn, E.D., Mermin, J.H., Mshar, P.A., Hadler, J.L., Voetsch, A., Hojtkunski, C., Swartz, M., Mshar, R., Lambert-Fair, M.A., Farrar, J.A., Glynn, M.K. and Slutsker, L. 1999. A multistate outbreak of *Escherichia coli* O157:H7 infections associated with consumption of mesclun lettuce. *Archives of Internal Medicine*. 159: 1758-1764.

Himathongkham, S., Bahari, S., Riemann, H., and Cliver, D., 1999. Survival of Escherichia coli O157:H7 and Salmonella typhimurium in cow manure and cow manure slurry. *FEMS Microbiology Letters*. 178: 251-257.

Hochmuth, G.J. 1994. Efficiency ranges for nitrate-nitrogen and potassium for vegetable petiole sap quick tests. *Horticulture Technology*. 4(3): 218-222.

Hodges, D.M. and Toivonen, P.M.A. 2008. Quality of fresh-cut fruits and vegetables as affected by exposure to abiotic stress. *Postharvest Biology Technology*. 48:155–162.

Hoigné, J., and Bader, H. 1983. Rate constants of reactions of ozone with organic and inorganic compounds in water—II: dissociating organic compounds. *Water Research*. 17(2): 185-194.

Hollman, P.C., and Katan, M.B. 1997. Absorption, metabolism and health effects of dietary flavonoids in man. *Biomedicine and Pharmacotherapy*. 51: 305–310.

Hong, J.H., Mills, D.J., Coffman, C.B., Anderson, J.D., Camp, M.J., and Gross, K.C., 2000. Tomato cultivation systems affect subsequent quality of fresh-cut fruit slices. *Journal Am Social Horticultural Science*. 125: 729–735.

Hopkins, W.G., and Hüner, N.P. 2008. *Introduction to plant physiology*. 4th ed. (Vol. 503). New York: J. Wiley.

Horvath, M., Bilitzky, L., and Huttner, J. 1985. Ozone (Topics in inorganic and general chemistry, Monograph 20). Amsterdam.

Horvitz, S., and Cantalejo, M. J. 2012. Effects of ozone and chlorine postharvest treatments on quality of fresh-cut red bell peppers. *International Journal of Food Science and Technology*. 47: 1935–1943.

Hu, C.X., Deng, B.E. and Liu, T.C. 1992. Effects of nitrogen fertilizer on nitrate accumulation by the Chinese cabbage (Brossica chinenses) and tomato (*Lycopersicum esculentum*). *Journal Huazhong Agriculture University*. 11: 239–243.

Huarte-Mendicoa, J.C., Astiasaran, I., and Bello, J. 1997. Nitrate and nitrite levels in fresh and frozen broccoli. Effect of freezing and cooking. *Food chemistry*. *58*(1): 39-42.

Hunt, J., and Turner, M.K. 1994. A survey of nitrite concentrations in retail fresh vegetables. *Food Additives and Contaminants*. 11(3): 327-332.

Hussain, P.R., Meena, R.S., Dar, M.A., and Wani, A.M. 2010. Carboxymethyl Cellulose Coating and Low-Dose Gamma Irradiation Improves Storage Quality and Shelf Life of Pear (*Pyrus Communis* L., Cv. Bartlett/William). *Journal of food science*. *75*(9): M586-M596.

Ikemoto, Y., Teraguchi, M. and Kogayashi, Y. 2002. Plasma level of nitrate in congenital heart disease: comparison with healthy children. *Pediatric Cardiol*ogy. 23: 132–136.

Ikeura, H., Kobayashi, F., and Tamaki, M. 2011. Removal of residual pesticide, fenitrothion, in vegetables by using ozone microbubbles generated by different methods. *Journal of Food Engineering*. 103: 345-349.

Inal A., and Tarakcioglu C. 2001. Effects of nitrogen forms on growth, nitrate accumulation, membrane permeability, and nitrogen use efficiency of hydroponically grown bunch onion under boron deficiency and toxicity. *Journal Plant Nutrition* 24: 1521–1534.

Institute of Food Technologists (IFT). 2002. *Emerging microbiological food safety issues: Implication for control in the 21st century*. Chicago: IFT.

Ishiwata, H., Yamada, T., Yoshiike, N., Nishijima, M., Kawamoto, A., and Uyama, Y. 2002. Daily intake of food additives in Japan in five age groups estimated by the market basket method. *European Food Research Technology*. 215: 367–374.

Islam, M., Doyle, M.P., Phatak, S.C., Millner, P., and Jiang, X. 2004a. Persistence of enterohemorrhagic *Escherichia coli* O157, H7 in soil and on leaf lettuce and parsley grown in fields treated with contaminated manure composts or irrigation water. *Journal of Food Science.* 67: 1365–1370.

Islam, M., Morgan, J., Doyle, M.P., Phatak, S.C., Millner P., and Jiang, X. 2004b. Persistence of *Salmonella enterica* serovar Typhimurium on lettuce and parsley and in soils on which they were grown in fields treated with contaminated manure composts or irrigation water. *Foodborne Pathogens and Disease*. 1: 27–35.

Ivashikina, N.V., and Sokolov, O.A. 1997. Regulation of nitrate uptake and distribution in maize seedlings by nitrate, nitrite, ammonium and glutamate. *Plant Science*. 123(1): 29-37.

Izmailov S.F. 2004. Saturation and utilization of nitrate pools in pea and sugar beet leaves. *Russion Journal of Plant Physiology*. 51: 189–193.

Jacques, M.A. and Morris, C.E. 1995. Bacterial population dynamics and decay on leaves of different ages of ready-to-use broad-leaved endive. *International Journal Food Science Technology.* 30: 221–236.

Jacxsens, L., Devlieghere, F., Ragaert, P., Vanneste, E. and Debevere, J. 2003. Relation between microbiological quality, metabolite production and sensory quality of equilibrium modified atmosphere packaged fresh-cut produce. *International Journal of Food Microbiology.* 83: 263–280.

Jay, J.M., Loessner, M.J., and Golden, D.A. 2005. *Modern food microbiology*, 7th ed. New York: Springer.

Jia, H.J., Mizuguchi, K., Hirano, K., and Okamoto, G. 2006. Effect of fertilizer application level on the pectin composition of Hakuho peach (*Prunus persica* Batsch) during maturation. *HortScience.* 41(7)1571-1575.

