Supplementary Information (SI)

Table S1. Specifications and maximum levels of acceptance of the compact Dry discs used in the experiment.

Name	Description	Specification	Incubation time	Incubation temperature	Acceptable levels (log cfu/g) [1, 2]
Compact Dry Total Count (TC)	Quantification of aerobic mesophilic total count	Approved by MicroVal (certificate Nr. RQA2007LR01), NordVal (certificate Nr.033) and AOAC-RI (certificate Nr. 010404)	48 hours	35 ± 2° C	≤4-5
Compact Dry Yeasts & Molds (YM)	3-dimensional growth of yeast and mold	Approved by AOAC-RI	3 – 5 days	25 – 30° C	≤4

Table S2. Results of shelf-life study on tomato fruits stored at 5° C, room temperature and 45° C and a relative humidity of 80% for 1 week.

Type of packaging	Temperature (° C)	Weight loss (%)	pH	Appearance	Compact Dry Yeasts & Molds (YM)	Compact Dry Total Count (TC)
PF [1]	5	0.16 ± 0.03	4.15 ± 012	Red-acceptable	Unacceptable after 5d	Unacceptable after 6d
	Room Temp.	2.39 ± 0.08	4.03 ± 0.23	Red-slightly darker than day zero	Unacceptable after 4d	Unacceptable after 5d
	45	18.4 ± 1.03	3.37 ± 0.36	darker than day zero-shrinkage-oil secretion	Unacceptable after 3d	Unacceptable after 3d
EF [2]	5	0.21 ± 0.06	4.23 ± 0.21	Red-acceptable	Marginally acceptable after 7d	Acceptable after 7d
	Room Temp.	1.09 ± 0.18	4.11 ± 0.15	Red-acceptable	Unacceptable after 7d	Acceptable after 7d
	45	9.61 ± 1.31	3.95 ± 0.24	darker than day zero-shrinkage-oil secretion	Unacceptable after 5d	Unacceptable after 5d

CF [3]	5	0.31 ± 0.04	4.21 ± 0.08	Red-acceptable	Acceptable after 7d	Acceptable after 7d
	Room Temp.	1.13 ± 0.11	3.89 ± 0.10	Red-acceptable	Unacceptable after 7d	Acceptable after 7d
	45	9.8 ± 1.65	3.65 ± 0.14	darker than day zero-shrinkage-oil secretion	Unacceptable after 5d	Unacceptable after 5d

1. PF: Plain PP film (PF)
2. EF: Film with incorporated tomato leaf-stem extract and flavomix through extrusion
3. CF: PP film coated with zein nanofibers containing the aforementioned bioactive compounds through electrospinning

Table S3. Life Cycle Inventory for Scenario a.

Dataset	**Source**	**Unit**	**Agricultural production**	**Film production**	**Tray production**	**Tomato packaging**	**Retail**	**Consumption**
Biowaste {CH}| treatment of biowaste by anaerobic digestion | Cut-off, S	Ecoinvent v3	g	201.9	0.0	0.0	35.1	0.0	28.6
Biowaste {CH}| treatment of biowaste, industrial composting | Cut-off, S	Ecoinvent v3	g	227.7	0.0	0.0	39.6	0.0	32.2
Biowaste {GLO}| treatment of biowaste, municipal incineration | Cut-off, S	Ecoinvent v3	g	17.5	0.0	0.0	3.0	15.5	183.4
Electricity, low voltage {Europe without Switzerland}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	0.0	0.0	0.0	0.0	22.3
Electricity, medium voltage {Europe without Switzerland}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	0.0	0.0	328.3	0.0	0.0

