|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Process Stage & Steps | Parameter | Parameter Sources for Each Identified Process Model | | | | | | | |
| *M1* | *M2* | *M3* | *M4* | *M5* | *M6* | *M7* | *M8* |
|  |  | Madamba at al. 2022 | Mokhtari et al. 2022 | Pang et al. 2022 | Mokhtari et al. 2018 | Pang et al. 2017 | Allende et al. 2018 | Bozkurt et al. 2021 |  |
| **Primary Raw Material Production** | | | | | | | | | |
| Season Parameters | Days in Season – Spring | NA | NA | NA | NA | NA | Pert (32.0, 36.8, 43.0)  *Days* | NA |  |
| Season Parameters | Days in Season – Winter | NA | NA | NA | NA | NA | Pert (51.0, 56.7, 67.0)  *Days* | NA |  |
| Season Parameters | Days in Season - Summer | NA | NA | NA | NA | NA | NA | Pert (35, 40, 45)  *Days* |  |
| Season Parameters | Rainy Days – Spring | NA | NA | NA | NA | NA | Pert (1, 5.6, 14)  *Days* | NA |  |
| Season Parameters | Rainy Days - Winter | NA | NA | NA | NA | NA | Pert (3, 10.6, 23)  *Days* | NA |  |
| Season Parameters | Rainy Days - Summer | NA | NA | NA | NA | NA | NA | Pert (1 ,6, 11)  *Days* |  |
| Season Parameters | Sun Hours – Spring | NA | NA | NA | NA | NA | Pert (5, 10.4, 12)  *Days* | NA |  |
| Season Parameters | Sun Hours - Winter | NA | NA | NA | NA | NA | Pert (6, 8.5, 11)  *Days* | NA |  |
| Season Parameters | Sun Hours Summer | NA | NA | NA | NA | NA | NA | Pert (8, 10, 14.4)  *Days* |  |
| Soil Quality | E. coli concentration in soil | NA | NA | NA | NA | 10Normal Truncated (0.  928, 1.11, 0, 3.67)  *Log CFU/g* | Normal (0.549, 0.816)  *Log CFU/g* | NA |  |
| Soil Quality | O157:H7 ratio to E. coli in Soil | NA | NA | NA | NA | 10Normal Truncated (-1.9, 0.6, -inf, 0)  *Proportion* | NA | 10Normal Truncated (-1.9, 0.6, -inf, 0)  *Proportion* |  |
| Manure-Amended Soil (MAS) Quality | E. coli concentration in positive MAS | NA | NA | NA | NA | NA | NA |  |  |
| Manure-Amended Soil (MAS) Quality | E. coli concentration in negative MAS | NA | NA | NA | NA | NA | NA | Uniform (1, 100)  *CFU/g* |  |
| Manure-Amended Soil (MAS) Quality | Prevalence of E. coli in MAS | NA | NA | NA | NA | NA | NA | 30/72 = 0.416  *Proportion* |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Water Quality | E. coli prevalence in water | NA | NA | NA | NA | NA | Source 1 = 0.95  Source 2 and 3 = 1.0  *Proportion* |  |  |
| Water Quality | E. coli concentration in irrigation water | NA | NA | NA | NA | Uniform (1, 235) *CFU/100 mL* | Source 1: (10Normal (1.270, 0.567))/100  Source 2: (10Normal (4.289, 0.544))/100  Source 3: (10Normal (2.972, 0.459))/100  *CFU/100 mL* |  |  |
| Water Quality | O157:H7 ratio to E. coli in irrigation water | NA | NA | NA | NA | 10Normal Truncated (-1.9, 0.6, -inf, 0)  *Proportion* | NA |  |  |
| Water Transfer | Amount of water transferred to plant during irrigation | NA | NA | NA | NA | NA | Uniform (1.8, 21.6)  *mL/ g* |  |  |
| Soil Splashing | Probability of irrigation splashing | NA | NA | NA | NA | NA | Pert (0.02, 0.04, 0.06)  *Probability* |  |  |
| Soil Splashing | Probability of rain splashing | NA | NA | NA | NA | NA | Pert (0.02, 0.04, 0.06)  *Probability* |  |  |
| Soil Transfer | Soil transferred by irrigation or rain splash | NA | NA | NA | NA | NA | Beta Generalized (0.4, 0.8, 0.05, 16.4)  *g soil/ g produce* |  |  |
| Soil Transfer | Probability E. coli transfers from soil to plant | NA | NA | NA | NA | NA | Uniform (0.35, 0.9)  *Probability* |  |  |
| Preharvest Die off | Die off Lettuce | NA | NA | NA | NA | (Time / (2.45/24))0.3  *Log CFU/g* | Summer:  -0.52 x (Sun hours/24)  Winter:  0.48 x (Sun hours/24)  *Log CFU/g* |  |  |
| Preharvest Intervention | Irrigation holding | NA | NA | NA | NA | Triangular (2 ,4 ,8)  *Days* | NA |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Harvest** | | | | | | | | | |
| Harvesting blade … |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Manufacturing (packinghouse)** | | | | | | | | | |
| Manual Trimming – Knives | Transfer coefficient from lettuce to knives | Zilelidou et al. 2015 | NA | Zilelidou et al. 2015 | Zilelidou et al. 2015 | NA |  |  |  |