Johannessen, G.S., Loncarevic, S. and Kruse, H. 2002. Bacteriological analysis of fresh produce in Norway. *International Journal of Food Microbiology*. 77: 199-204.

Jol, S., Kassianenko, A., Wszol, K., and Oggel, J. 2006. Issues in time and temperature abuse of refrigerated foods. *Food Safety*. 11(6): 30-32.

Jore, L. 2012. Revised from *Commodity Profile: Lettuce*. Boriss, H., and Brunke, H. 2005. Economics, University of Minnesota.

Kader A. 2002. Chapter 2: quality parameters of fresh-cut fruit and vegetable products. In: Lamikanra O, editor. *Fresh-cut fruits and vegetables-science, technology and market* (pp. 11–20). Boca Raton: CRC Press.

Kader, A.A. 2005. Increasing food availability by reducing postharvest losses of fresh produce. *Acta Horticulturae*. 682: 2169–2176.

Kader, A.A. 2008. Flavor quality of fruits and vegetables. *Journal Science Food and Agriculture*. 88: 1863-1868.

Kaneko, K., Hayashidani, H., Takahashi, K., Shiraki, Y., Lim a-wongpranee, S. and Ogawa, M. 1999. Bacterial contamination in the environment of food factories processing ready-to-eat fresh vegetables. *Journal Food Protection*. 62: 800–804.

Kangasja¨rvi, J., Talvinen, J., Utriainen, M., and Karjalainen, R., 1994. Plant defence systems induced by ozone. *Plant Cell and Environment.* 17: 783-794.

Kaper, J.B., Nataro, J.P., and Mobley, H.L. 2004. Pathogenic *Escherichia coli*. Nature. *Review Microbiology*. 2: 123–140.

Karioti, A., D. Hadjipavlou-Litina, M.L.K. Mensah, T.C. Fleischer and H. Skaltsa, 2004. Composition and antioxidant activity of the essential oils of *Xylopia aethiopica* (Dun) A. Rich. (Annonaceae) leaves, stem bark, root bark and fresh and dried fruits, growing in Ghana. *Journal of Agriculture Food Chemistry*. 52: 8094-8098.

Katz, S.H., and Weaver, W.W. (Eds.). 2003. *Encyclopedia of Food and Culture: Obesity to Zoroastrianism. Index* (Vol. 3). Macmillan Reference USA.

Keutgen, A. J., and Pawelzik, E. 2008. Influence of pre-harvest ozone exposure on quality of strawberry fruit under simulated retail conditions. *Postharvest Biology and Technology* 49: 10−18.

Khadre, M. A., and Yousef, A. E. 2001a. Sporicidal action of ozone and hydrogen peroxide: A comparative study. *International Journal of Food Microbiology*. 71(2-3): 131–138.

Khadre, M.A., Yousef, A.E., and Kim, J.G. 2001b. Microbiological aspects of ozone application in foods: a review, *Journal of Food Science*. 66(9): 1242-1252.

Khan, M.R., Saha, M.L. and Kibria, A.H.M.G. 1994. A bacteriological survey of ready to eat salad with special reference to coliform and non-lactose fermenters. *Bangladesh Journal Botany*. 23: 47–51.

Kim, J.G., Yousef, A.E., and Chism, G.W. 1999a. Use of ozone to inactivate microorganisms on lettuce. *Journal of Food Safety*. 19: 17-34.

Knobeloch L., Salna B., Hogan A., Postle J., and Anderson H. 2000. Blue babies and nitrate-contaminated well water, Environ. *Health Perspective*. 108: 675–678.

Koike, S.T., Gladders, P., and Paulus, A.O. 2007. *Vegetable diseases: a color handbook*. UK: Academic Press.

Konstantopoulou, E., Kapotis, G., Salachas, G., Petropoulos, S. A., Chatzieustratiou, E., Karapanos, I.C., and Passam, H.C. 2012. Effect of nitrogen application on growth parameters, yield and leaf nitrate content of greenhouse lettuce cultivated during three seasons. *Journal of Plant Nutrition.* 35(8): 1246-1254.

Kordali, S., A. Cakir, A. Mavi, H. Kilic and A. Yildirim, 2005. Screening of chemical composition and antifungal and antioxidant activities of the essential oils from three Turkish Artemisia species. *Journal of Agriculture Food Chemistry*. 53: 1408-1416.

Koseki, S. and S. Isobe. 2006. Effect of ozonated water treatment on microbial control and on browning of iceberg lettuce. *Journal of Food Protection.* 69:154-160.

Kozukue, N., Kozukue, E., Kisguchi, M., and Lee, S. 1978. Studies on keeping-quality of vegetables and fruits III. Cahnges in sugar and organic acid contents accompanying the chilling-injury of eggplant fruits. *Scientia Horticulturae.* 8: 19-26.

Kramchote, S., Srilaong, V., Wongs-Aree, C., and Kanlayanarat, S. 2012. Low temperature storage maintains postharvest quality of cabbage (*Brassica oleraceae* var. capitata L.) in supply chain. *International Food Research Journal*. 19(2): 759-763.

Kross, B.C., 1992. Methemoglobinemia, nitrate toxicity in rural America. *American Family Physician.* 46:183-188.

Kute, K.M., Zhou, C., and Barth, M.M. 1995. Effect of ozone exposure on total ascorbic acid activity and soluble solids content in strawberry tissue. In *Institute of Food Technologist Annual Meeting, libro de resúmenes*, pp. 82.

Lairon, D. 2010. Nutritional quality and safety of organic food. A review. *Agronomic Sustainable Development*. 30**:** 33–41.

Lamikanra, O., Imam, S.H., and Ukuku, D.O. (Eds.). 2005. *Produce degradation: pathways and prevention*. UK: CRC Press.

Lampkin, N. 1990. *Organic farming*. Farming press books. Ipswich: United Kingdom.

Lang, N.L., Smith, S.R., 2007. Influence of soil type, moisture content and biosolids application on the fate of Escherichia coli in agricultural soil under controlled laboratory conditions. *Journal Application Microbiology.* 103: 2122-2131.

Larson, R.A. 1995. Plant defenses against oxidative stress. *Archieves of Insect Biochemistry and Physiology.* 29: 175-186.

Las Hojas, C.D.N.E. 2009. Response of hydroponic lettuce cultivars to different treatments of nitrogen: growth and foliar nitrate content. *IDESIA (Chile).* 27(1): 83-89.