Municipal solid waste {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	8.3	0.0	0.0	1.4	14.6	171.6
Oriented polypropylene film E	Industry 2.0	g	0	6	0	0	0	0
Tomato, fresh grade {ES}| tomato production, fresh grade, in unheated greenhouse | Cut-off, S	Ecoinvent v3	kg	1.98	0	0	0	0	0
Transport, freight, lorry 16-32 metric ton, EURO3 {RER}| transport, freight, lorry 16-32 metric ton, EURO3 | Cut-off, S	Ecoinvent v3	kgkm	0	0	0	0	3.1	0
Transport, freight, lorry 16-32 metric ton, EURO4 {RER}| transport, freight, lorry 16-32 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	22.8	0.0	0.0	4.0	0.0	1.2
Transport, freight, lorry 3.5-7.5 metric ton, EURO3 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO3 | Cut-off, S	Ecoinvent v3	kgkm	6.8	0.0	0.0	1.2	0.0	0.0
Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	0	0	0	76	0	0
Transport, freight, lorry 7.5-16 metric ton, EURO4 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	0.00	0.00	0.00	0.00	0.00	72.78

Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, S	Ecoinvent v3	kgkm	0	0	4.05	0	0	0
Transport, freight, lorry with refrigeration machine, cooling {GLO}| market for | Cut-off, S	Ecoinvent v3	kgkm	0	0	0	0	222	0
Transport, passenger car {RER}| market for | Cut-off, S	Ecoinvent v3	m	0	0	0	0	0	87
Waste paperboard {CH}| treatment of, municipal incineration | Cut-off, S	Ecoinvent v3	g	0.00	0.00	0.00	0.00	0.31	8.71
Waste paperboard {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	0.00	0.00	0.00	0.00	0.29	8.09
Waste paperboard, sorted {Europe without Switzerland}| treatment of waste paperboard, unsorted, sorting | Cut-off, S	Ecoinvent v3	g	0.00	0.00	0.00	0.00	0.00	9.30
Waste polyethylene terephthalate, for recycling, sorted {Europe without Switzerland}| treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | Cut-off, S	Ecoinvent v3	mg	0.0	0.0	0.0	0.0	0.0	517.6
Waste polypropylene {CH}| treatment of, municipal incineration | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.1	2.9

Waste polypropylene {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.0	2.6
Wastewater, unpolluted, from residence {CH}| market for wastewater, unpolluted, from residence | Cut-off, S	Ecoinvent v3	cm3	0.0	0.0	0.0	122.0	0.0	0.0
Water, completely softened {RER}| market for water, completely softened | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	121.6	0.0	0.0
White lined chipboard carton {RER}| white lined chipboard carton production | Cut-off, S	Ecoinvent v3	g	0	0	27	0	0	0

Table S4. Life Cycle Inventory for Scenario b.

Dataset	**Source**	**Unit**	**Agricultural production**	**Film production**	**Tray production**	**Tomato packaging**	**Retail**	**Consumption**
Acetic acid, without water, in 98% solution state {GLO}| market for | Cut-off, S	Ecoinvent v3	mg	0.0	1.3	0.0	0.0	0.0	0.0
Biowaste {CH}| treatment of biowaste by anaerobic digestion | Cut-off, S	Ecoinvent v3	g	173.3	0.1	0.0	30.1	0.0	24.5
Biowaste {CH}| treatment of biowaste, industrial composting | Cut-off, S	Ecoinvent v3	g	195.5	0.1	0.0	34.0	0.0	27.7
Biowaste {GLO}| treatment of biowaste, municipal incineration | Cut-off, S	Ecoinvent v3	g	15.1	0.0	0.0	2.6	8.2	157.5

