



Case study for measuring food loss

Vegetables and fruit sector case study

This is a case study focusing on the measurement of fruits and vegetables in Spain, led by Espigoladors. This case study is based on measurements of food losses in 6 main crop types: cabbages, lettuces, tomatoes, peaches and nectarines, apples and pears, with additional experiments on citrus (especially oranges and tangerines), plums, and potentially other crops.

Food Loss information	
Commodity	Cabbages, lettuces, tomatoes, peaches, apples, pears, oranges and plums
Quantification	Weighting
Timing	Primary production: pre-harvest and/or harvesting losses

General information	
Policies	On a regional scale: <u>Law 3/2020, of 11 March, on Food Loss and Wastage Prevention</u>
Challenges	To properly assess the impacts of pre-harvest and harvest losses, a high level of operational agility is required in order to be on the ground within a three-day window once farmers confirm that harvesting has taken place, as adverse weather conditions or other factors may sometimes make it impossible to conduct measurements within that timeframe.
Technology	Perhaps, the most notable aspect is the use of a scale and software for data management and analysis; however, no additional advanced technology is required
Destination	Mainly left on the field
Benefits	At this stage, the key objective is to make a problem visible that is primarily borne by them
Operations	A detailed analysis of the costs associated with measurement is currently being carried out, including both human and material resources. To provide some initial rough figures and an approximate indication, loss measurements are typically conducted by two people. These activities usually require one working morning, amounting to around five hours, for pre-harvest or harvest measurements, resulting in one or two measurement campaigns depending on the crop type. In addition, at least three hours are required for data entry and subsequent analysis.
Other comments	A table containing all disaggregated data collected to date is attached.



Example of food loss estimates in WP4 pilots

Table 1. In-field quantification data from 2024 and 2025 measurements (Part A)

Quantification CODE	Crop	NACE Code	CPA Code 6 digits	Production system	Measurement			Sampling size	FL (Kg/ha)			% FL (FL/yield + FL)	
					Pre-harvest	Inter-harvest (cuts)	Post-harvest		0.10%	1%	10%		
Q1	Apples	01.24 Growing of pome fruits and stone fruits	01.24.10 Fresh apples	Conventional	X		X			X		3,093	7,08%
Q2	Apples	01.24 Growing of pome fruits and stone fruits	01.24.10 Fresh apples	Conventional			X				X	217	0,23%
Q3	Pears	01.24 Growing of pome fruits and stone fruits	01.24.21 Pears	Conventional			X				X	423	2,57%
Q4	Apples	01.24 Growing of pome fruits and stone fruits	01.24.10 Fresh apples	Conventional	X		X			X		1,187	2,84%
Q5	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X				X	2,534	11,42%
Q6	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X					1,282	6,12%
Q7	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X				X	1,284	6,13%
Q8	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X				X	2,226	10,17%
Q9	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X				X	1,014	4,90%
Q10	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Organic			X			X		5,750	22,79%
Q11	Lettuces	01.13 Growing of vegetables and	01.13.14 Lettuce	Organic			X				X	4,596	19,09%



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Quantification CODE	Crop	NACE Code	CPA Code 6 digits	Production system	Measurement			Sampling size	FL (Kg/ha)		% FL (FL/yield + FL)	
					Pre-harvest	Inter-harvest (cuts)	Post-harvest	0.10%	1%	10%		
		melons, roots and tubers										
Q12	Tomatoes	01.13 Growing of vegetables and melons, roots and tubers	01.13.34 Tomatoes	Conventional		X				X	850	0,74%
Q13	Cabbages	01.13 Growing of vegetables and melons, roots and tubers	01.13.12 Cabbages	Agroecological			X			X	4,405	15,97%
Q14	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Agroecological			X			X	3,786	13,22%
Q15	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Conventional			X		X		3,067	13,60%
Q16	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Conventional			X			X	4,735	19,56%
Q17	Cabbages	01.13 Growing of vegetables and melons, roots and tubers	01.13.12 Cabbages	Organic			X			X	2,848	10,59%
Q18	Cabbages	01.13 Growing of vegetables and melons, roots and tubers	01.13.12 Cabbages	Conventional			X			X	10,611	37,13%
Q19	Cabbages	01.13 Growing of vegetables and	01.13.12 Cabbages	Conventional			X			X	2,988	14,26%