Leclerc, J., Miller, M.L., Joliet, E. and Rocquelin, G. 1991. Vitamin and mineral contents of carrot and celeriac grown under mineral or organic fertilization. *Biological Agriculture and Horticulture.* 7(4): 339-348.

Lentz, C.P. 1963. Temperature, air movement and moisture loss in fresh fruit and vegetable storage. Proc.11th Intl Cong. Refrig. Munich. 2:1169-1179.

Lewis, L., Zhuang, H., Payne, F.A., Barth, M.M. 1996. Beta-carotene Content and Color Assessment in Ozone-treated Broccoli Florets During Modified Atmosphere Packaging. In *1996 IFT Annual Meeting Book of Abstracts.* Institute of Food Technologists: Chicago.

Li, Y., Brackett, R.E., Chen, J.R., and Beuchat, L.R. 2001. Survival and growth of *Escherichia coli* O157:H7 inoculated onto cut lettuce before or after heating in chlorinated water, followed by storage at 5 or 15◦C. *Journal Food Protection.* 64:305–9.

Liew, C.L., and Prange, R.K. 1994. Effect of ozone and storage temperature on postharvest diseases and physiology of carrots (*Daucus carota* L.). *Journal of the American Society for Horticultural Science.* 119(3): 563-567.

Liu, R.H. 2003. Health benefits of fruit and vegetables are from additive and synergistic combinations of phytochemicals. *American Journal. Clinical Nutrition.* 78:517S-520S.

Liu, X., Ardo, S., Bunning, M., Parry, J., Zhou, K., Cecil Stushnoff, C., Stoniker, F., Yu, L. and Kendall, P. 2007. Total phenolic content and DPPH radical scavenging activity of lettuce (*Lactuca sativa* L.) grown in Colorado. *LWT* 40: 552-557.

Luning, P. A., Devlieghere, F., and Verhé, R. 2006. *Safety in the agri-food chain*. Wageningen: Academic Publication.

Luo, J., Lion, Z. and Yan, X. 1993. Urea transformation and the adaptability of three leafy vegetables to urea as a source of nitrogen in hydroponic culture. *Journal Plant Nutrition* 16: 797–812.

Lynch, M. 2007. *Escherichia coli* O157:H7 outbreaks due to raw leafy green vegetables. Memorandum by the US Center of Disease Control and Prevention.

Maga, J.A., Moore, F.D. and Oshima, N. 1976. Yield, nitrate levels and sensory properties of spinach as influenced by organic and mineral nitrogen fertilizer levels. *Journal Science of Food and Agriculture.* 27: 109-114.

Magkos, F., Arvaniti, F., and Zampelas, A. 2003. Organic food: nutritious food or food for thought? A review of the evidence. *International Journal Food Science Nutrition*. 54**:**357–371.

Maguire, K.M., Banks, N.H., and Opara, L.U. 2001. Factors affecting weight loss of apples. *Horticultural Reviews.* 25: 197-234.

Majchrowicz, A. 1998. *Food safety technology: a potential role for ozone? Agricultural Outlook, Economic Research Service* (pp. 13–15). USDA.

Manning, K. 1993. Soft fruit. In *Biochemistry of Fruit Ripening,* ed. G.B. Seymor, J.E. Taylor and G.A. Tucker (pp 347-377). London: Chapman and Hall.

Marschner, H. 1999. *Mineral Nutrition of Higher Plants* (pp. 229–312). Academic Press, London.

Martı´nez-Sa´ nchez, A., Allende, A., Bennett, R.N., Ferreres, F. and Gil, M.I. 2006. Microbial, nutritional and sensory quality of rocket leaves as affected by different sanitizers. *Postharvest Biology and Technology.* 42: 86–97.

Martin, P.N. 2011. Composition of salad greens: A comparison of locally-grown and supermarket produce. In Bulletin 1032, Department of Forestry and Horticulture, New Haven.

Matile, P., Ortensteiner S.H. and Thomas, H. 1999. Chlorophyll degradation. Annu. Rev. Plant Physiol. *Plant Molecular Biology.* 50: 67–95.

Matt, P., Krapp, A., Haake, V., Mock, H.P., and Stitt, M. 2002. Decreased Rubisco activity leads to dramatic changes of nitrate metabolism, amino acid metabolism and the levels of phenylpropanoids and nicotine in tobacco antisense RBCS transformants. *The Plant Journal*. 30(6): 663-677.

Mattila, P., Hellstrom, J., and Torronen, R. 2006. Phenolic acids in berries, fruits, and beverages. *Journal Agriculture Food Chemistry.* 54: 7193–7199.

Maynard, D.N., Barker, A.V., Minotti, P.L. and Peck, N.H. 1976. Nitrate accumulation in vegetables. *Advances in Agronomy.* 28: 71–118.

McCall, D., and Willumsen, J. 1998. Effects of nitrate, ammonium and chloride application on the yield and nitrate content of soil-grown lettuce. *Journal Horticulture Science Biotechnology.* 73: 698–703.

McFeeters, R.F., Chichester, C.O. and Whitaker, J.R. 1971. Purification and properties of chlorophyllase from *Ailanthus altissima* (Tree-of-Heaven). *Plant Physiology* 47: 609–618.

Meah, M.N., Harrison N. and Davis, A. 1994. Nitrate and nitrite in foods and the diet. *Food Additives Contamination.* 11: 519–532.

Mehlhorn, H., Tabner, B.J., and Wellburn, A.R. 1990. Electron spin resonance evidence for the formation of free radicals in plants exposed to ozone. *Nature.* 327: 417–418.

Mensinga, T.T., Speijers, G.J., and Meulenbelt, J. 2003. Health implications of exposure to environmental nitrogenous compounds. *Toxicological reviews*. *22*(1): 41-51.

Michael, T.M., Mduduzi, M.H., Olusegun, T.O., and Thokozile, E.S. 2010. Effects of organic fertilizers on growth, yield, quality and sensory evaluation of red lettuce (*Lactuca sativa* L.) 'Veneza Roxa'. *Agriculture and Biology Journal of North America.* 1(6): 2151- 7525.

Midmore, D.J. and Jansen, H.G.P. 2003. Supplying vegetables to Asian cities: Is there a case for peri-urban production?. *Food Policy.* 28(1):13–27.

Miller, A.J. and Smith, S.J. 1996. Nitrate transport and compartmentation in cereal root cells. *Journal of Experimental Botany* 47: 843–854.