Electricity, low voltage {Europe without Switzerland}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	0.0	0.0	0.0	0.0	22.3
Electricity, medium voltage {Europe without Switzerland}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	62.7	0.0	283.0	0.0	0.0
Electricity, medium voltage {RER}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	3.2	0.0	0.0	0.0	0.0
Ethanol, without water, in 99.7% solution state, from ethylene {RER}| market for ethanol, without water, in 99.7% solution state, from ethylene | Cut-off, S	Ecoinvent v3	mg	0.0	24.5	0.0	0.0	0.0	0.0
Heat, central or small-scale, natural gas {Europe without Switzerland}| heat production, natural gas, at boiler atmospheric non-modulating <100kW | Cut-off, S	Ecoinvent v3	kJ	0.0	9.2	0.0	0.0	0.0	0.0
Municipal solid waste {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	7.2	0.0	0.0	1.2	7.8	147.3
Oriented polypropylene film E	Industry 2.0	g	0.0	5.8	0.0	0.0	0.0	0.0
Soybean oil, crude {GLO}| market for | Cut-off, S	Ecoinvent v3	mg	0.0	128.9	0.0	0.0	0.0	0.0
Tomato, fresh grade {ES}| tomato production, fresh grade, in unheated greenhouse | Cut-off, S	Ecoinvent v3	kg	1.7	0.0	0.0	0.0	0.0	0.0
Transport, freight, lorry 16-32 metric ton, EURO3 {RER}| transport, freight,	Ecoinvent v3	kgkm	0.0	0.0	0.0	0.0	1.7	0.0

lorry 16-32 metric ton, EURO3 | Cut-off, S								
Transport, freight, lorry 16-32 metric ton, EURO4 {RER}| transport, freight, lorry 16-32 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	19.6	0.0	0.0	3.4	0.0	1.0
Transport, freight, lorry 3.5-7.5 metric ton, EURO3 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO3 | Cut-off, S	Ecoinvent v3	kgkm	5.9	0.0	0.0	1.0	0.0	0.0
Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	0.0	65.5	0.0	0.0
Transport, freight, lorry 7.5-16 metric ton, EURO4 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.2	0.0	0.0	0.0	22.6
Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	3.5	0.0	0.0	0.0
Transport, freight, lorry with refrigeration machine, cooling {GLO}| market for | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	0.0	0.0	190.5	0.0
Transport, passenger car {RER}| market for | Cut-off, S	Ecoinvent v3	m	0.0	0.0	0.0	0.0	0.0	75.0
Waste paperboard {CH}| treatment of, municipal incineration | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.2	7.7
Waste paperboard {CH}| treatment of,	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.1	7.2

sanitary landfill | Cut-off, S								
Waste paperboard, sorted {Europe without Switzerland}| treatment of waste paperboard, unsorted, sorting | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.0	8.2
Waste polyethylene terephthalate, for recycling, sorted {Europe without Switzerland}| treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | Cut-off, S	Ecoinvent v3	mg	0.0	0.0	0.0	0.0	0.0	517.6
Waste polypropylene {CH}| treatment of, municipal incineration | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.1	2.9
Waste polypropylene {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.0	2.6
Wastewater, unpolluted, from residence {CH}| market for wastewater, unpolluted, from residence | Cut-off, S	Ecoinvent v3	cm3	0.0	0.0	0.0	122.0	0.0	0.0
Water, completely softened {RER}| market for water, completely softened | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	104.8	0.0	0.0
White lined chipboard carton {RER}| white lined chipboard carton production | Cut-off, S	Ecoinvent v3	g	0.0	0.0	23.0	0.0	0.0	0.0

Table S5. Life Cycle Inventory for Scenario c.