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Quantification n CODE	Crop	NACE Code	CPA Code 6 digits	Production system	Measurement			Sampling size	FL (Kg/ha)		% FL (FL/yield + FL)	
					Pre- harvest	Inter- harvest (cuts)	Post- harvest	0.10%	1%	10%		
		melons, roots and tubers										
Q20	Cabbages	01.13 Growing of vegetables and melons, roots and tubers	01.13.12 Cabbages	Conventional			X			X	5,430	18,98%
Q21	Tangerines	01.23 Growing of citrus fruits	01.23.14 Tangerines, mandarins, clementines	Conventional	X		X		X		3,376	14,00%
Q22	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Conventional			X			X	2,378	10,88%
Q23	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Conventional			X			X	2,457	11,20%
Q24	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X		X		1,700	7,96%
Q25	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X		X		3,387	14,70%
Q26	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Conventional	X		X		X		2,274	10,37%
Q27	Peaches	01.24 Growing of pome fruits and stone fruits	01.24.25 Peaches	Conventional			X			X	679	8,82%
Q28	Pears	01.24 Growing of pome fruits and stone fruits	01.24.21 Pears	Conventional	X		X			X	99	0,61%
Q29	Tomatoes	01.13 Growing of vegetables and	01.13.34 Tomatoes	Conventional	X	X				X	157	0,23%



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Quantification n CODE	Crop	NACE Code	CPA Code 6 digits	Production system	Measurement			Sampling size	FL (Kg/ha)		% FL (FL/yield + FL)	
					Pre- harvest	Inter- harvest (cuts)	Post- harvest	0.10%	1%	10%		
		melons, roots and tubers										
Q30	Tangerines	01.23 Growing of citrus fruits	01.23.14 Tangerines, mandarins, clementines	Conventional	X		X		X		850	3,92%
Q31	Tangerines	01.23 Growing of citrus fruits	01.23.14 Tangerines, mandarins, clementines	Conventional	X		X		X		21,624	50,92%
Q32	Tangerines	01.23 Growing of citrus fruits	01.23.14 Tangerines, mandarins, clementines	Conventional	X		X		X		2,165	9,41%
Q33	Lettuces	01.13 Growing of vegetables and melons, roots and tubers	01.13.14 Lettuce	Organic			X			X	12,750	39,56%
Q34	Apples	01.24 Growing of pome fruits and stone fruits	01.24.10 Fresh apples	Agroecological	X		X		X		1,181	2,83%
Q35	Pears	01.24 Growing of pome fruits and stone fruits	01.24.21 Pears	Organic	X		X			X	973	5,72%
Q36	Plums	01.24 Growing of pome fruits and stone fruits	01.24.27 Plums	Organic		X	X			X	7,814	58,31%
Q37	Oranges	01.23 Growing of citrus fruits	01.23.13 Oranges	Organic			X			X	295	1,48%
Q38	Cauliflowers	01.13 Growing of vegetables and melons, roots and tubers	01.13.13 Cauliflowers and broccoli	Organic			X			X	379	1,89%



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Quantification CODE	Crop	NACE Code	CPA Code 6 digits	Production system	Measurement			Sampling size	FL (Kg/ha)		% FL (FL/yield + FL)	
					Pre-harvest	Inter-harvest (cuts)	Post-harvest	0.10%	1%	10%		
Q39	Cabbages	01.13 Growing of vegetables and melons, roots and tubers	01.13.12 Cabbages	Agroecological			X			X	5,651	19,60%
Q40	Tomatoes	01.13 Growing of vegetables and melons, roots and tubers	01.13.34 Tomatoes	Agroecological		X	X			X	4,093	5,69%



Table 2. In-field quantification data from 2024 and 2025 measurements (Part B)