Moreira, M.D.R., Roura, S.I., and del Valle, C.E. 2003. Quality of Swiss chard produced by conventional and organic methods. *LWT-Food Science and Technology*. *36*(1): 135-141.

Muramatsu, N., Takahara, T., Kojima, K., Ogata, T. 1996. Relationship between texture and cell wall polysaccharides of fruit flesh in various species of Citrus. *HortScience.* 31(1): 29-57.

Muramoto, J. 1999. *Comparison of nitrate content in leafy vegetables from organic and conventional farms in California*. Rev. Version. Center for Agroecology and Sustainable Food Systems University of California, pp. 1-64. Santa Cruz.

Murphy, M.T., Zhang, F., Nakamura, Y.K., and Omaye, S.T. 2011. Comparison between Hydroponically and Conventionally and Organically Grown Lettuces for Taste, Odor, Visual Quality and Texture: A Pilot Study. *Food and Nutrition.* 2: 124-127.

Mustafa, M.G. 1990. Biochemical basis of ozone toxicity. *Free Radical Biology and Medicine.* 9: 245–265.

NAAS. 2005. Policy options for efficient nitrogen use. Policy Paper No. 33, National Academy of Agricultural Sciences, pp. 1–4. New Delhi.

Nadas A, Olmo M, Mart´ınez MC, and Garc´ıa JM. 2000. El ozono en la conservaci´on de los c´ıtricos. *Levante agr´ıcola*. 352:251–8.

Nadas, A., Olmo, M., and Garcia, J.M. 2003. Growth of Botrytis cinerea and Strawberry Quality in Ozone enriched Atmospheres. *Journal of food science*. 68(5): 1798-1802.

Nam, S., Kwon, Y., 1999. Quality changes of hydroponically produced leaf lettuce (L. sativa L., cv. cheongchima) during postharvest storage. *Acta Horticulturae.* 483: 173–184.

Narciso, J., and Plotto, A. 2006. A comparison of sanitation systems for fresh-cut mango. *HortTechnology*. 15: 837–842.

Natvig, E.E., Ingham, S.C., Ingham, B.H., Cooperband, L.R., and Roper, T.R. 2002. *Salmonella enterica* serovar Typhimurium and *Escherichia coli* contamination of root and leaf vegetables grown in soils with incorporated bovine manure. *Applied and Environmental Microbiology*. 68: 2737–2744.

Nazaryuk, V.M., Klenova, M.I., and Kalimullina, F.R. 2002. Ecoagrochemical approaches to the problem of nitrate pollution in agroecosystems. *Russian Journal of Ecology*. 33(6): 392-397.

Nguyen-the, C. and Carlin, F. 1994. The microbiology of minimally processed fresh fruits and vegetables. CRC Crit. Rev. *Food Science Nutrition.* 34: 371–401.

Nortan, J.S., Charig, A.J., and Demoranville, I.E. 1965. The effect of ozone on storage of cranberries. *Journal American Social Horticultural Science* 93: 792-796.

Nosengo N. 2003. Fertilized to death. *Natur.e* 425: 894–895.

Nunes, M.C.N., and Emond, J.P. 2003. Quality curves for Witloof Chicory as a Function of the Storage Temperature. Scientific report presented to Envirotainer, Sweeden by the Air Cargo Transportation Research Group, university Laval, Quebec, Canada.

Nunes, M.D.N., and Nunes, N. 2009. Color atlas of postharvest quality of fruits and vegetables. *Color atlas of postharvest quality of fruits and vegetables*. John Wiley & Sons.

Ogawa, J.M., Feliciano, A.J. and Manji, B.T. 1990. Evaluation of ozone as a disinfectant in postharvest dump tank treatment for tomato. *Phytopathology. 80*: 1020.

Olaimat, A.N., and Holley, R.A. 2012. Factors influencing the microbial safety of fresh produce: A review. *Food Microbiology*.

Oliveira, M., Viñas, I., Anguera, M., and Abadias, M. 2011. Fate of *Listeria monocytogenes* and *Escherichia coli* O157: H7 in the presence of natural background microbiota on conventional and organic lettuce. *Food Control.* 25(2): 678-683.

Ozone Solutions. 2012. Corona discharge versus UV-light. Availabe at: http://www.ozoneapplications.com/info/cd_vs_uv.html Retrieved 20 November 2012.

Oztekin, S., Zorlugenc, B., Zorlugenc, F.K. 2005. Effects of Ozone Treatment on Microflora of Dried Figs. *Journal of Food Engineering.* 75 (3): 396–399.

Palou, L., Crisosto, C.H., Smilaneck, J.L., Adaskaveg, J.E., and Zoffoli, J.P. 2002. Effects of continuous 0.3 ppm ozone exposure on decay development and physiological responses of peaches and table grapes in cold storage. *Postharvest Biology Technology.* 24:39-48.

Palou, L., Smilanick, J.L., and Margosan, D.A. 2007. *Ozone applications for sanitation and control of postharvest diseases of fresh fruits and vegetables*. In: Recent Advances in Alternative Postharvest Technologies to Control Fungal Diseases in Fruits and Vegetables, R. Troncoso-Rojas, M. Tiznado-Hernandez, A. Gonzalez-Leon (eds). Transworld Research Network, pp. 39–70. Mexico.

Paraskevopoulou-Paroussi, G., and Paroussis, E., 1995: Precocity, plant productivity and fruit quality of strawberry plants grown in soil and soilless culture. *Acta Horticulture.* 408: 109-117.

Paull, R.E., 1999. Effect of temperature and relative humidity on fresh commodity quality. *Postharvest Biology Technology*. 15: 263–277.

Peacock, E., Jacob, V.W., and Fallone, S.M. 2001. Escherichia coli O157: H7: etiology, clinical features, complications, and treatment. *Nephrology Nursing Journal.* 28(5): 547-557.

Peet, M.M. 1999. Greenhouse crop stress management. *Acta Horticulture.* 481: 643– 654.

Perez, A.G., Sanz, C., Rios, J.J., Olias, R., and Olias, J.M. 1999. Effects of ozone treatment on postharvest strawberry quality. *Journal of Agricultural and Food Chemistry*. 47(4): 1652-1656.

Pleijel, H., Eriksen, A.B., Danielsson, H., Bondesson, N., and Selldén, G. 2006. Differential ozone sensitivity in an old and a modern Swedish wheat cultivar—grain yield and quality, leaf chlorophyll and stomatal conductance. *Environmental and Experimental Botany* 56(1): 63-71.