Dataset	Source	Unit	Agricultural production	Film production	Tray production	Tomato packaging	Retail	Consumption
Acetic acid, without water, in 98% solution state {GLO}| market for | Cut-off, S	Ecoinvent v3	mg	0.0	1.2	0.0	0.0	0.0	0.0
Biowaste {CH}| treatment of biowaste by anaerobic digestion | Cut-off, S	Ecoinvent v3	g	173.3	0.1	0.0	30.1	0.0	24.5
Biowaste {CH}| treatment of biowaste, industrial composting | Cut-off, S	Ecoinvent v3	g	195.5	0.1	0.0	34.0	0.0	27.7
Biowaste {GLO}| treatment of biowaste, municipal incineration | Cut-off, S	Ecoinvent v3	g	15.1	0.0	0.0	2.6	8.2	157.5
Electricity, low voltage {Europe without Switzerland}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	0.0	0.0	0.0	0.0	22.3
Electricity, medium voltage {Europe without Switzerland}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	41.4	0.0	283.0	0.0	0.0
Electricity, medium voltage {RER}| market group for | Cut-off, S	Ecoinvent v3	kJ	0.0	3.0	0.0	0.0	0.0	0.0
Ethanol, without water, in 99.7% solution state, from ethylene {RER}| market for ethanol, without water, in 99.7% solution state, from ethylene | Cut-off, S	Ecoinvent v3	mg	0.0	23.1	0.0	0.0	0.0	0.0
Heat, central or small-scale, natural gas {Europe without Switzerland}| heat	Ecoinvent v3	kJ	0.0	8.7	0.0	0.0	0.0	0.0

production, natural gas, at boiler atmospheric non-modulating <100kW | Cut-off, S								
Maize starch {GLO}| market for | Cut-off, S	Ecoinvent v3	mg	0.0	605.9	0.0	0.0	0.0	0.0
Municipal solid waste {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	7.2	0.0	0.0	1.2	7.8	147.3
Oriented polypropylene film E	Industry 2.0	g	0.0	5.3	0.0	0.0	0.0	0.0
Tomato, fresh grade {ES}| tomato production, fresh grade, in unheated greenhouse | Cut-off, S	Ecoinvent v3	kg	1.7	0.0	0.0	0.0	0.0	0.0
Transport, freight, lorry 16-32 metric ton, EURO3 {RER}| transport, freight, lorry 16-32 metric ton, EURO3 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	0.0	0.0	1.7	0.0
Transport, freight, lorry 16-32 metric ton, EURO4 {RER}| transport, freight, lorry 16-32 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	19.6	0.0	0.0	3.4	0.0	1.0
Transport, freight, lorry 3.5-7.5 metric ton, EURO3 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO3 | Cut-off, S	Ecoinvent v3	kgkm	5.9	0.0	0.0	1.0	0.0	0.0
Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	0.0	65.5	0.0	0.0
Transport, freight, lorry 7.5-16 metric ton, EURO4 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO4 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.1	0.0	0.0	0.0	22.6

Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	3.5	0.0	0.0	0.0
Transport, freight, lorry with refrigeration machine, cooling {GLO}| market for | Cut-off, S	Ecoinvent v3	kgkm	0.0	0.0	0.0	0.0	190.5	0.0
Transport, passenger car {RER}| market for | Cut-off, S	Ecoinvent v3	m	0.0	0.0	0.0	0.0	0.0	75.0
Waste paperboard {CH}| treatment of, municipal incineration | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.2	7.7
Waste paperboard {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.1	7.2
Waste paperboard, sorted {Europe without Switzerland}| treatment of waste paperboard, unsorted, sorting | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.0	8.2
Waste polyethylene terephthalate, for recycling, sorted {Europe without Switzerland}| treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | Cut-off, S	Ecoinvent v3	mg	0.0	0.0	0.0	0.0	0.0	517.6
Waste polypropylene {CH}| treatment of, municipal incineration | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.1	2.9
Waste polypropylene {CH}| treatment of, sanitary landfill | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	0.0	0.0	2.6
Wastewater, unpolluted, from residence {CH}|	Ecoinvent v3	cm3	0.0	0.0	0.0	122.0	0.0	0.0

market for wastewater, unpolluted, from residence | Cut-off, S								
Water, completely softened {RER}| market for water, completely softened | Cut-off, S	Ecoinvent v3	g	0.0	0.0	0.0	104.8	0.0	0.0
White lined chipboard carton {RER}| white lined chipboard carton production | Cut-off, S	Ecoinvent v3	g	0.0	0.0	23.0	0.0	0.0	0.0