| Transfer coefficient from knives to lettuce | Zilelidou et al. 2015 | NA | Zilelidou et al. 2015 | Zilelidou et al. 2015 | NA |  |  |  |
| Manual Trimming – Hands | Transfer coefficient from lettuce to hands | Zilelidou et al. 2015 | NA | Jensen et al. 2017 | Zilelidou et al. 2015 | NA |  |  |  |
| Transfer coefficient from hands to lettuce | Jensen 2017 | NA | Zilelidou et al. 2015 | Jensen et al. 2017 | NA |  |  |  |
| Washing … |  |  |  |  |  |  |  |  |  |
| Shredding | Transfer coefficient from lettuce to shredder | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Transfer coefficient from shredder to lettuce | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Conveying | Transfer coefficient from shredded lettuce to conveyor belt | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Transfer coefficient from conveyer belt to shredded lettuce | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Shaker Table | Transfer coefficient from shredded lettuce to shaker table | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Transfer coefficient from shaker table to shredded lettuce | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Centrifuge | Transfer coefficient from shredded lettuce to centrifuge | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Transfer coefficient from centrifuge to shredded lettuce | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | NA | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Buchholz et al. 2012a,  Buchholz et al. 2012b, Buchholz et al. 2014 | Perez Rodriguez et al. 2011 |  |  |  |
| Transport | Transportation time | NA | Zeng et al. 2014 | Zeng et al. 2014 |  |  |  |  |  |
| Transportation temperature | NA | Zeng et al. 2014 | Zeng et al. 2014 |  |  |  |  |  |
| **Presentation to consumer (Retail/Food Service)** | | | | | | | | | |
| Storage | Retail storage time | NA | Zeng et al. 2014 | Zeng et al. 2014 |  |  |  |  |  |
| Retail storage temperature | NA | Zeng et al. 2014 | Zeng et al. 2014 |  | EcoSure 2007 |  |  |  |
| **Consumer Handling** | | | | | | | | | |
| Transport | Transportation time |  |  |  |  | EcoSure 2007 |  |  |  |
| Transportation temperature |  |  |  |  |  |  |  |  |
| Storage | Consumer storage temperature |  | EcoSure 2007 | EcoSure 2007 |  | EcoSure 2007 |  |  |  |
| **Misc.** | | | | | | | | | |
| Growth model | Growth model parameter, α |  | Koseki & Isobe 2005 | Koseki & Isobe 2005 |  |  |  |  |  |
| Growth model parameter, b |  | Koseki & Isobe 2005 | Koseki & Isobe 2005 |  |  |  |  |  |
| Minimum growth temperature |  | Koseki & Isobe 2005 | Koseki & Isobe 2005 |  |  |  |  |  |
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| **ID #** | Model ID | Authors | Article Title | Publication Year | DOI |
| **1** | M1 | Madamba, T; Moreira, RG; Castell-Perez, E; Banerjee, A; da Silva, D | Agent-based simulation of cross-contamination of Escherichia coli O157:H7 On lettuce during processing with temperature fluctuations during storage in a produce facility. Part 1: Model development | 2022 | 10.1111/jfpe.14002 |
| **2** | M2 | Mokhtari, A; Pang, H; Farakos, SS; Davidson, GR; Williams, EN; Van Doren, JM | Evaluation of Potential Impacts of Free Chlorine during Washing of Fresh-Cut Leafy Greens on Escherichia coli O157:H7 Cross-Contamination and Risk of Illness | 2022 | 10.1111/risa.13818 |
| **3** | M3 | Pang, H; Pouillot, R; Van Doren, JM | Quantitative risk assessment-epidemic curve prediction model for leafy green outbreak investigation | 2022 | 10.1111/risa.14073 |
| **19** | M8 | Bozkurt, H; Bell, T; van Ogtrop, F; Phan-Thien, KY; McConchie, R | Assessment of microbial risk during Australian industrial practices for Escherichia coli O157:H7 in fresh cut-cos lettuce: A stochastic quantitative approach | 2021 | 10.1016/j.fm.2020.103691 |
| **15** | M6 | Allende, A; Truchado, P; Lindqvist, R; Jacxsens, L | Quantitative microbial exposure modelling as a tool to evaluate the impact of contamination level of surface irrigation water and seasonality on fecal hygiene indicator E. coli in leafy green production | 2018 | 10.1016/j.fm.2018.01.016 |