Pollack, S. 2001. *Consumer Demand for Fruit and Vegetables: The U.S. Example: Economic Research Service*. Washington, DC, USA: United States Department of Agriculture.

Poulsen, N., Johansen, A.S., and Sorensen, J.N., 1995. Influence of growth conditions on the value of crisphead lettuce. 4. Quality changes during storage. *Plant Food Human Nutrition.* 47(2): 157–162.

Prange, R., and DeEll, J.R. 1997. Preharvest factors affecting quality of berry crops. *Horticulture Science.* 32: 824–830.

Prudente, A.D., and King, J.M. 2002. Efficacy and Safety Evaluation of Ozonation to Degrade Aflatoxin in Corn. *Journal of Food Science.* 67 (8): 2866–2872.

Pryor, A. and Rice, R.G. 1999. Introduction to the use of ozone in food processing applications. In *Proceedings of the 14th Ozone World Congress.* Dearborn, MI., USA. 22-26 August. Pan American Group, CT.

Ranganna, S. 1977. Manual of analysis of fruits and vegetables products, pp. 135-141, 484-572. New Delhi, India: McGraw Hill Publication Corporation.

Rangel, J.M., Sparling, P.H., Crowe, C., Griffin, P.M. and Swerdlow, D.L., 2005. Epidemiology of *Escherichia coli* O157:H7 outbreaks, United States, 1982–2002. *Emerging Infectious Disease Journal.* 11: 603–609.

Ranieri, A., D'Urso, G., nail, C., Lorenzini, G., and Soldatini, G.F. 1996. Oozne stimulates apoplastic antioxidant systems in pumpkin leaves. *Physiologia Plantarum.* 97: 381-387.

Rappaport, F. and Henig, E. 1952. Media for the isolation and differentiation of pathogenic *Esch. coli* (serotypes O 111 and O 55). *Journal of Clinical Pathology*. 5**(**4):361–362.

Rasmussen, M.A., Cray, W.C., Casey T.A. and Whipp S.C. 1993. Rumen contents as reservoir of enterohemorrhagic *Escherichia coli. FEMS Microbial Letters.* 114: 79-84.

Raupp, J. 1996. Fertilization effects on product quality and ex-amination of parameters and methods for quality assessment, in: Raupp, J. (Eds.), Quality of Plant Products Grown with Manure Fertilization, pp. 44–48. Darmstadt.

Rayner, J., Veeh, R., and Flood, J. 2004. Prevalence of microbial biofilms on selected fresh produce and household surfaces. *International Journal of Food Microbiology.* 95: 29–39.

Reeve, R.M. 2007. Relationships of histological structure to texture of fresh and pro-cessed fruits and vegetables. *Journal Texture Study.* 1(3): 247–284.

Rembialkowska, E. 2007. Quality of plant products from organic agriculture. *Journal Science Food Agriculture.* 87**:** 2757–2762.

Restaino, L., Frampton, E.W., Hemphill, J.B., and Palnikar, P. 1995. Efficacy of ozonated water against various food-related microorganisms. *Applied and Environmental Microbiology.* 61(9): 3471-3475.

Rettke, M.A., Pitt, T.R., Maier, N.A., and Jones, J.A. 2006. Quality of fresh and dried fruit of apricot (cv. Mooprark) in response to soil applied nitrogen. *Australian Journal of Experimental Agriculture.* 46(1):123-129.

Rice, R.G. 1986. Application of ozone in waterand waste water treatment. In R.G. Rice, & M.J. Browning (Eds.), *Analytical of ozone treatment of water and waste water* (pp. 7–26). Syracuse, NY: The Institute.

Rice, R.G., Farguhar, J.W., and Bollyky, L.J. 1982. Review of the applications of ozone for increasing storage times of perishable foods. *Ozone Science and Engineering.* 4: 147–163.

Ridley, J.D., and Sims, E.T. 1967. *The response of peaches to ozone during storage*. South Carolina Agricultural Experiment Station, Clemson University.

Rodgers, S.L., Cash, J.N., Sıddıq, M., Ryser, E.T., 2004. A comparison of different chemical sanitizers for inactivating *Escherichia c*oli O157:H7 and *Listeria monocytogenes* in solution and on apples, lettuce, strawberries and cantaloupe. *Journal of Food Protection.* 67: 721–731.

Rodoni, L., Casadel, N., Concello´ n, A., Chaves, A. and Vicente, A.R. 2010. Effect of short-term ozone treatments on tomato (Solanum lycopersicum L.) fruit quality and cell wall degradation. *Journal of Agricultural and Food Chemistry.* 58: 594–599.

Roura, S.I., Davidovich, L.A., and del Valle, C.E. 2000. Quality loss in minimally processed Swiss chard related to amount of damaged area. *LWT.* 33: 53–59.

Rutherford, G. 2010. http://bioscholars2.wikispaces.com/Biogeochemical+Cycles. Retrieved 17 December 2012.

Ryall, A.L., Lipton, W.J., and Pentzer, W.T. 1982. *Handling, transportation and storage of fruits and vegetables* (2: 1-40). AVI Publishing Company.

Sagoo, S.K., Little, C.L. and Mitchell, R.T. 2001. The microbiological examination of ready-to-eat organic vegetables from retail establishments in the United Kingdom. Letters in *Applied Microbiology.* 33: 434-439.

Saitanis, C.J., Riga-Karandinos, A.N., and Karandinos, M.G. 2001. Effects of ozone on chlorophyll and quantum yield of tobacco (*Nicotiana tabacum* L.) varieties. *Chemosphere.* 42(8): 945-953.

Sakaki, T., Kondo, N., and Sugahara, K. 1983. Breakdown of photosynthetic pigments and lipids in spinach leaves with ozone fumigation: Role of active oxygens. *Physiology Plant*. 59:28–34.

Sakaki, T., Kondo, N., and Sugahara, K. 2006. Breakdown of photosynthetic pigments and lipids in spinach leaves with ozone fumigation: role of active oxygens. *Physiologia Plantarum.* 59(1): 28-34.

Salvador, A., Abad, I., Arnal, L., and Martínez Jávega, J.M. 2006. Effect of ozone on postharvest quality of persimmon. *Journal of food science.* 71(6): S443-S446.

Sandermann Jr, H. 1998.Ozone : An air pollutant acting as a plant-signalling molecule. *Naturwissenschaften*. 85:369-375.

Santamaria, P. 2006. Nitrate in vegetables: Toxicity content, intake and EC regulation. *Journal of the Science of Food and Agriculture* 86: 10-17.