Quantification CODE	Crop	% Edible and marketable	% Edible but not marketable	% Neither edible nor marketable	Preharvest stage causes	Harvest stage causes
Q1	Apples	5,34	57,89	36,86	Fallen to the ground due to the wind, pests and diseases incidence	Fruit too small, pests and diseases
Q2	Apples	0	44,62	55,38	Pests and diseases incidence	Fruit too small, fallen to the ground due to the wind
Q3	Pears	0	55	45	-	Undersized and Plagues/diseases
Q4	Apples	3	38	59	Fallen to the ground due to the wind, pests and diseases incidence	Fallen to the ground due to the wind
Q5	Oranges	51	26	23	Pests and diseases incidence	Fruit in the top of trees, overproduction
Q6	Oranges	20	51	29	Part of the production fallen to the soil due to the wind	Fruit undersized, pests and diseases
Q7	Oranges	46	41	13	Part of the production fallen to the soil due to the wind	Fruit in the top of the trees, Pests and diseases
Q8	Oranges	20	43	37	Part of the production fallen to the soil due to the wind, pests and diseases incidence	Fruit in the top of the trees, fruit undersized
Q9	Oranges	20	51	29	Fallen to the ground but not collected/harvested and plagues/diseases	Undersized (too small), part of the production fallen to the soil due to the wind, and pests and diseases
Q10	Lettuces	100	0	0	-	Overproduction, lack of buyers
Q11	Lettuces	38	62	0	-	Overproduction, lack of buyers
Q12	Tomatoes	98	0	2	-	Fallen to the ground due to the wind
Q13	Cabbages	0	76	24	-	Aesthetic reasons (undersized) and lack of utilization for other purposes.
Q14	Lettuces	79	21	0	-	Overproduction, lack of buyers
Q15	Lettuces	69	31	0	-	Eaten by snail, overproduction
Q16	Lettuces	69	31	0	-	Eaten by snail, overproduction
Q17	Cabbages	51	8	41	-	Half of the parcel was not harvested due to lack of buyers, other part was not sold due to pests and diseases incidence
Q18	Cabbages	0	100	0	-	Aesthetic reasons (undersized) and lack of utilization for other purposes.
Q19	Cabbages	0	78	22	-	Aesthetic reasons (undersized) and lack of utilization for other purposes.



Quantification CODE	Crop	% Edible and marketable	% Edible but not marketable	% Neither edible nor marketable	Preharvest stage causes	Harvest stage causes
Q20	Cabbages	17,49	79,85	2,65	-	Aesthetic reasons (undersized) and lack of utilization for other purposes.
Q21	Tangerines	21,31	50,68	28	Fallen to the ground due to the wind, plagues/diseases.	Fruit in the top of trees, pests and diseases
Q22	Lettuces	0	88	12	-	Aesthetic reasons (undersized) and lack of utilization for other purposes.
Q23	Lettuces	67,6	32,39	0	-	Aesthetic damages, plagues/diseases and management/overlapping of crops
Q24	Oranges	20,17	12,79	67,03	Fallen to the ground but not collected/harvested and plagues/diseases	Pests and diseases
Q25	Oranges	49,96	3,85	46,19	Fallen to the ground but not collected/harvested and plagues/diseases	Fallen to the ground but not collected/harvested and plagues/diseases
Q26	Oranges	35,38	12,23	52,37	Fallen to the ground but not collected/harvested and plagues/diseases	Fallen to the ground but not collected/harvested and plagues/diseases
Q27	Peaches	69,95	17,6	15,43	-	Aesthetic reasons (undersized, wonky or slightly imperfect fruits)
Q28	Pears	0	100	0	Production fallen to the ground due to the wind	Undersized and Plagues/diseases
Q29	Tomatoes	0	57,14	42,85	Blossom-end rot and aesthetic damages	Aesthetic damages and plagues/diseases
Q30	Tangerines	18,55	45,92	35,52	Not losses in preharvest	Aesthetic reasons (undersized) and lack of utilization for other purposes (juices). Furthermore, plagues/diseases.
Q31	Tangerines	16,38	74,04	9,57	Fallen to the ground due to the wind, plagues/diseases.	Aesthetic reasons (undersized) and lack of utilization for other purposes (juices). Furthermore, plagues/diseases.
Q32	Tangerines	8,33	24,39	67,37	Fallen to the ground due to the wind, plagues/diseases.	Fruit undersized, pests and diseases
Q33	Lettuces	0	54,5	45,5	-	Too small, and pests and diseases incidence
Q34	Apples	11,98	23,96	64,05	Fallen to the ground due to the wind, pests and diseases incidence	Bird bites, pests and diseases incidence



Quantification CODE	Crop	% Edible and marketable	% Edible but not marketable	% Neither edible nor marketable	Preharvest stage causes	Harvest stage causes
Q35	Pears	0	1,64	98,35		The producer is going to uproot these trees, they were the last production and when we went there the trees were pruned, with the branches on the ground (although there were no pears on the branches). All the pears that we found were the ones that were already on the ground
Q36	Plums	59,73	16,37	23,89	Plagues and diseases	Not sold because is not a commercial plot. Plagues/diseases and eaten by bird
Q37	Oranges	31,74	19,04	49,2	-	Difficulties in identifying commercial outlets and plagues/diseases
Q38	Cauliflower	0	35,22	64,77	-	Too small, and pests and diseases incidence
Q39	Cabbages	20,66	60,06	19,26	-	Aesthetic reasons (undersized) and lack of utilization for other purposes
Q40	Tomatoes	8,08	21,69	70,22	Fallen to the soil due tot the wind	Aesthetic damages, pests and diseases