| **4** | M4 | Mokhtari, A; Oryang, D; Chen, YH; Pouillot, R; Van Doren, J | A Mathematical Model for Pathogen Cross-Contamination Dynamics during the Postharvest Processing of Leafy Greens | 2018 | 10.1111/risa.12960 |
| **21** |  | Allende, A; Castro-Ibanez, I; Lindqvist, R; Gil, MI; Uyttendaele, M; Jacxsens, L | Quantitative contamination assessment of Escherichia coli in baby spinach primary production in Spain: Effects of weather conditions and agricultural practices | 2017 | 10.1016/j.ijfoodmicro.2017.06.027 |
| **16** |  | Mishra, A; Guo, M; Buchanan, RL; Schaffner, DW; Pradhan, AK | Prediction of Escherichia coli O157: H7, Salmonella, and Listeria monocytogenes Growth in Leafy Greens without Temperature Control | 2017 | 10.4315/0362-028X.JFP-16-153 |
| **17** | M7 | Mishra, A; Pang, H; Buchanan, RL; Schaffner, DW; Pradhan, AK | A System Model for Understanding the Role of Animal Feces as a Route of Contamination of Leafy Greens before Harvest | 2017 | 10.1128/AEM.02775-16 |
| **10** | M5 | Pang, H; Lambertini, E; Buchanan, RL; Schaffner, DW; Pradhan, AK | Quantitative Microbial Risk Assessment for Escherichia coli O157:H7 in Fresh-Cut Lettuce | 2017 | 10.4315/0362-028X.JFP-16-246 |
| **20** |  | Atwill, ER; Chase, JA; Oryang, D; Bond, RF; Koike, ST; Cahn, MD; Anderson, M; Mokhtari, A; Dennis, S | Transfer of Escherichia coli O157:H7 from Simulated Wildlife Scat onto Romaine Lettuce during Foliar Irrigation | 2015 | 10.4315/0362-028X.JFP-14-277 |
| **18** |  | Castro-Ibanez, I; Gil, MI; Tudela, JA; Ivanek, R; Allende, A | Assessment of microbial risk factors and impact of meteorological conditions during production of baby spinach in the Southeast of Spain | 2015 | 10.1016/j.fm.2015.02.004 |
| **7** |  | Munther, D; Luo, YG; Wu, JH; Magpantay, FMG; Srinivasan, P | A mathematical model for pathogen cross-contamination dynamics during produce wash | 2015 | 10.1016/j.fm.2015.05.010 |
| **5** |  | Zilelidou, EA; Tsourou, V; Poimenidou, S; Loukou, A; Skandamis, PN | Modeling transfer of Escherichia coli O157:H7 and Listeria monocytogenes during preparation of fresh-cut salads: Impact of cutting and shredding practices | 2015 | 10.1016/j.fm.2014.06.019 |
| **6** |  | Zeng, WT; Vorst, K; Brown, W; Marks, BP; Jeong, S; Perez-Rodriguez, F; Ryser, ET | Growth of Escherichia coli O157:H7 and Listeria monocytogenes in Packaged Fresh-Cut Romaine Mix at Fluctuating Temperatures during Commercial Transport, Retail Storage, and Display | 2014 | 10.4315/0362-028X.JFP-13-117 |
| **9** |  | Buchholz, AL; Davidson, GR; Marks, BP; Todd, ECD; Ryser, ET | Transfer of Escherichia coli O157:H7 from Equipment Surfaces to Fresh-Cut Leafy Greens during Processing in a Model Pilot-Plant Production Line with Sanitizer-Free Water | 2012 | 10.4315/0362-028X.JFP-11-558 |
| **12** |  | Danyluk, MD; Schaffner, DW | Quantitative Assessment of the Microbial Risk of Leafy Greens from Farm to Consumption: Preliminary Framework, Data, and Risk Estimates | 2011 | 10.4315/0362-028X.JFP-10-373 |
| **14** |  | McKellar, RC; Delaquis, P | Development of a dynamic growth-death model for Escherichia coli O157:H7 in minimally processed leafy green vegetables | 2011 | 10.1016/j.ijfoodmicro.2011.07.027 |
| **11** |  | Ottoson, JR; Nyberg, K; Lindqvist, R; Albihn, A | Quantitative Microbial Risk Assessment for Escherichia coli O157 on Lettuce, Based on Survival Data from Controlled Studies in a Climate Chamber | 2011 | 10.4315/0362-028X.JFP-10-563 |
| **13** |  | Rodriguez, FP; Campos, D; Ryser, ET; Buchholz, AL; Posada-Izquierdo, GD; Marks, BP; Zurera, G; Todd, E | A mathematical risk model for Escherichia coli O157:H7 cross-contamination of lettuce during processing | 2011 | 10.1016/j.fm.2010.06.008 |
| **8** |  | Koseki, S; Isobe, S | Prediction of pathogen growth on iceberg lettuce under real temperature history during distribution from farm to table | 2005 | 10.1016/j.ijfoodmicro.2005.02.012 |