Santamaria, P., Elia, A., Gonnella, M., Parente, A. and Serio, F. 2001. Ways of reducing rocket salad nitrate content. *Acta Horticulture*. 548: 529–537.

Santamaria, P., Elia, A., Serio, F. and Todaro, E. 1999. A survey of nitrate and oxalate content in retail fresh vegetables. *Journal Science Food Agriculture*. 79: 1882–1888.

Samuelson, M.E., Campbell, W.H., and Larsson, C.M. 1995. The influence of cytokinins in nitrate regulation of nitrate reductase activity and expression in barley. *Physiologia Plantarum*. 93(3): 533-539.

SAS, 1999. Statistical Methods. SAS Institute Inc., Cary, North Carolina.

Satin, M. 2008. Food Alert! The Ultimate Source book for Food Safety. Facts on File Inc. 2nd ed.

Saure, M.C. 1998. Causes of the tipburn disorder in leaves of vegetables. *Science Horticulture*. 76: 131–147.

Scaife, A., Ferreira, M.E.S. and Turner, M.K. 1986. Effect of nitrogen form on the growth and nitrate concentration of lettuce. *Plant Soil*. 94: 3–16.

Seginer, I., Bleyaert, P. and Breugelmans, M. 2004. Modelling on-togenetic changes of nitrogen and water content in lettuce. *Annals of Botany Journal*. 94:393–404.

Shalluf, M.A., Tizaoui, C., and Karodia, N. 2007. Controlled atmosphere storage technique using ozone for delay ripening and extend the shelf life of tomato fruit. *IOA Conference and Exhibition*, Valencia.

Shamaila, M., Lamikanra, O., and Iman S.H. 2005. Water and its relation to Fresh produce. *In Produce Degradation: Pathway and Prevention* (pp. 268-287), CRC.

Shank, R.C. 1975. Toxicology of N-nitroso compounds. *Toxicology and Applied Pharmacology*. 31: 361.

Sharma, R.R., Demirci, A., and Beuchat, L. R. et al. 2002. Inactivation of *Escherichia coli* O157:H7 on inoculated alfalfa seeds with ozonated water and heat treatment. *Journal Food Protection*. 65: 447–451.

Sharma, O.P., and Bhat, T.K. 2009. DPPH antioxidant assay revisited. *Food Chemistry*. 113(4): 1202-1205.

Shraudner, M., Langerbartels, C. and Sandermann, H. 1997. Changes in the biochemical status of plant cells induced by the environmental pollutant ozone. *Physiologia Plantarum. 100*: 274-280.

Singh, N., Singh, R.K.,. Bhunia, A.K., and Stroshine, R.L. 2002. Efficacy of chlorine dioxide, ozone, and thyme essential oil or a sequential washing in killing *Escherichia coli* O157:H7 on lettuce and baby carrots. *International Food Science Technology*. 35: 720-729.

Sinha, N.K., Siddiq, M., and Ahmed, J. 2010. *Handbook of vegetables and vegetable processing*. Wiley-Blackwell.

Siomos, A. 2000. Nitrate levels in lettuce at three times during a diurnal period. *Journal Vegetable Crop Product.* 2: 37-42.

Siomos, A.S., Papadopoulou, P.P., Niklis, N.D., and Dogras, C.C. 2000b. Quality of romaine and leaf lettuce at harvest and during storage. In *II Balkan Symposium on Vegetables and Potatoes 579* (pp. 641-646).

Skog, J.L., and Chu, C.L. 2001. Effect of ozone on qualities of fruits and vegetables in cold storage. *Canadian Journal of Plant Science.* 81: 773−778.

Skrdleta, V., Gaudinova, A. and Nemcova, M. 1979. Relationships between nitrate level, nitrate reductase activity and anaerobic nitrite production in *Pisum sativum* leaf tissue. *Biology of Plant.* 21: 307–310.

Slob, W., van der Berg, R. and van Veen, M.P. 1995. A statistical exposure model applied to nitrate intake in the Dutch population. *In: Health Aspects of Nitrates and Its Metabolite*s pp. 75-82. Strasbourg: Council of Europe Press.

Smilanick, J. L. 2003. Influence of ozone gas on the appearance of fresh fruit and Vegetables. Postharvest Technology Research Information Center, University of California: Davis, CA.

Smilanick, J.L., Crisosto, C. and Mlikota, F. 1999. Postharvest use of ozone on fresh fruit. *Perishable Handling Querterly.* 99:10-14.

Smith DeWaal, C. and Bhuiya, F. 2007. Outbreak Alert 2007. Center for Science in the Public Interest. Ninth Edition. www.cspinet.org. Retrieved on 7 Oktober 2009.

Smyth, A., Song, J., and Cameron, A. 1998. Modified atmosphere packaged of packaged cut iceberg lettuce: effect of temperature and O2 partial pressure on respiration and quality. *Journal Agriculture Food Chemistry*. 46: 4556–62.

Snell, F.D and Snell, C.T. 1955. Colorimetric Methods of Analysis. *Soil Science.* 79(3): 226.

Solomon, E.B., Potenski, C.J. and Matthews, K.R. 2002a. Effects of irrigation method on transmission and persistence of Escherichia coli O157:H7 on lettuce. *Journal Food Protection*. 65 (4): 673–676.

Solomon, E.B., Yaron, S., and Mathews, K.R., 2002b. Transmission of *Escherichia coli* O157:H7 from contaminated manure and irrigation water to lettuce plant tissue and its subsequent internalization. Application Environment Microbiology. 68: 397-400.

Song, J., Fan, L., Hildebrand, P.D., and Forney, C.F. 2000. Biological effects of corona discharge on onions in a commercial storage facility. *Horticulture Technology*. 10(3): 608–612.

Sopher, C.D., Battles, G.T., and Knueve, E.A. 2007. Ozone applications in catfish processing. *Ozone: Science and Engineerin.g* 29(3): 221-228.

Soriano, J.M., Rico, H., Molto, J.C. and Manes, J. 2001. Incidence of microbial flora in lettuce, meat and Spanish omelette from restaurants. *Food Microbiology*. 18: 159-163.

Spotts, R.A. and Cervantes, L.A. 1992. Effects of ozonated water on postharvest pathogens of pear in laboratory and packing house tests. *Plant Disease*. *76,* 256-259.

Steele, M., Odumeru, J. 2004. Irrigation water as source of foodborne pathogens on fruit and vegetables. *Journal of Food Protection*. 67: 2839–2849.

Steingröver, E., Ratering, P. and Siesling, J. 1986. Daily changes in uptake, reduction and storage of nitrate in spinach grown at low light intensity. *Plant Physiology*. 66: 550–556.

Stopes, C., Woodward, L., Forde, G., and Vogtmann, H. 1988. The nitrate content of vegetable and salad crops offered to the consumer as from "organic" or "conventional" production systems. *Bio. Agriculture & Horticulture*. 5(3): 215-222.

Strain, J.J., and Benzie, I.F.F. 1999. Diet and antioxidant defence. *In The Encyclopedia of Human Nutrition*, [M Sadler, JJ Strain and B Cabellero, editors], (pp. 95–105). London. Academic Press.

Sudheer K.P. and Indira V. 2007. Post Harvest Technology of Horticultural Crops. 7th Volume, (pp. 201-202). New Delhi: New India Publishing Agency.

Suslow, T. 1998. Basics of ozone applications for the postharvest treatment of fruits and vegetables. *Perishable Handling Quarterly*. 94:9-11.

Suzuki, Y., Doi M. and Shioi, Y. 2002. Two enzymatic reaction pathways in the formation of pyropheophorbide. *Photosynthetic Research*. 74: 225–233.

Szczesniak, A.S. 1998. The meaning of textural characteristics of crispiness. *Journal of Textural Studies*. 19: 51-59.

Temme, T., Reinik M. and Roasto, M. 2010. Nitrates and nitrites in vegetables: Occurrence and health risks. In Watson, R., and Preedy, V. R (Eds) *Bioactive foods in promoting health: fruits and vegetables (*pp. 307-321). New York: Academic Press.

Termine, E., Lailon, D., Taupier-Letage, B., Gautier, S., Lafont, R., and Lafont H. 1987. Yield and content in nitrates, minerals and ascorbic acid of leeks and turnips grown under mineral or organic nitrogen fertilizations. *Plant Foods for Human Nutrition.* 37: 321-332.

Tingey, D.T., and Taylor Jr, G.E. 1980. *Variation in plant response to ozone: a conceptual model of physiological events* (No. CONF-8009172-1). Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.; Oak Ridge National Lab., TN (USA).

Tingey, D.T., Fites, R.C., and Wickliff, C. 2006. Ozone alteration of nitrate reduction in soybean. *Physiologia Plantarum.* 29(1): 33-38.

Tiwari, B. K., Muthukumarappan, K., O'Donnell, C. P., and Cullen, P. J. 2008. Kinetics of freshly squeezed orange juice quality changes during ozone processing. *Journal of Agriculture and Food Chemistry*. 56: 6416−6422.

Toor, R.K. and G.P. Savage. 2006. Changes in major antioxidant components of tomatoes during post-harvest storage. *Food Chemistry.* 99:724-727.

Torsethaugen, G., Pell, E.J., and Assmann, S.M. 1999. Ozone inhibits guard cell K+ channels implicated in stomatal opening. *Proceedings of the National Academy of Sciences*. 96(23): 13577-13582.

Tosun, I., and Ustun, N. S. 2004. Nitrate content of lettuce grown in the greenhouse. *Bulletin Environmental Contaminants and Toxicology*. 72: 109-113.

Tucker, G.A. 1993. Introduction. Pages 3-43 in G.B. Seymour, J.E Taylor and G.A. Tucker, eds., Biochemistry of Fruit Ripening. Chapman and Hall, London.

Tzortzakis, N., Borland, A., Singleton, I., and Barnes, J. 2007. Impact of atmospheric ozone-enrichment on quality-related attributes of tomato fruit. *Postharvest Biology and Technology*. 45: 317−325.

Tzortzakis, N.G. 2007. Maintaining postharvest quality of fresh produce with volatile compounds. *Innovative Food Science Emmerging Technology*. 8:111-116.

Uddin, J., Solaiman, A.H.M., and Hasanuzzaman, M. 2009. Plant Characters and Yield of Kohlrabi (*Brassica oleraceae* var. *gongylodes*) as Affected by Different Organic Manures. *Journal of Horticultural Science Ornamental Plants.* 1(1): 1-4.

Ulrich, R. 1970. Organic acid. In *The Biochemistry of Fruits and Their Products*, ed. A.C. Hulme, vol. I (pp 89-118). London: Academic Press.

Umar S., Iqbal, M. and Abrol, Y.P. 2007. Are nitrate concentrations in leafy vegetables within safe limits?. *Current science*. 92(3): 355-360.

Vaccaro, R.F., Thunberg, J.C., and Ketchum, B.H. 1962. Nitrate Measurements in the Presence of High Nitrite Concentrations. *Limnology and Oceanography*. 322-329.

Van der Boon, J., Steenhuizen, J.W. and Steingröver, E.G. 1990. Growth and nitrate concentration of lettuce as affected by total nitrogen and chloride concentration, NH4 /NO3 ratio and temperature of the re-circulating nutrient solution. *Journal Horticulture Science*. 65: 309–321.

Valko, M., Leibfritz, D., Moncol, J., Cronin, M.T., Mazur, M., and Telser, J. 2007. Free radicals and antioxidants in normal physiological functions and human disease. *The international journal of biochemistry & cell biology*. 39(1): 44-84.

Veltman, R.H., Sanders, M.G., Persijn, S.T., Peppelenbos, H.W., and Osterhaven, J. 1999. Decreased ascorbic acid levels and brown core development in pears (Pyrus communis L. Cv Conference). *Physiologia Plantarum*. 107:39-45.

Vernon, G. 1999. Sustainable Vegetable Production from Start-Up to Market. Cornell Univesity. Ithaca, New York.

Vieira, I.S., Vasconselos, E.P., and Monteiro A.A. 1998. Nitrate accumulation, yield and leaf quality of turnip greens in response to nitrogen fertilization. *Nutrition Cycle Agroecosystem*. 51: 249–258.

Virgili, F., C. Scaccini, L. Packer, and G. Rimbach. 2001. Cardiovascular disease and nutritionalphenolics. In *Antioxidants in food*, ed. J. Pokorný, N. Yanieshlieva, and M. Gordon (pp 7-21). New York: CRC Press.

Vogtmann, H., Eichenberger, M., Ott, P., Temperli, A., and Kunsch, U. 1983. Accumulation of nitrates in leafy vegetables grown under contrasting agricultural systems. Paper presented at the *Fourth International Conference of the International Federation of Organic Agriculture Movements*, Cambridge, Massachusetts.

Vogtmann, H., Temperli, A.T., Künsch, U., Eichenberger, M., and Ott, P. 1984. Accumulation of nitrates in leafy vegetables grown under contrasting agricultural systems. *Biological Agriculture and Horticulture*. 2: 51-68.

Vries, I.M de. 1997. Origin and domestication of *Lactuca sativa* L. *Genetic Resources Crop Evolution*. 171:233–248.

Wade, W.N., Scouten A.J., and McWatters, K. H., Wick, R. L., Demirci, A., Fett, W. F., and Beuchat, L.R. 2003. Efficacy of ozone in killing Listeria monocytogenes on alfalfa seeds and sprouts and effects on sensory quality of sprouts. *Journal Food Protection*. 66(1): 44–51.

Walker, R. 1990. Nitrates, nitrites and N-nitroso compounds: a review of the occurrence in food and diet and the toxicological implications. *Food Additives Contamination*. 7:717–768.

Waller, J.M. 2002. Postharvest diseases. In: *Plant Pathologist's Pocketbook*, J.M. Waller, J.M. Lenne, S.J. Waller (eds) (39–54). Oxford, UK: CAB International.

Wang, Z.H., Tian, X.H., Wei, Y.S., Li, S.X. 2000. Nitrate accumulation and its regulation by nutrient management in vegetables. In: *Balanceable Fertilization and High Quality Vegetables Continual Production* (in Chinese). Beijing: China Agricultural University Press.

Watada, A.E., Ko N.P. and Minott, D.A. 1996. Factors affecting quality of fresh cut horticultural products. *Postharvest Biology Technology*. 9: 115-125.

Wedding, R.T. 1989. Malic enzymes of higher plants: Characteristics, regulation, and physiological function. *Plant Physiology*. 90: 367-371.

Wei, K., Zhou, H., Zhou, T. and Gong, J. 2007. Comparison of aqueous ozone and chlorine as sanitizers in food processing industry: Impact on fresh agricultural produce quality. *Journal of Publication Medicine*. 29(2): 113-120.

Welfare, K., Flowers, T.J., Taylor, G., Yeo, A.R., 1996. Additive and antagonistic effects of ozone and salinity on the growth, ion contents and gas exchange of five varieties of rice *Oryza sativa* L. *Environmental Pollution*. 92: 257-266.

Whipps, J.M., Hand, P., Pink, D.A., and Bending, G.D., 2008. Human pathogens and the phyllosphere. *Advanve Application Microbiology*. 64: 183-221.

Wickramanayake, G.B. 1991. *Disinfection and sterilization by ozone*. Chapter 10 in Disinfection, Sterilization, and Preservation, 4th ed. (Block, S.S., Ed.). Lea and Febiger, Philadelphia.

Williams, C. M. 2002. Nutritional quality of organic food: shades of grey or shades of green? *Procedures Nutrition Society*. 61**:** 19–24.

Wills, R., McGlasson B., Graham, D., and Joyce, D. 2007. Postharvest: An introduction to the physiology and handling of fruit, vegetables and ornamentals. 5th Ed (pp 73). Australia: UNSW Press.

Winter, C.K., and Davis, S.F. 2006. Organic foods. *Journal Food Science.* 71**:** R117- R124.

Woese, K., Lange, D., Boess, C., Bögl, K.W. 1997. A comparison of organically and conventionally grown foods – Results of a review of the relevant literature. *Journal of the Science of Food and Agriculture.* 74: 281-293.

World Health Organization (WHO). 2012. Food Safety, Chemical Risks in Food. Website http://www.who.int/foodsafety/chem/en/ . Retrieved 2 May 2012.

Worthington, V. 1998. Effect of agricultural methods on nutritional quality: a comparison of organic with conventional crops. *Alternative Therapies Health Medicine*. 4 (1): 58-69.

Worthington, V. 2001. Nutritional quality of organic versus conventional fruits, vegetables and grains. *Journal Alternative Complementary Medicine*. 7: 161-173.

Wu, J., Luan, T., Lan, C., Hung Lo, T.W., and Chan, G.Y.S. 2007. Removal of residual pesticides on vegetable using ozonated water. *Food Control*. 18(5): 466-472.

Xu, H.L., Wang, R., Xu, R.Y., Mridha M.A.U., and Goyal, S. 2005. Yield and quality of leafy vegetables grown with organic fertilizations. *Acta Horticulturae*. 627: 25-33.

Xu, L. 1999. Use of ozone to improve the safety of fresh fruits and vegetables. *Food Technology*. 53(10): 58– 63.

Yamauchi, N. and Watada, A.E. 1991. Regulated chlorophyll degradation in spinach leaves during storage. *Journal of the American Soceity of Horticulture Science*. 116: 58–62.

Yau, J. 2008. Nitrate in food. *Food Safety Focus.* 25: 45-47.

Yuk, H.G., J.A. Bartz, and K.R. Schneider. 2006. The effectiveness of sanitizer treatments in inactivation of *Salmonella* spp. from bell pepper, cucumber, and strawberry. *Journal Food Science.* 71: M95-M99.

Zadik, P.M., Chapman, P.A. and Siddons, C.A. 1993. Use of tellurite for the selection of verocytotoxigenic *E.coli* O157. *Journal of Medicine Microbiol*ogy. 39: 155-158.

Zhang, G., Ma, L., Beuchat, L.R., Erickson, M.C., Phelan, V.H., and Doyle, M.P., 2009. Lack of internalization of Escherichia coli O157:H7 in lettuce (*Lactuca sativa* L.) after leaf surface and soil inoculation. *Journal Food Protection*. 72: 2028-2037.

Zhang, L., Lu, Z., Yu, Z. and Gao, X. 2005. Preservation Fresh-cut Celery by Treatment of Ozonated Water. *Food Control*. 16: 279–283.

Zhou, Z.Y., Wang, M.J. and Wang, J.S. 2000. Nitrate and nitrite contamination in vegetables in China. *Food Reviews International.* 16: 61–76.

ZongQi, C. 2009. Postharvest Technologies for Fresh Leafy Vegetables in Yunnan, China. In *Best practices in postharvest management of leafy vegetables in Greater Mekong*

Subregion countries: Proceedings of a GMS workshop, 25-27 October 2007, Hanoi, Vietnam. AVRDC Publication No. 09-731. AVRDC-The World Vegetable Center: Taiwan.